

**MINING, LIVELIHOOD AND UNDERDEVELOPMENT: A CASE
STUDY OF BASUNDHARA COAL MINES IN SUNDARGARH
DISTRICT OF ODISHA**

*Dissertation submitted to Jawaharlal Nehru University
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CERTIFICATE

I, SHIULI VANAJA, do hereby declare that the dissertation entitled '**Mining, Livelihood and Underdevelopment: A case Study of Basundhara Coal Mines in Sundargarh District of Odisha**', for the degree of **Master of Philosophy** is my bonafide work and may be placed before the examiners for evaluation.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Modern economic growth is unimaginable without excessive dependence on natural resources, especially minerals. The epitome of economic growth, that is, the industries, use minerals not merely as ores for building machinery, but also in producing goods as well as use the electricity generated often through the use of minerals. In addition, all other markers of modernity, from complex spaceships to ordinary things like cooking gas, bank on extraction of minerals. The modern world today will not survive if there is no more extraction of minerals. It is evident from the economic history of the world that the direction of development of a society in a particular period depended on the discovery of specific minerals and their extensive use in general.

There is another phenomenon occurring parallel and as a consequence of this process of economic growth and development based on the extraction and production of minerals. It is the displacement of the people from their land carrying the minerals. The displacement of the people from their land and their sources of livelihood disrupts their life completely and forces them to search for new sources of employment in order to sustain themselves.

In India, in the recent years, the investment in mining and the number of mining projects have increased tremendously. Especially after 2002, the rate of growth of mineral production increased in tune of their increased prices in the world market.

Along with this the instances of protest and resistance against mining companies have also increased in India, especially in the mineral rich regions, mostly dominated by tribal populations. The mining projects in India in recent years have been thus, surrounded by conflicts, debates and discussions.

If we look at the two phenomenon together i.e. the role and importance of mineral extraction in the process of economic development and the resistance of local people against mining projects; many questions arises, such as, why are people protesting

against mining projects if it is so important for economic development? Is the benefit of this process of economic development not reaching to the local people in the mining region? Do they believe that the mining projects will also lead to their development? If not, why? Is it an irrational fear of change or is it because they have been witness to other mining projects around them not leading to development of the local people?

These questions actuate us to study the impact of mining on local people and its implications for their development.

The focus of this study is the relationship between mining and underdevelopment of the mining regions. The variable which is used to analyse the link between mining and underdevelopment is the livelihood of the people in the region chosen for the empirical work. In India, mining regions, densely forested areas and tribal dominated regions coincides with each other. The livelihood of the people in the mining region thus is, based on the use of natural resources, land, water and forests. These are adversely affected by mining. Understanding, analyzing and measuring the changes introduced by mining in the livelihood of the people is the key to unravel the process of development or underdevelopment in a mining region. Consequently, understanding this process of development/underdevelopment in a mining region though livelihood changes is the main theme of this dissertation.

This chapter provides an introduction of the dissertation by stating the problem studied the reasons and motivations behind engaging with this particular problem, the manner in which this research has tried to find answers or explanations for the problem, and the conclusions drawn, with their implications, on the basis of empirical and theoretical engagements in this research. The second section provides the concepts or definitions used in this study. The third section provides a brief literature review of studies related to the impact of mining in India. The third section explains the motivation behind or the rationale for choosing the particular set of objectives. It also gives the broad objectives of this research. The fourth section is based on the conceptual framework of this research. The fifth section details the data sources and methodology used in various chapters. The sixth section gives a brief summary of the different chapters of the dissertation

1.2 Concepts and Definitions

There are various terms and concepts which are used in this dissertation. Since many of these terms are used differently by different scholars, definitions are provided here, so that the specific way in which these terms and concepts are used in this dissertation becomes clear.

Livelihood is a central term in this dissertation and it is used in the following way.

Livelihood: It is the capacity or ability of a household to provide for its consumption. It includes the products available from nature for direct consumption, monetary earnings through sale of products available from natural resources and money earned through different forms of labor work.

Livelihood Earnings: If the value of products available from nature can be estimated in terms of monetary equivalents then the aggregate of all the three components of livelihood can be termed as livelihood earnings for the concerned household.

Livelihood change then would mean a change in the livelihood earnings of a household.

Development: Development in the simple terms means a process of improvement in the standard of living of the people.

If a process results in the improvement of standard of living of a household then it can be called as the development of the household.

If there is an improvement in the standard of living of a considerable number of households in a region than it can be said that there is a development of the region as a whole.

Underdevelopment: The process of underdevelopment means a worsening of standard of living of the people over time.

Similar to the process of development if there is a worsening in the standard of living of a household over time then it will mean that there is an underdevelopment of the concerned household.

If there is a worsening (deterioration) in the standard of living of a considerable number of households in a region then it can be said that there is a process of underdevelopment going on in the region.

DP's (Displaced persons/ families): Those families and persons who are physically displaced from the place where they were living earlier. In this case the people lose both their agricultural land and home land and are now living at some other place.

PAP's (Project affected persons / families): Those families and persons who are deprived of their livelihood without their physical relocation (Fernandes, 2008). It includes mainly those who have lost their agricultural land (partly or completely) and/or other sources of livelihood directly to mining but is living at the same place where they were living before mining.

1.3 Literature Review

A number of empirical studies have been done to establish the link between natural resource, especially minerals, with the economic growth rates. The research under this theme can be broadly termed as 'resource curse'. According to Sachas and Warner (2001), the high resource intensity of various resource rich countries tends to correlate with slow economic growth in this countries over time and this phenomenon of existence of a correlation between high resource intensity with low rates of economic growth is termed as 'resource curse'. The research and literature on resource curse mainly concentrates on three things. One is the empirical evidence from different countries about negative relationship between resource dependence and growth rates. Secondly, the possible theoretical explanations for the existence of this negative relationship between the two and thirdly the studies which concentrate on the factors which affect and determine the nature of relationship between resource dependence and economic growth rates of different resource rich countries. In the third type of literature, various factors, affecting the relationship between resource dependence and growth rates, can be discerned as the nature of natural resources (point resource or cluster resource), institutions, nature of existing political regimes (democracy or dictatorship) etc. There are

types of explanation which are used to explain the phenomenon of resource links resource curse with 'Dutch Disease', second links it with rent seeking, and authoritarian states and third links it with quality of existing institutions. lot of variations in this area of research, but cross-country comparisons are l upon to look at the relationship between mining and rates of economic fferent countries.

sts the mining region in various ways. Introduction of mining activities brings of employment and income earning opportunities in the region at one hand. r hand however, mining changes the earlier existing pattern of living by of agricultural and forest land. The literature on the overall impact of mining i two parts. Some studies stress the positive impact of mining by citing the of new employment and income activities and some stress the negative the displacement and destruction of environment.

iges the land use pattern in the mining region. It does so by converting the ultural and forest land into mines and dumping the muck in and around the ;, the proportion of waste land in the mining region increases over time. r various forms of pollutants into water, air and soil leads to water, air d soil degradation in the mining region (Chauhan 2010, Murthy & Patra a and Redddy 2009, Fernandes 2007).

ent forms of pollution affect the lives of local people in various ways. Over sely affects the health of people. It is found through case studies that mining a negative health externality in the mining region (Sana, Pattnayak, Sills and). There are many instances when the mining has given birth to many new ch were not present earlier in that area.

o types of work which become available to the local people after opening up perations in the region. One is different forms of unskilled labor work in orkers are paid on the daily wage basis and secondly in the form of regular

salaried job in the company. The income earned through different forms of work in mining companies, many times may show an increase compared to the pre-mining situation in a mining region. This has lead/mislead many scholars to conclude that mining has resulted in an improvement in the standard of living of the local people (Mishra 2009)¹.

The main shortcoming of the studies looking at specific indicators is that it does not provide a comprehensive picture of the changes brought in the lives of people through mining. It gives information which is piecemeal in nature.

The mineral rich regions in the country are the also the regions which are covered by dense forests and dominated by tribal populations (Bhushan 2008). The life style and ways of earning a living of tribals is closely linked with forests and natural resources in the region. Many of these resources are in the form of common property resources and provide many goods and services freely available to the people. Thus the impact of livelihood of local people requires us to consider much broader contextual picture.

The impact of mining on the livelihood of local residents is described in detail in some of the studies, giving insights into the particular changes in livelihood, through changes in the availability and access to resources in the region. A case study conducted by 'Vasundhara' in the coal mines in Talabira of Odisha² found that the collection and production of NTFP (Non-timber forest products) and fish production has declined after the beginning of mining in the region.

Thus, in addition to health related consequences, pollution of water and soil and the reduction in natural resource base, also results in the loss in the earlier sources of livelihood. (Mishra and Pujari 2008, Mishra 2009).

¹ In her paper the author has said that there has been a loss of earlier sources of livelihood along with the increase in income due to mining. But the shift from agriculture to mining together with increased earning in mining has been taken as an indication of rural development.

² The official name for the state of Orissa has been changed to Odisha. The dissertation uses Odisha everywhere except when giving references if the references are available by the name of Orissa.

In order to have an aggregate picture of the changes in the mining region sometimes a comprehensive index is used which in some way incorporates different type of impacts. There are some efforts to build different kinds of index to capture the impact of mining on the lives of people inhabiting mining areas. One such attempt was building a 'quality of life' index (Normra and Nairy 2005). Another was the use of Sustainable livelihood framework in the Coal mines area of IB valley in Odisha (Mishra 2009). It divided the different assets used in providing livelihood to the local people in terms of financial, physical, human, social and environmental capital, used as livelihood assets. According to this study, changes in these assets will tend to affect the overall livelihood of the people. This study found a mixed result in assessing the impact of mining on these different capital assets. While the financial capital showed an improvement the natural capital declined after mining.

There is a link between the existing natural resources and the tribal livelihood in the region. The tribals are dependent on various resources to fulfill their daily needs. One of the best books which has recognized this link and explained it in detail is the anthropological and social study 'Out of this earth: East India Adivasis and Aluminium Cartel' by Padel and Das (2010) This book gives a good insight into the relationship of tribal life with natural resources and how mining, by destroying this link, not only destroys their sources of livelihood but also their identity and culture.

The overall impact of mining on the local people of a region can be looked upon it terms of the developmental impact of mining on the region. There are studies which try to link the mining in a region with backwardness or poverty of the region (Bhushan 2008). Center for Science and Environment have published a complete report, 'Rich Lands Poor People: Is Sustainable Mining Possible?'(2008). In this report they have tried to show a relationship between mining and underdevelopment. According to this report the backward districts, mining regions and tribal populations in India coincide with each other. Mining results on one hand in displacement, deforestation, different forms of pollution of environment. On the other hand the resettlement and rehabilitation packages are often inadequate to compensate for the loss of livelihood through mining. This

combined with continuous reduction in employment opportunities with globalization and mechanization of mining sector means deterioration in the standard of living of people.

1.4 Rationale of the Study

In the era of neo-imperialism, globalization and neo-liberalism, with the increasing importance of mining and metal based industries in the national economy and in the process of economic growth, a new interest has arisen in the research on mining and economic development. The major literature which tried to look at the negative impact of mining on the process of economic growth and economic development can be clubbed together under the name of 'resource curse'. There are some important limitations of the studies on 'resource curse'. First of all, it takes the extent of export of mineral resource as the measure of resource dependence of a country. Secondly, it looks only at the changes in rates of growth over time to indicate changes in the level of poverty and economic development inside a country. But in countries like India the percentage share of minerals in export might not be very significant but the extraction of minerals and production of it is considerable and is increasing rapidly over time. Furthermore, high growth rate does not always result in low rates of poverty and economic development. In many developing countries there is disparity in the level of development of different sections. There can be seen an existence of different developed and underdeveloped regions inside the country. It indicates that the process of economic growth or economic development viewed at the level of whole country may not provide a clear picture about mining and its link with economic development.

So in order to look at the impact of mining on the economic development it is important to go beyond the framework of 'resource curse' and look into the impact of mining on the development of regions inside the country.

In order to look at the impact of mining on the development of mining regions, an indicator or index is required, which can capture this impact of mining. Normally the various indicators which are used for looking into the developmental impact of any

vity consist of indicators which are based on change in the level of income, sumption expenditure, wealth etc. These indicators look into only the monetary ings of different families or persons in the region. So it does not capture non-etary earnings and change in it over time for the people in a region.

India mining regions are tribal dominated regions. The life of tribal population is sely linked with nature and they draw their livelihood by using the natural resources sting in the region. So there are many products which are available freely from nature are directly consumed by tribal families without entering into the domain of the ket.

is it can be seen that Tribals are one such groups of people, whose life and means of ning a living are not completely monetized and thus the economy of mining regions is completely market based economy, as is the case in other parts of the country. omics and economic indicators to capture the welfare or developmental impacts of nomic activities are generally developed keeping in mind the life of the people living he market based largely monetized world. Because of which it fails to capture the nges brought by any activity introduced into the life and standard of living of tribals mining region. When the commonly used indicators are applied to assess the welfare evelopmental impacts of mining on the local people (majority of who are tribals) then erally it provides results which do not represent the actual changes.

ne other indicators like Human Development Index include literacy rate and life ectancy at birth apart from income. But this also fails to assess the developmental act of mining. It is because of two reasons. Firstly it takes into account only the etary parts of the livelihood of the local population ignoring the changes in the non-etary components of livelihood due to mining. Secondly by taking into account the capita income of the mining region (district) as a whole it does not provide actual ormation of the developmental impact of mining on the people in the region.

The source of confusion here is in the way the development of a region is defined. In the calculation of Human Development Index, the District Domestic product is used to calculate the per capita income. It includes the income from the mining sector. But the income from mining sector generally does not go directly to the local people in the region. So in many cases due to very high value of income from the mining sector the HDI value of some districts comes out as very high. But it might not represent the actual condition of the people in the region.

The calculation of alternative Human Development Index by the Chhattisgarh Human Development Report (2005) showed that taking out the income from mining sector in the calculation of per capita income of the district it was seen that the major mining districts moved down in the intra-state ranking of development.

The development of a region if calculated completely or partly by taking into account the income generated from mining sector is not a good indicator of the development of the region. It seems in the generally used indicators of development there is a disparity in between the development of the region and development of the people of a region.

In order to overcome these shortcomings of the normally used indicators of development, development of region in this study is defined and used in a way which represents the development of the people residing in the region. It means an improvement in the standard of living of the people in the region. Since the best way to represent the standard of living of people in a mining region is by the level of their livelihood, the development of a mining region is assessed by calculating the changes in the livelihood of people due to mining.

By looking at the impact of mining on livelihood of local people we are trying to look beyond the monetary gains or losses in the process. Various case studies which have been conducted in this study, look either at changes at the level of per capita income after the mining started in that area or look at impact of mining on specific factors like health, environment, agriculture etc. The livelihood of local people in natural resource region is

dependent on agriculture, animal husbandry, forests products and fisheries. Thus choosing livelihood as the variable to study the impact of mining makes it possible to account for the changes in the living of people because of changes in natural resources (especially those which are common property resources and the products and earnings from which are many times not included in the money based indicators like income). This study is trying to include all the sources of livelihood and changes in such sources and their availability to local population after mining starts in the region.

There are certain existing literatures which have concentrated on the impact of mining on the livelihood of local people. But these studies have inherent limitations from the economic point of view, in their descriptive nature and in a lack of clarity about how the changes in livelihood affects the development of the people. This type of analysis even when it provide sometimes a good insight into the changes in the livelihood of local people it does not provide us with an index of livelihood change which can make the comparison between the pre-mining and post-mining livelihood levels possible. Because of a lack of a comprehensive quantitative measure of livelihood change often researcher who work on this topic tend to confuse the income with livelihood.

The lack of any proper methods or indicators to assess the change in the standard of living of the local people in a mineral rich tribal dominated region has prompted in this study the development of an indicator of net livelihood change which is used here to assess the developmental impact of mining.

Development of any indicator gains validity only after its use for capturing the changes (which it claims to capture) occurring in the real world. Its empirical use tests its applicability, use and accuracy. So in order to develop a measure of net livelihood change field survey of a mining region was needed. Another reason for the need of a field survey for the development of measure of net livelihood change lies in the fact that even though many of the mining regions are forest regions, the exact component of livelihood which is derived from forest and other natural resources may vary between different mining regions.

Odisha is one of the most underdeveloped states in the country. It is also one of the major mining states in the country. This along with a large tribal population in the region makes it an ideal choice for the study of the impact of mining on the development of the people and for the construction of a measure of net livelihood change to assess these developmental impacts. The choice of Odisha for the field survey is also guided by the large number of protests against the mining projects inside the state which questions the developmental impact of mining on the people residing in such regions. There are a relatively large number of studies on the impact of mining on the local people in Odisha than in any other mining state in India. The existence of different forms of literature gives a broad idea about the changes happening in a region due to mining and allows us to search for specific questions which have not been looked upon in the existing studies.

Sundargarh district of Odisha is district which again has large tribal population and dense forests. In order to assess the impact of mining on development through an indicator like net livelihood change calculated on the basis of the recollection of the pre-mining information we need a mining region in which the beginning of mining activity is neither too recent nor too dated. If too many years have passed after the beginning of mining in that region people do not remember information regarding their pre-mining livelihood . If it is too recent the changes in the pattern of livelihood may not be clearly visible. The Basundhara coal mines in Sundargarh district is one such region where mining activity is neither too recent nor too dated. Taking all these things into consideration, Basundhara coal mines in Sundargarh district in Odisha was taken as an area for the field study and for the application and development of the measure of net livelihood change.

The existing literature on the relationship between mining and underdevelopment (Centre for Science and Environment, 2008) shows that the mining and underdevelopment coincides in India. But it does not explain explicitly whether there is a causal relationship between the two i.e. whether mining is leading to underdevelopment or the causes of underdevelopment in a mining region are something different from mining and if these two phenomenon simply happen to coexist at a point of time in a region. It does not deal

with the process or mechanism through which mining may result in underdevelopment in a mining region.

This dissertation has attempted to go beyond the statement of a relationship between mining and underdevelopment and tries to explore the possibility of existence of a causal relationship between mining and underdevelopment. In this it draws upon Gunnar Myrdal (Myrdal, 1957) notion of underdevelopment as a result of a process of circular and cumulative causation and tries to outline the possible contours of this process in a mining region where the destruction of traditional livelihood system might lead to non-improvement of tribal population and the environmental degradation.

There are three broad objectives of this study.

First objective is to develop a measure of net livelihood change to capture the impacts of mining on the development of the people in a region. In a mining region the livelihood of local population seems a better indicator to assess their standard of living as it includes the non-monetary goods which are directly consumed from nature. So the measure of net livelihood change is to be developed in a way that it captures the impact of mining on the standard of living of the people. The pattern of livelihood of local people residing in a mining region before and after mining needs to be studied for the development of measure of net livelihood change. Furthermore for the development of a quantitative measure of net livelihood change all the livelihood components including those which are non-monetary in nature needs to be converted into their current monetary equivalents.

The second objective of this study is to apply the above developed measure of net livelihood change to a mining region in order to check its applicability and its usefulness as a proxy measure of development. For developing and applying the measure of net livelihood change in a region, the choice of region is determined by the availability and dependence of the local population in the region on its existing natural resource base.

The third objective consists of development of a framework tracing the conditions under which there could be an overlap between mining, underdevelopment and environmental degradation. If there are reasons to believe a causal relationship between mining and

underdevelopment then under this objective the aim is to find out the process or mechanism through which mining leads to underdevelopment.

1.5 Conceptual Framework

The major theoretical approaches behind this study are Gunnar Myrdal's (1957) idea of circular and cumulative causation and David Harvey's (2005) idea of accumulation through dispossession.

David Harvey (2005) explained the process of modern capitalist accumulation as a process involving dispossession and displacement of people and releases a set of assets into the market at very low cost. These assets are seized by the capitalist and turned into profitable use.

The concept of accumulation by dispossession was used by Harvey (2005) mainly for explaining the process the economic liberalization, globalization and privatization and the dispossession and displacement of people and their assets through it. The dispossession of people from their land by the mining companies for the extraction of minerals forms such a process of accumulation by dispossession. The basic concept of 'accumulation by dispossession' is taken in this study from David Harvey (2005) but it is modified to suit the specific context of this research.

In the era of globalization the process of economic growth and accumulation takes place through dispossession of people from their land, livelihood, assets etc. In other words the process of economic development is accompanied by a process of displacement of people from their land and livelihood. Mining through extraction and production of minerals is one of the major pillars of this process of economic growth and accumulation. On one hand mining provides the necessary minerals needed as raw material for a lot of industrial production. On the other hand it provides avenues for profitable investment. It is because the cost of production in mining is low due to cheap labor, low cost of land in the mining region, low rate of royalties and number of other tax concession provided by the state and central governments to mining companies. Along with this it can be seen that the prices of minerals and metals are on continuous rise in the domestic and world market. High

profit, low cost of production and continuously rising demand of minerals in the market ensures that mining attracts a lot of foreign and domestic private investment and is a major part of process of economic accumulation and growth in India.

Mining is an activity which simultaneously displaces people from their land and adversely affects environment through deforestation and pollution. The tribals earn their livelihood both through cultivation on private and community land and through their dependence on forest and rivers. Thus mining activity affects the livelihood of tribal people in two ways –one is through acquisition of land and another is through large scale deforestation and destruction of environment. The impact of mining on livelihood of tribals can be further divided into two parts. One is the immediate and direct impact which is in the form just stated above- through loss of land, forests, rivers and ponds³ as source of fisheries etc. The other impact is indirect and slow which affects livelihood of people over a longer time span. Some example of it can be drying up and pollution of rivers and ponds adversely affecting the fish catching activities, dumping of wastes in nearby agricultural lands, soil erosion and land degradation, lack of clean drinking water, occurrence of various diseases due to mining and its pollution etc. This may have adverse affects on the agricultural productivity, land productivity and labor productivity in the region, which will affect the livelihood of the people in the region in the long run.

This dissertation is based on a study and analysis of the relationship between mining and underdevelopment. The connecting link between mining and underdevelopment is livelihood. Mining affects the livelihood of the people residing in a mineral rich region. The changes in livelihood determines the development or under development in the region.

³ The immediate and direct impact of mining on livelihood occurs when a whole part of the natural resources like land, Forest, Rivers etc cease to exist in the form in which they used to exist earlier. To differentiate between the direct and immediate impact of mining on livelihood and long term impacts through pollution, let us take an example. The deforestation of a part of forest will lead to immediate and direct loss of livelihood through loss of goods available from forest for consumption and sale. The unavailability of certain forest product over time due to some form of pollution like depositing of coal dust from coal mines represents a long term impact of mining on livelihood through pollution of environment. Similar other example can be drying up of river due to flow of its water into mines and slow pollution of existing water resources. Both will reduce the availability of fish for the local people but the former is direct and immediate while the later is slow and indirect.

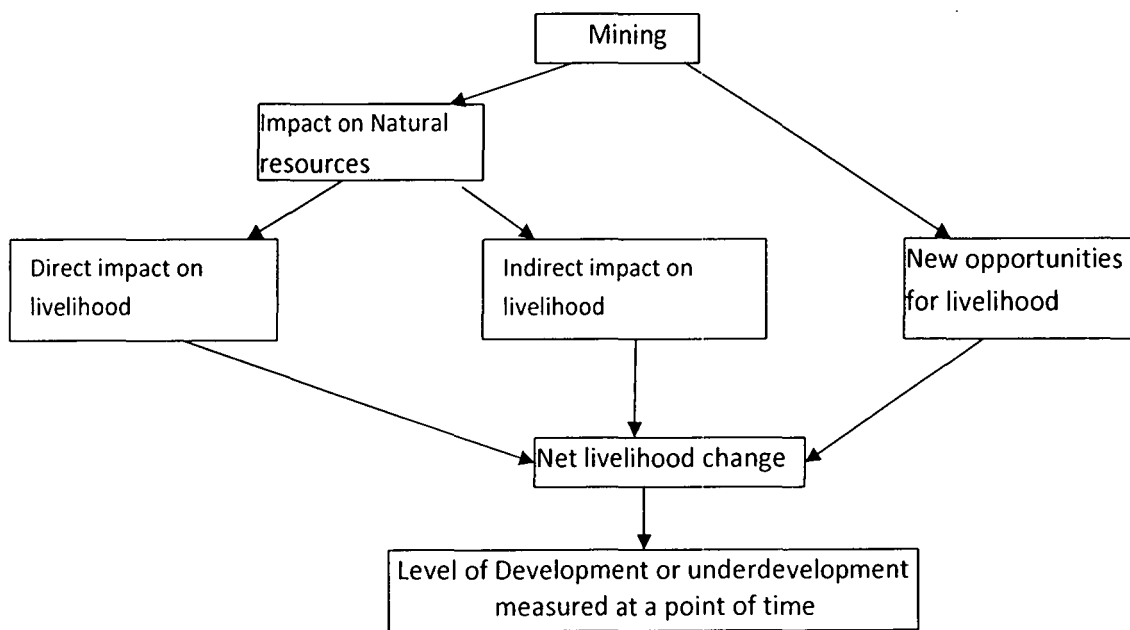
Underdevelopment can be studied in two ways. One is the change in the level of development between two periods of time. If the changes are negative in nature then it can be said that at any point of time there has been underdevelopment in the region. Underdevelopment is a process continuing over time. But at any point of time in order to find out whether underdevelopment or development is happening in a region some kind of quantitative measurement is needed to capture the changes in the standard of living of people in the region. In a mining region the standard of living of the people is broadly captured by the level of livelihood of the people. So the changes in the livelihood of the people measured in terms of net livelihood change of the household captures the level of development or under development in the mining region. The calculation of net livelihood change is done by comparing the pre-mining and post-mining level of livelihood of different households (at some particular point of time). Thus the net livelihood change represent the development or under development in the mining region between any two periods of time. At any point of time the direction of net livelihood change will determine whether there has been development or underdevelopment due to mining.

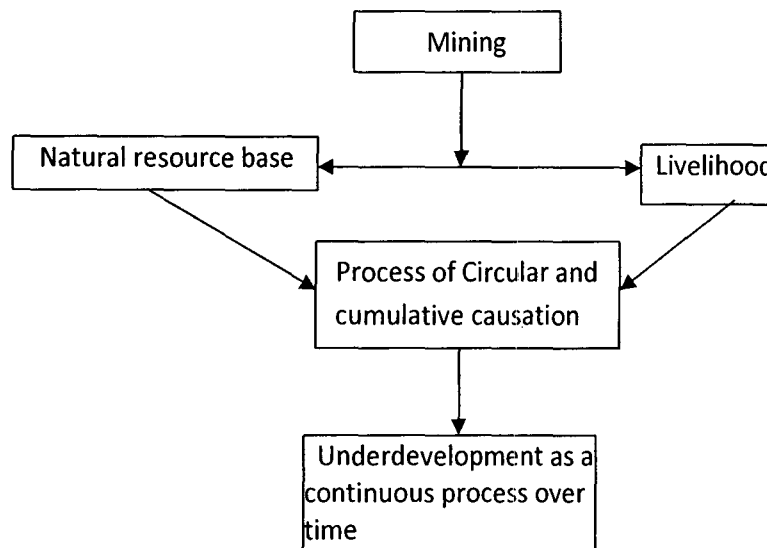
The other theoretical approach which is used in this research for studying the problem of mining and underdevelopment is based on the concept of circular and cumulative causation as used by Gunnar Myrdal (1957) in studying the existence of underdeveloped and economically developed regions inside a country and the interactions between the two. He explained the interactions between the economically developed and underdeveloped regions as a process of circular and cumulative causation. Centers of economic development in a country attract labor, capital, goods and services from the backward regions. The movement of labor, capital and goods and services from the underdeveloped regions to developed regions inside a country generate a process of cumulative causation between the two regions in which the movement of these factors makes the underdeveloped regions poorer further generating the movement of these factors towards the economic centers of growth. This is termed as backwash effects of economic development in certain centers on the development of other regions inside a country.

In this research the concept of circular and cumulative causation is used to study the impact of mining on the relationship of mutual interdependence between livelihood of tribal population and natural resource base.

The other way to look at underdevelopment is as a dynamic process taking place over period of time. In this the main concern is with the process of underdevelopment as compared to the quantitative measure of it as done by the calculation of net livelihood change in the first part of the dissertation. The mechanism through which underdevelopment happens in a mining region is explained through a series of reactions between livelihood and natural resource base. This series of reactions between these two factors is initiated by the process of mining but after the beginning of the process it can sustain itself even if there are no further additional impacts of mining on it. This series of reactions between these two factors takes the form of a process of circular and cumulative causation. If there are continuing impacts of mining on the factors of this process of circular and cumulative causation then it accelerates the process in the downward direction. This process of circular and cumulative causation leads to a dynamic process of underdevelopment in the region.

Conceptual Framework through Flow Chart





1.6 Data and Methodology

This section explains the different data sources which are used in this study and the methodologies adopted for different calculations and analysis.

1.6.1 Data Sources

There are two sets of data sources which are used in this dissertation. The secondary data sources are taken from various reports, studies and articles. Of the two main sources which are used for secondary data sources, one is the study done by Center for Science and Environment and another is the data collected by Walter Fernandes and others⁴ on displacement and rehabilitation by mining projects in India after independence. State human development reports of Odisha and Chhattisgarh are also used in this dissertation

⁴The data on displacement by mining projects in different states is computed by Fernandes and different authors. The lists of various authors who have collected the data which has been used in the study are as follows. The number of displaced in Andhra Pradesh is calculated for the years 1951-1995 (Fernandes et al 2001: 59), for Orissa (Fernandes and Asif 1997: 84), for Assam for years 1980-2000 (Fernandes and Bharali 2006: 77), for West Bengal (Fernandes et al 2006: 91) for Goa for years 1965-1995 (Fernandes and Naik 2001: 39), and for Jharkhand for years 1951-95 (Ekka and Asif 2000: 93). This data is taken from article 'Mining in North Eastern India in the age of Globalisation' by Walter Fernandes.

(Orissa Human Development Report, 2004, Chhattisgarh Human Development Report, 2005).

There is a lack of comprehensive data sources on the impact of mining on the local people. The other data source which is used in dissertation is based on a field survey carried out in Basundhara coal mines in Sundargarh district of Odisha (April 2012). The data from the field survey was collected through detailed interviews and informal discussions held with the households included in the sample.

The sample households were taken from two villages Tikalipada and Sardega. The Tikalipada village had two hamlets Khamarpada and Tikalipada. The Khamarpada and Sardega village people have lost their agricultural land and other sources of livelihood but were living in the same place. All these two hamlets and one village have lost their sources of livelihood in the Basundhara coal mines operated by Mahanadi Coalfield Limited, a subsidiary of Coal India Limited.

Data and information which was collected from different households in the sample was based on the memory of family members regarding their pre-mining status of livelihood.

1.6.2 Methodology

The methodologies used in this dissertation comprise of choice of sample households, data collection, data preparation, developing a method for the calculation of net livelihood change, actual calculation of net livelihood change etc.

The first part of the methodology used comprises of selection of a unit of analysis. Households are the basic sampling unit of this study. The overall sample was chosen keeping in mind a proportionate representation of different social groups existing in the village and after that households were chosen randomly from each social group.

A detailed questionnaire was prepared. Individuals from each household were interviewed according to the questionnaire. Simultaneously an informal discussion was also held with the households in the sample to get information about the general changes

in their way of living after mining and their perception about the causes behind these changes.

The collected data was in two forms. One in the form of quantities different goods consumed before and after mining. The second form in which data was collected was in terms of monetary earnings of different components of livelihood before and after mining. In order to do an aggregation of both forms of data available from a household the data which was available in quantity forms was required to be converted into current monetary equivalents.

There are two types of livelihood components. One type of livelihood is available in the form of goods produced and collected from natural resources and used for direct consumption of a household. The change in the quantity of such goods from pre-mining to post mining period is calculated and then multiplied by the current prices to get their current monetary equivalents. In the cases where the goods which were earlier used and are now no longer available from nature for direct consumption of the household, the current expenditure of the household on that good or its substitutes (if it is now bought from the market) is taken as the current monetary value of the loss of livelihood earnings under this particular head.

The second type of livelihood earnings are the monetary earnings from the sale of various products procured from different natural resources and sold into market and the earnings from different form of labor work. In order to calculate the changes in the monetary earnings from various sources the pre-mining monetary earnings were to be converted into current values to make it comparable with present monetary livelihood earnings. It is done by using a ratio of the values of consumer prices indices for agricultural labors for the present year and the year immediately before mining. The pre-mining monetary earnings on various heads are multiplied with this ratio to get the current values of them. Now the comparison of this value and the current monetary earnings gives the current value of changes in livelihood earnings on these heads.

The addition of the changes in the livelihood earnings in the form of current monetary equivalents of goods used for direct consumption from nature and the change in livelihood earnings which were available in monetary forms gives the value of net livelihood change for a household.

All calculation is in terms of current monetary equivalents of different forms of livelihood earnings but it should not be confused either with income or consumption expenditure of a household.

The comparison of net livelihood change for different households in the sample across various other variables is done by using simple cross tabulation.

1.7 A Brief Summary of Different Chapters

The first chapter of the dissertation contains the introduction of the study. It introduces the topic of the dissertation. It explains in detail the reasons behind choosing the 'mining, livelihood and underdevelopment' as the topic of this study. The protest by the local people indicated that mining may not be resulting in development of people in the mining region. The livelihood is the best variable to capture the impact of mining on local people. Also in tribal dominated regions the changes in level of livelihood indicate their development or under development. The first chapter provides a brief literature review, the conceptual framework, the methodology and data sources and chapter summaries.

The second chapter of the dissertation begins by establishing a link between mining and underdevelopment i.e. by showing that the mining regions are also the underdeveloped regions in the country. This establishment of the link between mining and underdevelopment takes place in two ways. It is accomplished indirectly through the information and data on displacement, deforestation, water and other forms of pollution, resettlement and rehabilitation in the mining region. Secondly it is accomplished by showing that mining districts in the country are also the most underdeveloped districts. This is done by using the data available on the other indicators of development like poverty etc. This chapter provides a base for this dissertation.

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The third chapter takes the results derived from the second chapter further and poses the question that if mining is linked with the underdevelopment of the mining regions then in what way can this underdevelopment be assessed? A quantitative measure is required to capture this impact of mining. Since the livelihood of a household in a mining region is the best indicator to represent its standard of living, the net livelihood change due to mining is calculated to capture the impact of mining on the people and their development. Net livelihood change is taken as the proxy for capturing the development or underdevelopment of the mining region. In the absence of any other method for the calculation of livelihood changes the methodology for the calculation of net livelihood change is developed. The data collected from the field survey is used for estimating the values of net livelihood change for different households in the sample. Different factors like the size of own landholdings, dependence on natural resources and type of compensation provided by the mining company plays a role in the determination of net livelihood change. The pattern of net livelihood change is analyzed in terms of these factors to get an idea about the changes induced by the mining in the life of local people. The analysis of pattern of net livelihood change also enables us to find out the factors that play an important role in determining whether there will be development or under development in a mining region.

In the fourth chapter the process of underdevelopment is analyzed as a dynamic process initiated by mining in the region. The causal relationship between mining and underdevelopment is established in this study through a process of circular and cumulative causation between livelihood loss and environment destruction. The relationship between livelihood of the local people and the natural resource base is disturbed by the beginning of mining in the region. If mining results in a net livelihood loss for a considerable proportion of households in the region then in the absence of alternative livelihood opportunities in the region this will initiate a process of circular and cumulative causation in the downward direction. This process of circular and cumulative causation as further analyzed in terms of the data collected from the field survey. Certain modifications of this process of circular and cumulative causation are also developed.

The fifth and last chapter provides the results and conclusion of all the chapters. In an aggregate form it explains the basic findings of the dissertation and its implication for the further research in this field. It explains in detail whether the analysis and calculation in various chapter have been able to fulfill the objectives of this study or not and what are the limitations and scope for further research.

CHAPTER 2

AN OVERVIEW OF MINING IN INDIA

2.1 Introduction

This chapter gives an overview of mining in India and its impact on the local people. The central theme of this dissertation is the relationship between mining activity and the development of the mining region, keeping the local people of the region at the centre of this development process. The development of the mining region is considered to take place only if the standard of living of the local population improves over time after the beginning of mining in the region.

The main objective of this chapter is to establish a relationship between mining and underdevelopment on the basis of the available information and secondary data from various studies and reports on mining.

The relationship between mining and underdevelopment is established here in two ways. First, it is done through the study of displacement, resettlement and rehabilitation, employment generation, deforestation and pollution from mining. All these activities affect the livelihood of the local population in the mining region either positively or negatively. So the aggregate result of the impact of mining through all these activities will determine the developmental impact of mining on the local population.

Second, in order to study the relationship between mining and underdevelopment, the development status of the mining regions is studied by using the various indicators of development as used by other studies.

The first section of the chapter provides an overview of the displacement, resettlement and rehabilitation of the displaced; deforestation and pollution of water sources by mining and its impact on the local population; the employment generation by the mining sector in India, and the overall impact of all these changes in the development of the local population.

The second section of the chapter looks at the coexistence of mining and underdeveloped regions in the country. This section is divided into two sub-sections; the first half contains a study of the major mining districts in India and their development status. The second sub-section looks at the development status of mining districts in Odisha by comparing them with other non-mining districts of the state. Odisha was chosen for studying the impact of mining because it is one of the major mineral rich, but relatively underdeveloped states in the country.

The third section of the chapter provides an overview of coal mining in India, with reference to the displacement, resettlement and rehabilitation, employment generation and environment degradation caused by it, to link the coal mining process with the development of local people in the region. Special emphasis is laid on the impact of coal mining on the local population because the area of field survey is such a mining region. The last section provides a conclusion of the chapter.

2.2 Impact of Mining

Since the primary interest is in the impact of mining on the state of development or underdevelopment of the local population, the discussion here is based only on those aspects of mining activity which affect the local population. Mining displaces people from their land, adversely affects their livelihood and pollutes the environment. In order to restore the displaced people to their earlier level of living, and to some extent improve their standard of living, they need to be properly resettled and rehabilitated. The loss of their earlier sources of livelihood can be recovered through employment in the mining sector if jobs are well paid and secure. Mining also results in an appropriation of common property resources. The livelihood of people residing in the mining region (the majority of who are tribals) depends on these common property resources. Thus if mining affects the environment and the natural resource base of the mining region, it also affects the livelihood of the local people in the region.

2.2.1 Brief Review of Mining in India

India is very rich in minerals reserves. It has a large number of minerals as well as abundant quantity of some of them. In 2010-11, India produced 84 minerals with an estimated value of Rs. 2,00,609 crores. The mining industry in India started properly only after Independence. Minerals are broadly classified into major minerals, minor minerals, fuel minerals and atomic minerals. Fuel minerals constitute of coal, lignite, petroleum oil and natural gas. The major metallic and non-metallic minerals produced in India are iron, coal, bauxite, manganese, chromium, limestone, along with precious metals and stones like gold, silver, diamond etc. The materials mainly used in construction, such as building stone, sand, brick, earth marble etc. fall under the minor mineral category.

The annual value of mineral production at the time of Independence was Rs. 58 crores (Center for Science and Environment, 2008). Earlier, the extraction and production of all major minerals was reserved for the public sector. In 1991, economic reforms were introduced, and a national mineral policy was formed and announced in March 1993. Since then, this national mineral policy has been used for the liberalization and privatization of the Indian mining industry. Thirteen major minerals which were earlier reserved for public sector were opened up for the private sector. Along with the liberalization of procedures, restrictions on the entry of private players in mining were removed, and government divested its equity holdings in a number of public sector mining companies and sold some of it completely to private players.

These relaxations of rules, simplification of procedures and concession to private players were carried out with the aim of increasing production of minerals, both to meet increasing domestic demand, and to earn foreign exchange through export of minerals.

After 2002, the world prices of metals and mineral ores has been rising significantly. The rise in world mineral prices began with an unprecedented high demand for minerals, especially of iron ore by China. The index of world prices of metals and mineral ores has doubled in between 2002-2005. This indicates a boom like situation in the mining industry at world level. This boom at world level has created frenzy in the Indian mining

industry and the number of mining leases and area under mining has increased greatly after 2002. This has added implications for the impact of mining on the local people.

This study concentrates on the post 1991 changes in the mining industry in India. This is because although there was displacement of people for mining projects before 1991, the scale of mining and the scale of displacement have completely changed after 1991 with the introduction of the New Mineral Policy in 1993. The large scale displacement and destruction of livelihood by the mining projects has put the problem of development of the local people and the impact of mining on them at the forefront of the mining process in India.

2.2.2 Mining and Displacement in India

Mining in any region results in large scale land acquisition from the people in that region. The two main types of land which are acquired are agricultural land and forest land. According to Walter Fernandes (2007), the people who lose their livelihood due to mining can be defined using two categories. The first consists of Displaced persons (DPs), referring to those who are displaced from their village or agricultural land. The second consists of Project Affected Persons (PAPs), which refers to those persons who are deprived of their livelihood without physical relocation.

According to Fernandes (2007), an estimated 60 million people have been displaced (DPs) or deprived of their livelihood (PAPs) from 1947 to 2004 in different development projects in India. Based on studies carried out by Fernandes and others¹, the number of DP's and PAP's by mining projects in this period is estimated to be about 1.5 million. This figure of 60 million people displaced by different development projects in India does not include the number of DP's in Maharashtra, Madhya Pradesh and Chhattisgarh.

¹ The data on displacement by mining projects in different states is computed by Fernandes and different authors. The lists of various authors who have collected the data which has been used in the study are as follows. The number of displaced in Andhra Pradesh is calculated for the years 1951-1995 (Fernandes et al 2001: 59), for Orissa (Fernandes and Asif 1997: 84), for Assam for years 1980-2000 (Fernandes and Bharali 2006: 77), for West Bengal (Fernandes et al 2006: 91) for Goa for years 1965-1995 (Fernandes and Naik 2001: 39), and for Jharkhand for years 1951-95 (Ekka and Asif 2000: 93). This data is taken from article 'Mining in North Eastern India in the age of Globalisation' by Walter Fernandes.

For some states, the estimates of DP's and PAP's are only for the period 1947 to 1995. According to Fernandes (2007), with the inclusion of previously excluded states, and updating of data on the others, the number of DP/PAP's by all mining projects is expected to be 5 million between 1947-2000.

The persons included in this calculation of the displaced or project affected persons due to mining do not include all the people who have lost their sources of livelihood. The people who were displaced from the agricultural lands they were using but did not have a 'patta' for, or those who had to move out of the place they were living earlier because of loss of common property resources used by them for their livelihood purposes², form such groups of people who are left out of this calculation of displacement by mining. The main reason behind this is the unavailability of any kind of record of such persons. The legal system in India does not give recognition to the rights of such persons to the land which they were using for earning their livelihood before mining. So according to Fernandes (2007), most of these figures of displacement of DPs and PAP's by mining projects in India are underestimates.

These estimates are for time periods before 2000. There has been a large increase in mining projects in all the main mining states after 2002. Thus the total number of the persons who have been displaced and have lost their sources of livelihood in mining would have also increased in all the states with increasing mining activity.

There are many regions in India, where there are communities who have faced multiple displacements from different development projects. There is no account of such people and the repeated loss of livelihood which they have suffered.

The situation regarding displacement from mining is expected to deteriorate with liberalisation because with this process, there has been a change in the nature of mining. There is an increase in the scale of operation, more mechanisation and a preference

² The movement of the people from a place where they were living to somewhere else because of loss of common property resources by mining which were used by them as sources of livelihood but who are not forced by government or mining company to do so is termed as voluntary displacement.

towards open cast mining. Mines are bigger due to mechanisation, than they were in the past. The average size of a mine has gone up from 150 acres in the 1970s, to around 800 acres in the 1980s (Fernandes and Asif, 1997) and is around 1,500 acres today. This will result in greater displacement than in the past.

2.2.3 Resettlement and Rehabilitation of People Displaced by Mining

The terms resettlement and rehabilitation are generally used together but their meanings are different. Resettlement involves physical relocation of the displaced families whereas rehabilitation is a much broader process. It involves replacing or rebuilding the economic resources, cultural systems, social structures and community support mechanisms that the displaced or project affected persons lose to the project (Fernandes, 2008).

The rehabilitation of the displaced and project affected persons often consists of the payment of monetary compensation for the private agricultural land with 'patta' which is lost to mining. In rare cases, especially in the case of public sector mining companies, it takes the form of a job in the company and monetary compensation. In its true sense, rehabilitation should be a restoration of the livelihood lost due to mining for both the displaced and project affected families. Most of the displacement in India by development projects including mining has been in the nature of 'involuntary displacement'³. World Bank has laid out certain conditions of a proper resettlement and rehabilitation scheme for those who face involuntary displacement due to development projects.

According to these conditions

“...the fundamental goal of any R&R (resettlement and rehabilitation) scheme is to restore the living standards and earning capacities of displaced persons – and where possible to improve them.”

“The first rule is that all parties to the project should be better off.”

In reality however, the resettlement and rehabilitation schemes and their execution are such that these goals are rarely achieved.

The following table provides the number of persons displaced by different development projects including mining, and the proportion of these resettled and rehabilitated from 1951 to 1990.

Table 2.1 Displacement by Mining Projects (1951-1990)

Type of projects	All DPs(in lakh)	As a % of total DPs	DPs resettled(in lakh)	Resettled persons as a % of total DPs	Tribals displaced(in lakh)	Tribal displaced as a % of total DPs	Tribals resettled(in lakh)	As a % of total tribal displaced
mines	25.5	12	6.3	24.7	13.3	52.2	3.3	24.8
All development project	213	100	53.8	25	85.4	40.9	21.2	24.8

Source: Source: Centre for Science and Environment, 2008.

From the above table 2.1, it can be observed that mining displaced 25.5 lakh persons in between 1951 to 1990.⁴ Only 24.7 percentages of the total persons displaced by mining in this period were resettled.

³ In those cases where the people are forced either by the mining company or the government to move from the place where they were living earlier to another place due to acquisition of their land by mining, the displacement and movement of people is termed as involuntary displacement.

⁴ The difference between the number of displaced here and in the last section is attributable to the fact that here we are taking the number of people who were displaced by mining projects but are not taking into account the project affected persons who were not directly displaced by mining. Furthermore the period of

Resettlement is poor for all the projects but is lower in mining. According to an estimate, Orissa resettled 35.27 percent of all its DPs in between 1951 and 1995 (Fernandes and Asif, 1997). In Andhra Pradesh, 28.82 percent of its DPs (Fernandes, 2001), in Kerala 13.8 percent of its DPs (Muricken, 2003), in Goa 40.78 percent of its DP's in the period 1965-1995 (Fernandes and Naik, 2001), in West Bengal 9 percent of its DPs in between 1947-2000 (Fernandes, 2006) and in Assam the DPs of only about 10 projects in the period of 1947-2000 (Fernandes and Bharali, 2006) were resettled.

Mining affects tribal population sometimes more adversely than other development projects, as mining reserves are concentrated in tribal dominated regions and the rights of tribals to common land, forests and other common property resources are not recognised by mining companies. Tribals accounted for a major proportion of the total persons displaced by mining in India in this period.

Among the total number of persons displaced by mining, tribals constitute 52.20 percentage and less than 25 percent of the tribals displaced by mining in this period were resettled. From the table 2.1, it can be seen that tribals constitute 41 percent of the total number of persons displaced by all the development projects, but in mining, they constitute around 52 percent of the total number of displaced persons.

Very few projects provide jobs as part of the rehabilitation package to the displaced. The provision of jobs to displaced persons as part of their rehabilitation has also declined after liberalisation.

Coal India Limited (CIL) provided jobs to 11,901 (36.34%) of the 32,751 families displaced by its mining projects in between 1981-1985 (Government of India 1985). Immediately after mechanization in the Upper Karanpura Valley of Jharkhand, the first 5

consideration here is from 1951 to 1991 but in the earlier estimate it was for the period of 1947-2004. Both the estimates are given by the same author. The earlier estimate is more comprehensive as it is giving information about both those who were directly displaced and those who were not directly displaced but lost their sources of livelihood nevertheless in mining. Here we are giving this particular estimate of the displaced persons in order to give an idea about the share of the resettled persons in the total displaced population as the number of such is available only for the later data.

of the 25 mines in the valley gave employment to 638 (10.18%) of the 6,265 displaced families till 1992 (Fernandes, 2007). In many cases, even when there is a rule for job provision in the R&R rules of the mining company, people who lose their earlier sources of livelihood do not get employment because of other conditions. In the North Karanpura Coalfields of Jharkhand, as per the rules of rehabilitation of CIL,, a family will get jobs if it loses three acres of land to mining. However, about 50 percent of the families who were displaced owned less than 3 acres of land and were thus deprived of employment (Roy, 2007). The problem of resettlement and rehabilitation is more acute in the mineral rich states of Odisha, Chhattisgarh and Jharkhand. One indication of the poor rehabilitation package on offer and people's dissatisfaction is the large number of anti-mining protests which have emerged in these states.

The data for displacement and resettlement and rehabilitation for 1951 to 1991 suggests that that the persons who have lost their earlier sources of livelihood do not generally get another source of livelihood to compensate for this loss. The increased scale of mining after 1991 suggests an increase in the volume of displacement. If the same trend as it was before 1991 continues in the resettlement and rehabilitation of the displaced persons, the loss of livelihood and the resulting deterioration in the standard of living of local people will increase.

2.2.4 Mining and Employment Generation

Employment in the mining sector is one of the main sources of livelihood for the local people who lose their earlier sources of livelihood due to mining. The availability of employment opportunities in the mining sector determines to a large extent the net impact of mining on the local residents.

Let us first look at the employment provision due to mining. The data for informal jobs in mining is not available but in the formal⁵ mining industry, the employment fell after

⁵This data is taken from the Centre for Science and Environment Reports. However Centre for Science and Environment Report has not defined the formal and informal sector in their reports so the data used is as used by them.

1991. It was about 8 lakh in the 1991 after which it has declined continuously, as shown in the table below.

Table 2.2 Employment in the Formal Mining Industry in India

Year	Employment in the formal mining industry (in lakhs)
1999-00	6.6
2004-05	5.6
2008-09	5.1

Source: Centre for Science and Environment, 2011.

This data refers to the average daily employment in the formal mining industry. A comparison in the number of persons employed in the formal mining sector in 1991 and 2008-09 indicates a fall in employment by 27 percent. In 2008-09, the public sector accounted for 81 percent of the total number of persons employed in the formal mining sector, while the private sector provided employment to 19 percent of the total (Center for Science and Environment, 2011).

At the worldwide level, the mining industry is moving towards modernization and automation and as a result the mining industry is employing less people to produce more. The Indian mining industry has also changed significantly after the introduction of the New Mineral Policy. It now involves investment from both global and domestic large private firms or companies who are competing at the worldwide level. This has resulted in a shift from small mines to large scale modernized mines, where the employment potential is much lower, and is declining day by day with the advent of new capital intensive technologies. In 1994-95 Indian mines employed 25 people to produce Rs. 1 crore worth of minerals. By 2004-05, only 8 people were required (Center for Science and Environment, 2008) to produce the same value of minerals.

Underground mining is more labor intensive than open-cast mining. Labor productivity in underground mines is about ten times lower than open-cast mines. For instance, in 2005-06, coal output per man shift in the underground mine of Coal India Limited (CIL) was

0.69 tonnes, whereas, in CIL's Open cast mines it was 7.15 tonnes. Most of the mining companies have started to shift production to open-cast mining in order to reduce labor requirements (Center for Science and Environment, 2008).

Detailed data is not available for the employment provided by different mining companies and over time, but the situation can be understood with an example. Mahanadi Coalfields Limited (MCL) is a subsidiary of Coal India Limited and was established in 1992. It undertakes production of coal in Odisha in the coalfields of IB valley and Talcher regions. Over a period of eighteen years, the coal production under MCL has grown from 23.14 million tonnes in 1992-93 to 104.08 million tonnes in 2009-10. In this period, the total employment provided by MCL has declined in absolute numbers from 21742 in 1992 to 21409 in 2010.

As shown above, there is a declining trend in the number of people employed in the formal mining industry. This is the case even without including the number of people who lose their sources of livelihood and employment due to the displacement and destruction of the environment caused by mining. If the number of such persons is subtracted from the employment provided by the mining sector, we would obtain an estimate of the net contribution to employment by the mining sector.

2.2.5 Mining and Deforestation

Most of the mineral reserves in the country lie under vast tracts of forests, and thus mining and especially open cast mining entails large scale deforestation. During the ten year period of 1995-2005, around 74,000 ha of forest land was diverted to mining. Forests provide a lot of products to tribal people and the communities living around them. The sale and personal use of timber and non-timber forest products is an important source of livelihood for them. As these products and services provided by forests, surrounding mountains and rivers are destroyed with deforestation, an important source of livelihood is lost. People lose access to fuel for food, fencing material, housing material, wood for implements, fruits, vegetables, roots, honey and several other consumable and non-

consumable products, which were earlier available to them free of cost.

The number of mining leases in the forest areas and the forest area diverted for mining has increased over time.

Table 2.3 Number of Mine Leases in Forests (1980-2005).

	1980-1997	1998-2005	TOTAL(1980-2005)
number of mining leases granted in forest areas	317	881	1198
averages number of mining leases granted per year	19	126	80
forest area diverted for mining (in hectares)	34527	60476	95003
average amount of forest land diverted for mining every year(in hectares)	2031	8639	6334

Source: Centre for Science and Environment, 2008.

Table 2.3 shows that while the average number of mining leases which were given forest clearance annually was just 19 in the period 1980-1997, it increased to 126 in the period 1998-2005. Similarly, the total forest land diverted annually for mining during 1998-2005 became four times of what was diverted annually in the period 1980-1997.

According to the statistics presented in the parliament in 2005 (Centre for Science and Environment, 2008), the states which lead in the production of minerals are also the states where maximum forest land has been diverted for mining. Odisha leads in this respect, accounting for 16 percent of total forest land diverted in India for mining during 1980-2005. It is closely followed by Chhattisgarh, where 14421 ha of forest land was diverted for mining in the same period and which accounted for about 15 percent of total forest land diverted for mining in India. The data for the number of mine leases in forest areas, the total forest land diverted for mining and the share of different states in this total forest land diverted for mining is available only up to the year 2005. The mining industry in India has started expanding at a rapid rate after 2005 and therefore all these figures are expected to be much higher for recent years.

Table 2.4 Forest Land Diverted for Mining in Different States (1980-2005)

States	Forest land diverted for mining	Share of total (in percentage)
Andhra Pradesh	13532	14.2
Arunachal Pradesh	142	0.1
Assam	87	0.1
Bihar	414	0.4
Chhattisgarh	14421	15.2
Goa	1282	1.3
Gujarat	9664	10.2
Himachal Pradesh	1228	1.3
Jharkhand	9059	9.5
Karnataka	7558	8
Kerala	29	0
Madhya Pradesh	10058	10.6
Maharashtra	4057	4.3
Orissa	15387	16.2
Rajasthan	4996	5.3
Tamil Nadu	436	0.5
Uttarakhand	247	0.3
Uttar Pradesh	2110	2.2
West Bengal	277	0.3
Andaman & Nicobar Islands	20	0
India	95003	100

Source: Centre for Science and Environment, 2008.

The average forest cover of the 50 major mineral producing districts in India stands at 28 percent. The total forest cover in these districts, 1,18,90,400 hectares (ha) is about 18 percentage of the country's forest cover. Mining and quarrying has destroyed large tracts

of forestlands in these areas affecting the ecosystem and the livelihood of the tribal population (Down to earth, sharing the wealth of minerals, Centre for Science and Environment, 2011).

2.2.6 Mining, Water Resources and Pollution

Most of India's iron ore reserves are along the courses and watershed of rivers like Indravati, Baitarani, Tungabhadra and Mandovi. Most of the coal reserves of the country are also located within river basins – Damodar, Godavari, Son, Kanhan and Mahanadi-Brahmani. Large-scale mining in these areas continues to degrade the catchment, affecting quantity and quality of water.

Mining results in pollution of both ground water and surface water. Mining wastes are often released into the water sources in the mining region, making the water unfit for any kind of use by the local population. Mining activity sometimes draws a large amount of water from the nearby water sources (both surface and ground water sources), which creates a shortage of water for agriculture, of clean drinking water and for daily purposes of the local inhabitants.

In open cast mining, the main pollutants are red oxide from iron ore mines, fly ash from Bauxite mines and coal dust from coal mining which make the surface water sources unusable for the local residents. In underground mining, one of the major problems especially in the case of coal mining is of acid drainage. In the coal mining areas of Jharkhand, acid drainage from mines, discharge of liquid effluents from coal handling plants, colliery workshops and mine sites and suspended solids from coal washeries have caused serious water pollution in the region, adversely affecting fish and aquatic life (Priyadarshi, 2008). The Karo River in the West Singhbhum district of Jharkhand is polluted with red oxide from the iron ore mines of Noamundi, Gua and Chiria. About 130 million litres of industrial effluents and 65 million litres of untreated domestic water waste find their way to the Damodar drainage system in Jharkhand every day. A study of the area showed that a single coal washery alone discharged about 45 tonnes of fine coal into the Damodar every day. There are as many as eleven coal washeries in the region

with an installed annual capacity of 20.52 million tonnes (Priyadarshi, 2008).

The deforestation and pollution of water resources adversely affects the livelihood of local people residing in the area.

2.2.7 Mining and Livelihood

Livelihood in its simplest sense means the capacity or ability of a household to provide for its consumption. This capacity or ability to provide for its consumption depends on the availability and access to the natural resources in the region. So the changes in the natural resources by changing their availability and ability to provide for people's livelihood will affect the livelihood of the local people living in the region.

Mining affects the livelihood of the local population at multiple levels. In India, almost all the areas which are declared mineral rich areas are regions with dense forests and large tribal populations. Ninety percent of India's coal and eighty percent of India's other minerals are found in the tribal areas. Among the fifty major mining districts in the country almost half are tribal districts (fall under the 'fifth schedule area'⁶ as defined by the constitution) (Centre for Science and Environment, 2008). Tribal livelihoods are dependent on the natural resources in the region. They are heavily dependent on common property resources like forests, ponds, rivers, village grazing lands etc. along with agriculture for their survival and day to day needs.

The Indian legal system gives recognition to land rights of only those who have 'patta' for their land. If people have been using a piece of land for years but do not have 'patta' for it, that land is simply declared to be government land. Similarly no recognition is given to the rights of people to the common property resources which they and their ancestors have used for centuries. The loss of common property resources and agricultural land with no 'patta' for it to mining leaves a number of people without a source of livelihood and with no legal right to compensation and resettlement. For example, almost all the land that has been handed over to Utkal Aluminium near Kashipur, Rayagada district for bauxite mining is tribal commons (Padel and Das, 2007).

So is the land used by the NALCO mines near Damanjodi in Koraput district (Fernandes and Asif, 1997). Of the 410,137.24 acres (166,047.47 ha) used for mining in Odisha till 1995, only 68,328.86 acres (16.66%) were private, the rest being predominantly tribal commons and forestland (Fernandes and Asif 1997). Only 35.7% of land under mining in Jharkhand is private and the rest is revenue commons or forestland (Ekka and Asif, 2000). In AP 30% of the 1,22,301 acres used by mines are Common Property Resources (CPRs) (Fernandes, 2001).

Since much of the land used for mining comes under CPRs, very few DP/PAPs get adequate compensation. The CPRs are considered state property though they are the main source of people's sustenance (Sethi, 2007). For example, the Manjhi-Manjhaar tribal and dalit DP/PAPs of Bharat Aluminium Company Limited (BALCO) in Mainpat, Chhattisgarh were promised compensation but only 50 families were paid compensation at the rate of Rs 12,000 per acre in 1992 even though the government set rate was Rs 50,000 per acre. The remaining 62 CPR dependent families were ignored (Agrawal, 2007). The compensation paid is often low, leaving DP's unable to buy any other land. When a village or a community loses land to mining, a large number of people with different occupations lose their source of livelihood. Apart from the farmers with proper 'patta' who are treated as the rightful displaced persons, there are farmers without patta, agricultural labourers, and farmers working on lease land, fishermen, local artisans and timber and non-timber forest product collectors etc. who lose their livelihood.

This section focussed on the displacement, resettlement and rehabilitation of the displaced due to mining, employment generation from mining, deforestation and water pollution from mining and the overall impact of mining on the livelihood of people of a region. Each of these impacts of mining either destroy livelihood or create new ones for the local population in a mining region.

⁶ Fifth schedule areas are those regions which are defined by constitution as the tribal dominated regions and where

Displacement, deforestation and water pollution adversely affects and sometimes completely destroys the natural resource base of the region where mining takes place, thereby destroying some of the sources of livelihood that existed before mining.

Resettlement and rehabilitation along with total employment generation in the mining areas to an extent can compensate the loss of the earlier sources of livelihood and provide the affected population new sources of livelihood. But as shown in the last section, the state of resettlement and rehabilitation and employment generation in India does not provide a very positive picture in terms of generation of alternative sources of livelihood. Thus, from the arguments presented above, it can be said that mining does not have a positive developmental impact on the local population in mining regions in India.

2.3 Mining and Underdevelopment

This section will make an attempt to establish the relationship between mining and underdevelopment by observing the development indicators of the mining regions, and by indirectly comparing it with other regions in the country. If it can be demonstrated that the mining districts are more underdeveloped than the other areas in the country, a relationship can be established between mining and underdevelopment.

2.3.1 Mining and Underdeveloped Regions in India

It was seen in the last section that if mining destroys the earlier sources of livelihood and does not compensate for this loss by creating alternative sources of livelihood, it leads to deterioration in the standard of living, and thus resulting in underdevelopment. Here, the relationship between mining and underdevelopment will be studied by looking at the developmental status of different mining regions in India – first, at the country level and second, as a special case in Odisha.

Studying the development or underdevelopment of a region involves the use of many different indicators. It considers the human development index, percentage of population

below poverty line in a region, the infant mortality rate etc. This section also uses similar indicators due to the lack of any other type of data⁷.

A study by Centre for Science and Environment showed that in 2004-05, there were many mining districts in India which were tribal dominated districts. These districts had a high rate of poverty and were declared backward districts in the country. The study arrived at this conclusion by comparing data available on the number of mining leases, area under mining with data on human development index, population below poverty line, and status as to whether it is tribal dominated and a backward district of the fifty major mining districts in India (Centre for Science and Environment, 2008).

These findings of the Centre for Science and Environment can further be supported by using the similar types of indicators across fifty major mining districts for the year 2011.

In 2011 among the fifty major mining districts in India, two third of the districts had more than fifty percentage of the population living below poverty line. Out of fifty major mining districts, around half of the districts have forest cover more than the national average and the percentage of combined schedule caste and schedule tribe population in 21 out of 50 districts is more than forty percent of the total population of the district⁸.

This shows in 2011 in the major mining districts in India the dense forests and schedule tribe and schedule caste populations coincide. Furthermore many of these districts have high incidences of poverty. These results coincide with the findings of the Centre for Science and Environment for the year 2004-05.

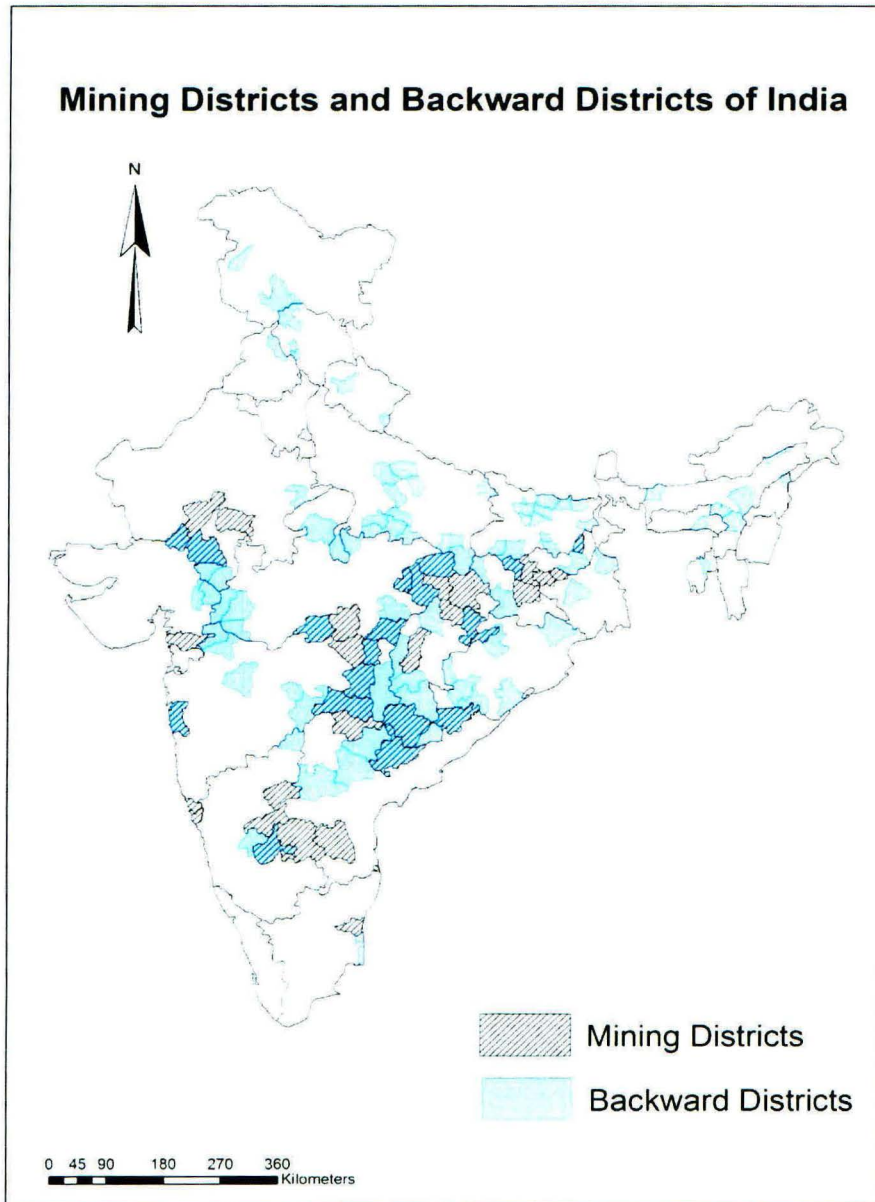
Another way of looking at the underdevelopment of the mining regions can be by looking at the development status of the major districts in which most of the mining activities are

⁷ In this chapter in order to provide a base for the study of the problem of mining and underdevelopment on the basis of existing literature, the developmental indicators used by others have been used. These indicators are used here because the secondary data on development of mining regions is available only in terms of these indicators. These indicators have the limitation of concentrating only on some components of development while ignoring some others especially in tribal dominated natural resource rich regions. The next chapter develops a proper index for assessing the developmental impact of mining.

going on. It is done by identifying the forty major mining districts and 150 most backward districts in India. The map which is derived by overlapping the major forty mining districts over the one fifty most backward districts is given below.

⁸ See appendix 2.1 for the table of fifty major mining districts in India and the head count ratio, combined Schedule Caste and Schedule Tribe population and the area under forest of these districts.

Figure 2.1 Overlapping of Mining Districts and Backward Districts in India



Source: Developed by the Author based on data from Planning Commission and Centre for Science and Environment 2011

The above map shows that out of 40 major mining districts in India, almost 50% (19 out of 20) of them belong to the 150 most backward districts in the country.

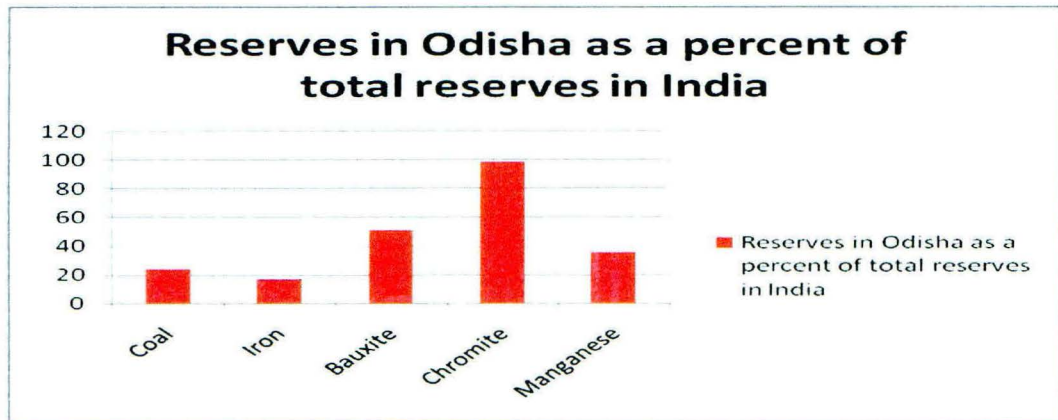
It can be seen that the major mining states like Odisha*, Chhattisgarh and Jharkhand together accounted for 54 percent of metallic mineral value and 45 percent of fuel mineral value created in the country in 2004-05. In each state more than 25 percent of the land is under forest cover and more than 20 percent of total population is tribal. Even when mining contributes between 10 to 15 percent of the gross domestic products of these states, large parts of these states are underdeveloped and poor: 86 percent of the districts in Jharkhand, 90 percent in Odisha and 94 percent districts in Chhattisgarh figure among the 150 most backward districts in the country (Centre for Science and Environment Report, 2008).

Two points can be made on the basis of all these illustrations and computations at the all India level for the mining regions. One, the major mining regions are regions with a large tribal population and dense forest cover. Two, there are reasons to believe that mining and underdevelopment in India coexist.

2.3.2 Mining and Underdevelopment in Odisha

The example of Odisha illustrates that despite the high growth in the mining sector the mining regions of India have remained underdeveloped and backward. Odisha is a state which holds a key position in mineral production in the country. It has 16.92 percent of the total mineral reserves of the country. The mineral industry in Odisha has registered a high growth rate in recent years especially after 2001-02. Between 1997-98 and 2001-02 the annual average growth rate of value of mineral production was in the range of 6 percent per year. From 2002-03 to 2004-05 it has grown at an average annual rate of 27 percent (Centre for Science and Environment, 2008).

Figure 2.2 Mineral Reserves in Odisha

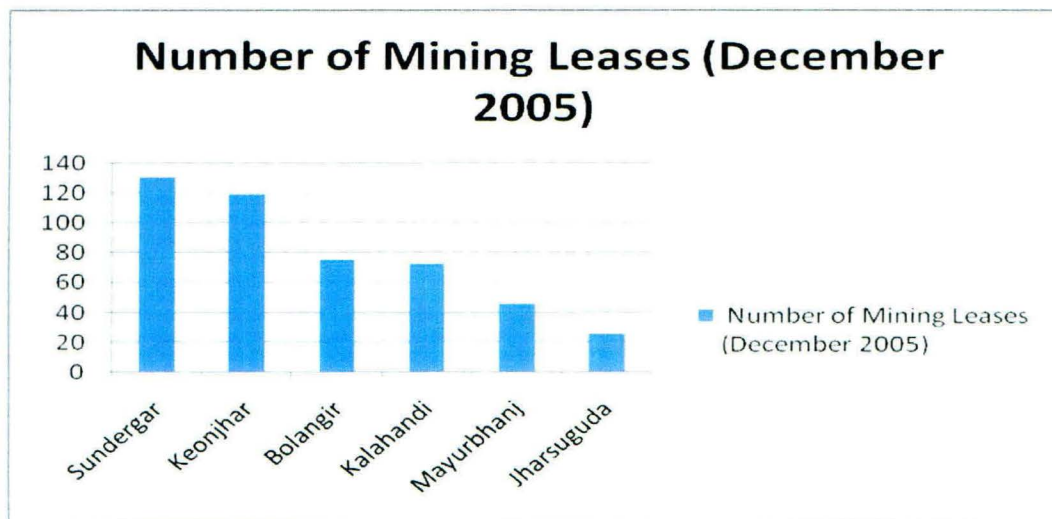


Source: Centre for Science and Environment Report, 2008.

In 2004-05 Odisha was responsible for 36 percent of the total value of metallic minerals, the highest in the country (Centre for Science and Environment Report, 2008).

By taking the number of mining leases as the indicator of the extent of mining in a district the following chart gives a picture of the major mining districts of Odisha

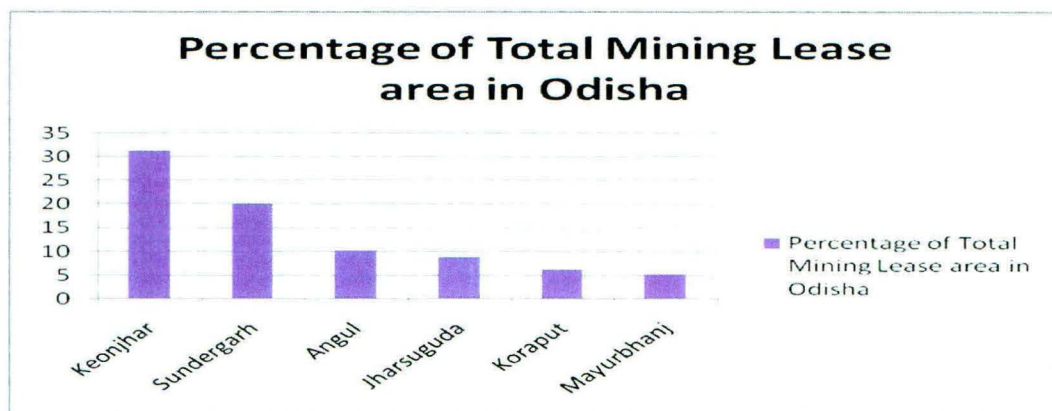
Figure 2.3 Numbers of Mining Leases in Different Districts of Odisha



Source: Directorate of Mines, Information obtained under RTI Act, Jan 2006.

The mining area falling under a district as a percentage of total mining area of the state can be taken as another indicator of the extent of mining in a district. According to this indicator the six major mining districts are Keonjhar, Sundargarh, Angul, Jharsuguda, Koraput and Mayurbhanj.

Figure 2.4 Percentage of Total Mining Lease Area in Different Districts of Odisha



Source: Directorate of Mines, Information obtained under RTI Act, Jan 2006.

Odisha has more than 11.4 percent of the total tribal population of the country. There are 62 tribal communities in the state and about 44.7 percent of the area of the state falls under the Scheduled Area according to the Fifth Schedule of the Indian Constitution. Tribals account for 57 percent of the total population in the Fifth Scheduled areas of Odisha (Nayak, 2004).

Looking at the districts which have high levels of mineral reserves and where mining is going on at large scale, it can be observed that except Jajpur and Angul all other districts are tribal dominated districts. In Sundergarh, Koraput and Mayurbhanj, tribals form more than 50 percent of the population, while in Keonjhar more than 44 percent of the population consists of tribal groups (Centre for Science and Environment, 2008).

In 1990 forest resources were the main sources of livelihood for about 80 percent of the tribal population in Odisha (Nayak, 2004). According to the estimates of the state's Forest and Environment Department, 31,780 hectares of land was diverted in Odisha for different projects including mining between 1980 and 2005. Mining alone accounted for 15,386 hectares of land diverted in this period, about half of the forest land diverted in the state. The total forest land declared for mining in Odisha accounted for 17 percent of the total forest land diverted in India.

So the trend observed at India level is also visible in Odisha. In the state, mining regions and tribal populations coincide. Mining in the state has resulted in deforestation. Since the livelihood of tribal populations is dependent to a large extent on forests the deforestation by mining tends to have an adverse impact on the livelihood of the tribal population. This adverse impact of mining will in turn affect the development of the mining region.

Taking the human development index and the head count ratio as two indicators of the development of a region the values of the human development index and head count ratio for the four major mining districts which are also tribal dominated districts reveal an interesting picture. Even though Odisha itself is one of the most poor and underdeveloped states in India, inside Odisha the mining districts with large tribal

population are in much worse condition (Table No. 2.5).

Table 2.5 Socio-Economic Conditions of Mining Districts in Odisha, 2004

Districts	Tribal population as a percentage of total population	Ranking among 150 backward districts made by CSE Delhi	Literacy Rate	Percentage of BPL Population
Keonjhar	44.52	30	59.75	61.92
Sundergarh	50.74	18	65.22	36.48
Koraput	50.67	10	36.2	78.65
Mayurbhanj	57.87	15	54.43	68.42
Odisha	23		50.97	48.01

Source: Human Development Report 2004, Government of Odisha.

A look at the condition of tribals inside Odisha it is shows that, in 1999-2000, 73 percent of the Scheduled Tribes were below poverty line as compared to 55 percent of the Scheduled Caste population and 33 percent of the population in the general category (Nayak, 2004).

According to the State Human Development Report of Odisha (2004) the poverty ratio (number of people below poverty line divided by total population), in the northern and southern regions (which include mining districts like Sundergarh, Mayurbhanj, Koraput, Keonjhar and Angul) has increased between 1993-94 and 1999-00⁹. This was the case

⁹ The regional divisions of Odisha used here are as used by NSSO in its surveys. The National Sample Survey Organization divides Odisha in three regions - the northern, southern and coastal.

even when there was a decreasing trend in the poverty ratio for the state of Odisha as a whole. According to the Human Development Report of Orissa in 2004 almost 75 percent of the state's poor lived in the northern and southern regions of the state.

It can be deduced from the available data for Odisha that mining has not contributed significantly to the development of those districts where it takes place on a large scale. These mineral rich tribal dominated districts have not only remained underdeveloped but the condition of the local population may have also worsened.

2.4 A Brief Review of Coal Mining in India

Coal is one of the oldest mined minerals in India. After independence planned coal production started with the formation of National Coal Development Corporation in 1956. Earlier both public sector and private sector companies were engaged in coal production in India. In the 1970's the Indian government nationalized coal mining in India. The nationalisation of coal was done in two phases; that of coking coal in 1971-72 and that of non-coking coal in 1973. Coal India Limited as a holding company was established on 1st November 1975.

Today most of the coal mining in the country is done by Coal India Limited (CIL), a public sector company, and its subsidiaries. These days' captive coal mines are also allotted to private sector mining companies. These companies are allowed to sell coal in the market from the captive coal mines allotted to them. The major part of coal production is, however, still done under the CIL.

Coal is one of the main fuel minerals available in India and till date the highest contributor to the value of minerals produced in the country. It is also one of the minerals in which most of the production is done under a public sector company. Coal mining in India increased from around 70 million tons at the time of nationalization in the early 1970's to over 355 million tonnes in 2003-04. In 2010-11 the coal production in India was 537 million tonnes and the value of annual coal production was 49012 crore rupees (Centre for Science and Environment, 2011).

In the mining and production of Coal the three major Indian states in a descending order are Chhattisgarh, Odisha and Jharkhand. Chhattisgarh has a share of 21 percent in total coal production while Odisha and Jharkhand have a share of 20 percent each in the total coal production in India (Centre for Science and Environment, 2011).

Coal mining like any other mining displaces people from their land and adversely affects the livelihood of the local people residing in that region.

In recent years the displacement from coal mining projects is expected to be more than what it was earlier due to a movement from the underground to open cast mining in coal. Till the 1970's most of the coal mining was underground coal mining. After that the coal mining shifted to open cast coal mining. Open cast mines require more land and displace more persons but create fewer jobs than underground mines.

In India, coal reserves are of two types- Gondwana and tertiary formations. The Gondwana coals are generally confined to river valleys like Damodar river valley, Mahanadi river valley, Godavari river valley etc. So most of the coal mining in the major coal mining states of Jharkhand, Odisha, Chhattisgarh and West Bengal is situated near these rivers and their tributaries. The pollution from coal mining tends to pollute these rivers and their tributaries.

Coal mining has various types of adverse impacts on the environment and thus on the livelihood of people living in and around the coal mines. Coal mining harms land, surface and ground water, and air. Surface mining removes the top soil of a place and completely destroys it. Unless the land used for mining purposes is reclaimed with proper vegetation to make it usable for other purposes, the mining area is completely destroyed by mining. The trees, landscape, water sources and houses in the mining region get coated by coal dust floating in the air.

The one major difference between coal mining and other types of mining in India is that the majority of the mining activities in this sector are done under a public sector company. Because of its public sector company status it is held accountable for its

actions by the public and this gets reflected sometime in the displacement and resettlement and rehabilitation policy of Coal India Limited.

Coal India Limited has a rehabilitation policy which includes provision of jobs in the mining part of the rehabilitation package given to the displaced population. Due to its public sector status Coal India Limited has provided more jobs than any of the private mining companies to the people displaced by mining as part of their rehabilitation process.

In 2007 almost three fourth of the total people employed in mining were employed in the coal mining sector, the majority of which is under CIL and its subsidiaries (Centre for Science and Environment, 2008).

The provision of jobs in the mining company as part of the rehabilitation package provides a source of livelihood to the displaced population. For the provision of jobs in the mining company, only those people are considered who have lost their agricultural land and have 'patta' for it. It seems that the positive effect of resettlement and rehabilitation schemes in creating new sources of livelihood in the mining region will only be for a part of the population who lose their earlier source of livelihood to mining.

2.5 Conclusion

It can be said that mining has generally resulted in displacement of the people and that the resettlement and rehabilitation of the displaced has been poor. Mining displaces more people than it rehabilitates. This has negative implications for those who lose their land but do not get alternative sources of livelihood to compensate for it.

Mining also seems to have adverse effects on the livelihoods of much larger numbers of people than those who are displaced. The local people in a mining region (majority of who belong to tribal population) use forest and water resources for their livelihood purposes. Thus mining by leading to deforestation and water pollution tend to have an adverse impact on the livelihood of local population.

Mining regions in the country are also the most underdeveloped regions in the country. Especially in Odisha, the mining districts are more underdeveloped than others. Furthermore it can be seen that in the mining regions which are also densely forested regions, a large tribal population resides in and uses the forests and other resources for their livelihood.

The dominance of a tribal population and existence of a large forest cover within mining regions has a special link with and specific implications on the development of such regions. The process of mining leads to large scale deforestation and through this adversely affects the livelihood of the tribal population which is dependent on forests and other natural resources. So the relationship between mining and underdevelopment operates through the impact of mining on natural resources like forests, and on the livelihood of tribal and other people dependent on natural resources.

On the basis of this analysis it can be said that there is a relationship between mining and underdevelopment and the data on displacement, resettlement and rehabilitation, deforestation and overall employment generation suggest that this relationship might be a causal relationship i.e. mining is resulting in the underdevelopment of these regions.

The development status of a mining district¹⁰ can be looked at in two ways. One way is by showing the co-existence of the mining and underdevelopment at any point of time. The other is to make a comparison of the development status of any mining region at two different points of time. In this section, because of lack of availability of data, the relationship between mining and underdevelopment has been established by looking at the development status of a mining region at one point of time. In the next chapter the development status of a mining region between any two points of times is looked upon by calculating the net livelihood change between pre-mining and post mining periods.

¹⁰ We are using districts as the unit of comparison across different regions in India to make the comparison easier as the district is a well defined geographical and statutory unit. Also because the data is available at the district level and it makes the comparison simpler and easier.

CHAPTER 3

CALCULATION OF NET LIVELIHOOD CHANGE DUE TO MINING

3.1 Introduction

The process of mining affects the lives of the local residents in various ways. In the previous chapter it was seen that mining in India has resulted in displacement of people from their land. It has also adversely affected different forms of natural resources in the surrounding region. The earlier pattern of living in the area gets destroyed due to mining and a new pattern of living emerges. It was seen in the previous chapter that a relationship can be established between mining and underdevelopment by looking at specific and national level examples. The districts which are mining districts are also the more underdeveloped and backward districts.

The previous chapter showed that there is a link between mining and underdevelopment. In this chapter the aim is to go beyond the establishment of a link between mining and underdevelopment and to find out how the process of mining leads to underdevelopment in a mining region. The local people are the centre of any process of development or underdevelopment. So in order to find out how mining leads to underdevelopment the impact of mining on local people needs to be captured and analyzed. The impact of mining on local people can be captured in terms of various different indicators. The indicators which are generally used are income, consumption, expenditure, wealth etc. In this study the indicator or the variable which is used is 'livelihood'.

The changes in livelihood over time will then decide the impact of mining on the people. The change in livelihood of a household is estimated by calculating the net livelihood change for a household. The direction of change in net livelihood will decide whether the local people are benefitting or losing by the process of mining.

The objective of this chapter is to calculate the net livelihood change and analyze the pattern of net livelihood change. Net livelihood change is taken as a proxy for development or underdevelopment of the local people between any two periods of time. The entire analysis and calculation in this chapter is based on the data collected from field survey of villages affected by Basundhara coal mines in Sundargarh district of Odisha.

The chapter is divided into seven sections. The first section contains an introduction of the chapter. The second section gives an overview of the study area. The third section is based on a qualitative analysis of the area in terms of changes which have been brought in the way of living of the people by mining. This gives an insight into the large scale economic changes in the region which are sometimes left out of quantitative calculations. The methodology for calculation of net livelihood change is developed in the fourth section. The basic components of net livelihood change calculation and the specific method of computation of their estimates is done in this section. The fifth section explains the basic characteristics of the sample used in the calculation and analysis. The sixth section analyses the pattern of net livelihood change for different households calculated using the methodology developed in section four. There are three parts to this analysis. First contains the analysis through comparison of pre and post mining distribution of livelihood earnings. The second part explains the pattern of net livelihood change through impact of different factors in the determination of this pattern. The third part of this section singles out two important factors- the size of individual landholdings before mining and the type of compensation received which affect the pattern of net livelihood change. The partial analysis of each factor by controlling the other is done to find out the significance of them in the analysis.

The last section of this chapter gives the conclusions of the chapter and their implications for our overall analysis.

3.2 An Overview of the Field Survey Area

As the calculation and analysis in this chapter is based on the field survey of the villages affected and displaced by Basundhara coal mines in Sundargarh district of Odisha, giving an overview of the study area is important before going into detailed analysis and calculations. Overview of the study area will give an idea about the background of the field survey. It will also put our sample and data collected from the field survey in a broader framework and allow us to look at it in comparison to the situation in the mining region as a whole.

Basundhara coal mines are situated in the Sundargarh district of Odisha. Sundargarh is the second largest district of Odisha in terms of its geographical area and sixth largest in terms of its population. The present Sundargarh district was formed by the merger of two princely states of

Gangpur and Bonai on 1st January 1948. The district is surrounded on the north by Ranchi district of Jharkhand, on north west and west by Raigarh district of Chhatisgarh , on the south and southeast by Jharsuguda and Debagarh districts of Odisha and on the east by the Singhbhum district of Jharkhand and Kendujhar district of Odisha. Scheduled tribes account for 50.19 percent of the population of the district and the major tribal groups are the Oraon (27.05percent), Munda (21.16 percent) and the Kisan (14.56 percent). The scheduled castes of the district constitute 8.62 percent of the total population of the district. In 1993 many of Odisha's districts got divided and new districts were formed, but Sundargarh district remain undivided.

Sundargarh district has abundant natural resources. The total forest cover in the district is 43.58 percent of the total geographical area and is the second largest among the entire districts in the state accounting for 8.53 percent of the state's total forest cover. It contains mineral reserves of coal, iron ore, manganese and a small amount of bauxite. The coal reserves in Sundargarh forms a part of IB coalfields and the iron ore reserves are a part of the iron ore belt which is spread from Kendujhar to Sundargrah.

Sundargarh district was in the list of 250 most backward districts in the country declared by the Ministry of Panchayat Raj in 2006. At present it is one of the 19 districts in Odisha which are receiving funds under the Backward Regions Grant Fund Program.

3.2.1 Basundhara Coal Mines

Basundhara coal mines, the field area of this study, fall under Gopalpur gram panchayat of the Hemgir tehsil of Sundargarh district. They are situated at a distance of forty eight kilometers from the district headquarter Sundergarh.

Basundhara coal mines are open cast mines. The mining in the region started around 1996-97 and is conducted by Mahanadi Coalfield Limited (MCL). Mahanadi Coalfield Limited is a subsidiary of Coal India Limited (CIL). Basundhara coal mines have two parts - east mines and west mines. The east mines started operating in 1996-97 and the west mines started in 2003-04. Tikalipada village which had two hamlets – Tikalipada and Khamarpada-lost their land in the east mines. The Tikalipada hamlets lost both its agricultural and residential land while the Khamarpada hamlets lost a part of its agricultural land but the hamlet (consisting of houses of the people) was not displaced. Sardega and Kulapada (hamlet of Gopalpur village) villages lost their

land in Basundhara west mines. In this cases both of these villages lost both their agricultural and residential land. But the people of Sardega village have refused to leave their village land until they get a proper rate of compensation based on market prices and are still living where they were living before mining even though technically that land is now owned by MCL.

The coal in the east mine of the Basundhara mines got exhausted in 2005-06 and now there is simply a big hole in the ground filled with water at the site of the mine. The extraction and production of coal at present is being done only from the Basundhara west mines.

Even though the mining started in the region in 1996-97 the survey of the region for the purpose of finding out coal reserves by the Mahanadi Coalfield Limited was done in 1985-86. After the survey the land of total fourteen villages in the region was marked as the land containing coal reserves. Furthermore the sale and purchase of land in these fourteen villages was banned from 1986 onwards. The beginning of mining in the region after 1996-97 directly involved the process of land acquisition and displacement from Tikalipada (both of its hamlets), Sardega and Kulapada. But the other villages in the region whose land has been surveyed but not taken up for mining are also being affected due to mining in the region.

In the field survey, two villages were covered, namely Tikalipada (including both of its hamlets, Tikalipada and Khamarpada) and Sardega. A detailed questionnaire was prepared and individuals in selected households were interviewed to get the required data and information.

The main tribes in this region are Bhuiyan tribes (who come under the schedule tribe category). The three main social groups in the surveyed villages are the Bhuiyan tribes, the Ganda community (belonging to the schedule caste) and the Agariya community (belonging to the other backward category).

Two other villages Kulapada and Gopalpur were also visited. As stated earlier Kulapada is one of the villages which lost its land in the Basundhara mine. Lack of proper transport and distance from the main residential area prevented a detailed interview and survey of this village. But informal discussions with people were held in this village to find out the impact of mining on their livelihood. Kulapada was actually a hamlet of Gopalpur village. Before mining started there were two hamlet of Gopalpur village, one was Kulapada and the other was Gopalpur. These two hamlets were situated on the either side of Basundhara River. When mining started on the one

side of the Basundhara River and displaced the Kulapada hamlet it gradually lead to drying up of a major part of the Basundhara River. The drying up of parts of Basundhara River and proximity to the Basundhara west mines has made agriculture unviable for the people from Gopalpur hamlet that have lands on the other side of Basundhara River. Gopalpur village was visited and informal discussions were held with the village people in order to get an idea about the impact of mining on the nearby regions which are not directly displaced or affected.

3.2.2 Displacement and Rehabilitation in Basundhara Coal Mines

According to official documents of MCL the numbers of families which were affected¹ or displaced from the Basundhara mines in these three villages (Tikalipada², Sardega and Kulapada) are as follows: 207 families from Sardega, 258 families from Tikalipada and 58 families from Kulapada village. In total 292 families have been given employment in MCL: 115 families from Sardega, 177 families from Tikalipada (including families from both Tikalipada and Khamarpada hamlets of Tikalipada village) and 24 families from Kulapada. The resettlement site is Basundhara Nagar (which is now also called as Tikalipada as the whole of the earlier

¹ The term 'affected' is used here to denote those families which have lost their complete or partial agricultural land in the mining but who have not lost their residential land. So they are living where they were living before mining but are technically not displaced from their villages. The term 'displaced' is used to denote those who have lost both their agricultural and residential land and are now living at a different location. The affected families which are referred to here should not be confused with other households in the nearby regions which have neither lost their agricultural land nor home land but nonetheless are feeling the adverse impact of mining.

² Tikalipada village includes both of its hamlets, Tikalipada and Khamarpada. The people earlier residing in the Tikalipada hamlet are now residing in the resettlement site of MCL i.e. Basundhara Nagar, while those of Khamarpada are still living where they were living before the mining. So in this whole paragraph wherever it is written as Tikalipada it includes people from both Tikalipada and Khamarpada hamlets. Because the official data regarding number of families displaced, resettled and who were provided jobs with MCL are given for the Tikalipada village as a whole we are unable to give here the numbers of the households displaced and who got job in the MCL separately for the Tikalipada and Khamarpada hamlets. But since none of the households from Khamarpada hamlet are displaced from their village (till the time this survey was done) the numbers of households from the Tikalipada which are stated to have got plots in the Basundhara Nagar are entirely from the Tikalipada hamlet of Tikalipada village. Since a number of households from the Khamarpada hamlet have lost their agricultural land in mining and many of such households have got job in the mining company as part of their rehabilitation, the number of households from Tikalipada village who were displaced or affected and the number of those who got job in MCL as given above includes households both from Tikalipada and Khamarpada hamlets.

Tikalipada hamlet is resettled there) where total number of plots is 260 out of which 256 have already been allotted.

Out of these 256 allotted plots 124 plots have been allotted to Sardega village people and 132 plots have been allotted to Tikalipada (these comprises of families only from Tikalipada hamlet of Tikalipada village) village people. According to MCL the resettlement and compensation of the affected people from Sardega and Tikalipada village has been completed and for the Kulapada village it would be completed after providing 5 jobs in the company (as on 11.07.2008). The total quantity of land acquired for the Basundhara open cast mines is 437.10 hectares out of which 120.28 is forest land and 316.82 is non-forest land.

According to the official records it can be seen that the total number of households which were displaced or affected by Basundhara coal mines is 523. Out of these 523 households 292 were given jobs in MCL (not including the 5 of households which were still to be given jobs at the time of publication of this document because we don't know whether it was actually given or not). It means that the job as part of the compensation package was provided to fifty five percent of the total number of households which were displaced or were affected by Basundhara open cast coal mines (including both east and west Basundhara coal mines).

3.3 A Qualitative Analysis of the Impact of Mining

The visit to any field area and the discussion with its residents gives a general idea about the region and its characteristics. Discussions with the people in the field area of this study provided different kinds of information regarding the impact of mining on the region and on the life of local people. Many times the information which is provided by the people cannot be quantified or put into any data form but nonetheless it gives important insights into the changes taking place in the region. This section uses the information provided by the people who were interviewed and with whom informal discussions were held during the field survey. In some places this section also relies on the observations which were made by the researcher during the survey. In this section a qualitative analysis of the field area is done with reference to the impact of mining on the local people and their livelihood.

3.3.1 Impact of Mining on Agriculture

Besides the villages covered in this field study (which have been directly affected by mining due to the loss of their agriculture and home land) there are surrounding villages that have experienced adverse impacts of mining on their sources of livelihood, especially agriculture. After the mining started there has been an overall shortage of water in the region. This shortage is in both ground water and surface water. After the beginning of mining in the area the ground water level has become very low. This together with the deposit and accumulation of coal dust on agricultural land and crop has resulted in a decline in agricultural produce. This has forced people to give up agriculture even when their lands have not been acquired for mining. In these villages there are many households which have stopped growing crops on their agriculture land. These people are leaving agriculture and trying to take up some other occupations. These alternative forms of occupation consist mainly of labor work as a daily wage laborer either in the construction sector, in the mining company or in the transport services.

Even the people who are still engaged in agriculture activities in the region complain of reduced annual production from their land. In many cases where people were earlier growing vegetables along with paddy by using water from nearby water sources like wells, ponds etc, they have stopped growing these because of drying up of earlier irrigation sources.

People who are still engaged in agriculture are facing an additional problem these days. It is very difficult for them to find agricultural workers willing to work on their land. The daily wage rate in the region has increased over time. This has been a combined result of higher wage rate for unorganized unskilled work in mining and the fixing of daily wage rate in the MGNREGA program. This is a problem which is being faced by farmers in other parts of the state as well. The price which a farmer gets for his/her crop has not increased in proportion to the increase in the wage rate or other costs involved in agricultural production. As a result those who are pursuing agriculture as their main occupation are facing twin problems, one is of reduced agricultural produce and the other is of increased cost of production.

3.3.2 Impact of Mining on Land Use and Land Rights

Mining has changed the land use pattern and land distribution in the region. A large quantity of land (both agricultural and forest land) has been diverted for mining purposes. The land which

was earlier privately owned has now become the property of the mining company. The land which was earlier used as common property by the village like grazing land, forest land etc., and is now no longer available to the villagers. In the field area one can see coal dumps everywhere around villages (where the agricultural land of the people has been acquired for mining but the residential land and thus the *hamlet* of the village has remained). There are large heaps of coals surrounding the villages. There is no place to graze for the domestic animals.

There are tracts of land in the mining region which before mining were used for agricultural purposes but now which have simply become waste or barren land. There are tracts of agricultural lands which have been acquired by the mining company but are not presently in use for mining purposes. Some households are still engaged in such lands but only when it is far away from the mining site and have adequate water sources. But most of the time agriculture on these lands is unviable because of the deposit of coal dust on its surface and shortage of water. So these lands are often left barren and become waste land.

Furthermore as we discussed in the last section that there are surrounding villages which are not directly displaced by mining, but farmers have stopped farming because of shortage of water and accumulation and deposit of coal dust on their agricultural lands. These tracts of lands also become waste land over time.

One of the major results in terms of changes in land use structure in the region of mining is the increase in the amount of waste land.

The people from the displaced villages Tikalipada basti of Tikalipada village and Sardega have got land for housing amounting to ten decimal per family (to those who had '*patta*' for the residential land which was acquired for mining) as a part of the compensation and resettlement scheme. The people who were living in Tikalipada hamlet have lost both their residential land (land on which their house were situated) and agriculture land and are now residing in a rehabilitated colony i.e. Basundhara nagar, in which residential plots of ten decimal were given to every family at the time of displacement. But even sixteen to seventeen years after their displacement and compensation they have not been given a '*patta*' (legal entitlements) for the residential plots on which they are living. The people from Sardega village have also got residential plots of ten decimal as part of their compensation scheme but most of them have not

shifted to the proposed place of resettlement. Neither those who have shifted nor those who have not shifted have received any 'patta' for the plots of land which has been given to them. In the case of the most recently displaced village Kulapada no residential plots were given. They were simply given some monetary compensation instead. Now they have re-established the village on nearby forest land which is technically also the property of the mining company.

Earlier mining people used two types of land for livelihood purposes, one was privately owned land and the other was common property land which was jointly used by the village community. Traditionally they had rights of use and access to the common property land like village grazing land or forest land. The rights of people to common property were not recognized by the mining company. The mining in the region has resulted in the loss of these rights and now the displaced villages have no rights to any kind of common land in the region. The right to common property land is completely lost and any use of it is now illegal with the possibility of its takeover anytime by the mining company. The legal right to private home and agriculture land has now been replaced with illegal stay on forest or government land. Both those who are staying in the compensation colony and those who have resettled in a new place in the region on their own technically have no legal rights to these plots of land.

The future of both these categories of people is insecure as they do not have any legal rights over the land on which they are staying. They themselves say that they might have to shift to someplace else in the next ten years as it is highly possible that the land where they are now staying will be taken up for mining.

Before the advent of the mining the availability and access to common land, the amount of privately owned land and the quality of such land were the main factors determining the standard of living and the livelihood pattern of a family living in a village. After the advent of mining almost everybody has become landless. Thus land is no longer a deciding factor for the livelihood and standard of living of a family.

3.3.3 Impact of Mining on Forest and Water Resources

The forest area has declined after the beginning of mining in the area. The access to the forests and use of forests for livelihood purposes has also declined. Still there are some forests in nearby areas at a distance of approximately ten to fifteen kilometers from the mining region. But the

coal dust from mining is also adversely affecting these forests. Some forest products have become extinct and others have become scarcer. The families that are still collecting non-timber forest products for livelihood purposes have to now travel a larger distance to get it. Almost everyone used wood as cooking fuel before mining. Now they use either cooking gas (if they are in a permanent job in MCL) or coal. Very few households still use wood as cooking fuel. Now either they have to travel quite far to bring fuel wood or they have to buy it. Earlier wood was used in house building. Now almost nobody uses wood in house building because it is not available freely in the required quantity.

There is an acute water crisis in the region and most of the available water sources are either the old village ponds, the remaining unpolluted part of the Basundhara River or the tap connections provided by the Panchayat. Many of the old wells have dried. Part of the Basundhara River has dried up and part of it has a layer of coal dust and cannot be used for drinking or bathing purposes. The people living adjacent to the river are now taking drinking water by creating holes in the sand in the riverbed. Earlier everybody had a right to go and catch fishes in the village pond. People used to catch fishes most of the time for their own consumption and very rarely for selling it in the market as there was no developed market for it and anybody who wanted to consume it could easily catch it from the village pond. Today on one hand the number of fishes in the pond has declined due to water pollution and on the other hand the contract for catching fish in the pond are exclusively given to some outsiders and fishing is no longer free for everybody. Earlier nobody bought fish. Now almost everybody has to buy it. The entry of market has turned the earlier non- marketed village common property resource into a marketable commodity and now the village people do not have free access to the fish in that pond. The rights for catching the fish in the village pond are now sold to some contractor by the Panchayat.

3.3.4 Impact of Mining on Occupational Structure and Employment in the Region

Before mining the main occupation in the region was agriculture. Collection and sale of forest produce was the subsidiary occupation. Now for the majority of the people the main occupation is either a job in the MCL (provided by the mining company as a part of their compensation) or labor work in the mines on a daily wage. The subsidiary occupation is still collection of the forest product but this is mainly for those people who have not got a job in the mining company. There are very few for whom agriculture is still the main source of livelihood. These are the

people who had land at some other place, those whose land has been taken away by the mining company but mining has not yet started on it or those who have lost only a part of their agricultural land to mining.

MCL provided only one job per family at the time of displacement. So there are now many unemployed family members in the working age group. Before mining started since they had agricultural land they were able to do some kind of labor in their fields. They might have been underemployed but now they are openly unemployed and are simply sitting in the house and doing nothing the whole day.

Over time MCL has started outsourcing and subcontracting its work to other small private firms. These firms hire their workers from Jharkhand and Bihar on a contractual basis. They generally do not prefer to employ the local displaced population as they can bring workers from other states and pay them very low wages with no other work benefits. These days MCL is doing only a partial amount of work related to extraction of minerals like removal of overburden from the mining site and loading of coal to the trucks. All the remaining work like extraction of coal, breaking and transport of it from one place to another is done by these various contract based companies. There is a drive for land acquisition in 12-13 villages nearby. Some people say that at present MCL is over staffed and thus no jobs will be given to the people who are going to be displaced from these villages. Only cash would be given to them as compensation.

3.3.5 Mining and Infrastructure in the Region

Although MCL is a public sector company and generally public sector companies are known to spend more on building physical and social infrastructure as compared to private mining companies, the condition of physical and social infrastructure is not very good in many respects. The condition of roads is very bad. It takes two and half hours to travel 48 km from the district headquarter Sundargarh to the Basundhra coal mines.

The availability of electricity is good. But after coal mining the average temperature has also increased therefore the dependency on electric gadgets has also increased.

MCL has given land and helped in the establishment of the Dayanand Anglo Vedic (DAV) public school in the area. The school fee for the children of the MCL employees is very low

about 30 rupees per month. Consequently many people believe that education in the region has improved after the opening of the mines. There are also many MCL employees whose children are studying in the old Odiya medium government school. Now there are three schools in the region: one is the DAV public school supported by MCL, another is a government school (which existed even before MCL started operating in the region) and the third one is Sarswati Shishu Mandir a private primary level school.

3.3.6 Impact of Mining on Health

The health of the population in the district has deteriorated after mining started. People say that earlier there were few incidences of malaria in the region. Now almost everybody sleeps in a mosquito net as there is a high incidence of malaria and specially Falciparum in the region. There is one small hospital in the area in which medical consultation and a few medicines are free only for MCL employees. Despite this most people including MCL employees prefer not to go to the MCL hospital as they say that the treatment and medicines provided don't work. Most of the people prefer to go to the government hospital at Gopalpur for treatment. This is about 8 to 10 km away.

3.3.7 Mining and Market Dependency

People report that before mining started in the region it was quite a secluded area. Not many roads and not much transport was available linking it to the district headquarter and other towns in the area. People were mainly engaged in agriculture and in the collection, use and sale of forest products. There was not much contact with the institution of market. Generally the agriculture was non-irrigated with one crop in a year and the main crop was paddy. Only those farmers who had their own private water source or those who had land near ponds or rivers were able to grow vegetables as a second crop. Most of the daily needs were available either through agriculture or from the forest, the rivers and ponds. Very few things were bought from the market. The extent of dependence on the market was very low. Therefore even though the amount of money in the hands of people was much less the need of such money was also minimal.

There is an increased dependence on the market after the beginning of mining in the region. After the advent of mining the total expenditure in money terms and the need for money for

various forms of transactions have increased. The people are dependent on the jobs in mining and on the sale of goods acquired from the use of remaining natural resources in the region for money. For the goods and services of their daily needs they are now dependent on the market. The prices and availability of goods and services in the market is dependent on a lot of other factors which are outside the control of local people. Because of this the increased dependence on market also increases the uncertainty and the risk associated with new forms of livelihood.

3.3.8 Mining and Price levels in the Region

The prices of vegetables and many daily requisites or items of daily consumption in the mining region are two to three times more than what is in the nearby areas. Those people who have not got jobs in the mining company are in dire situations. The goods and services which were available free from the use of common property resources of the region are either unavailable or are available in reduced quantity. Therefore local people have to buy more and more things from the market, pay extra for them (due to higher prices) while their income and their livelihood opportunities have not increased accordingly. High prices in the mining region can be explained as a result of two factors. One is the destruction of agriculture in the area including the production of livestock products and second is the large scale influx or in-migration of people from outside the region. The first has resulted in a shortage of goods in the region and the second has resulted in an increased demand for such goods.

3.3.9 Mining and Livestock Production in the Region

As a result of the loss of community grazing land to mining and the loss of agricultural land there is a shortage of fodder for domestic animals in the region. This has forced households to sell their domestic animals. The pollution from the coal dust has given rise to different kinds of diseases in animals and consequently many domestic animals have died after the beginning of mining. Before the advent of mining many households had cows, bulls, hen and goats in their homes and used livestock products like milk, chicken, eggs and mutton both for self consumption and sale. The loss of domestic animals either because of lack of fodder or because of mining generated diseases has resulted in a reduction of income as well as consumption. Now very few households (mainly those who are still engaged in agriculture) have domestic animals and among them also there are very few who sell livestock products.

The general opinion among the affected public is that the beginning of mining in the region has resulted in a situation of loss for them. Some people who were earlier landless laborers and didn't have much agriculture land of their own believe that they have benefitted from the mining. This situation is true only for those people who have got permanent jobs in the company and didn't have much agricultural land before mining. Those who had a fairly large amount of agricultural land mostly feel that their lot has worsened.

3.4 Methodology for Calculation of Net Livelihood Change due to Mining

The objective of this section is to develop a methodology for the calculation of net livelihood change in a mining region. The development of methodology is done keeping in mind the specific characteristics of livelihood in a tribal dominated forest region. The various components of the net livelihood calculation are explained in detail along with the methods used in estimating values of these components.

The first part of this section gives a general and specific definition of livelihood. The second part discusses the reasons for choice of livelihood over other indicators like income, consumption expenditure, wealth etc. The third part explains the concept of net livelihood change. In the fourth part the discussion is centered on the pre-mining and post-mining pattern of livelihood. In the fifth part of this section the components of net livelihood change, the methods involved in the calculation of net livelihood change and the exact formula used are described. The last sub-section of this section explains the limitations of the above methodology.

3.4.1 Definition of Livelihood

Livelihood in the simplest terms means 'means of securing necessities of life'. All the activities which are carried out by individuals and families to support themselves can be termed as livelihood. Generally, the concept of livelihood is used in those cases where the life and the ways of earning a living by the people are in some way connected with nature. There are different types of livelihood which are based on different pattern of life and different forms of uses of natural resources. It also varies with the change in the type and availability of natural resources. For example the livelihood of a fisherman in a coastal area will be different from the livelihood of a tribal in a forest area. The mining regions in India are covered with dense forests and often tribals are the main inhabitants of such regions. In case of livelihood of tribal households in a

forest area the exact use and dependence on forest resources may vary between different households but the forest resources still play an important role in providing the means of living to all the households in the region. This is the reason why livelihood of households in a mining region can be used as a general term in discussing the impact of mining on the local people.

Livelihood is used in a specific sense in this study. It is defined as the ‘Capacity or ability to provide for consumption of a household by its members’. The term “livelihood changes” therefore means a change in this capacity or ability to provide for consumption of the households. As the capacity or ability to provide for one’s consumption will decide the standard of living and in a broader sense the level of development of different households in the region, the livelihood becomes in our case an indicator representing the status of living or standard of living of different households at any given point of time. The livelihood of any household can be divided into two parts one is the part which is acquired in kind (goods) through use of different natural resources and the other which is earned in money form (like through working as agricultural labor).

3.4.2 Choice of Livelihood as a Measure to Assess the Impact of Mining on Local People in the Region

There are other variables like income, consumption expenditure or wealth which are generally used to capture the impact of mining or any other economic activity on the local residents and their development. But livelihood is a better, broader and more holistic concept and measure to capture the impact of mining on their lives.

One main reason behind this is related to the life style of the local residents in the mining regions. As it was explained earlier the mining regions are generally tribal dominated regions. The life style of tribals is closely linked with nature and is dependent on the use of natural resources (to fulfill their day -to- day requirements). Many of these resources provide goods and services which are non-monetary in nature. They are not marketed but are consumed directly by the people.

Income is a variable which covers all the monetary earnings of a household. It is the total money earned by a household either through sale of labor or through sale of goods produced or procured

by it. But if there are goods which are procured from the natural resources like forests, grazing lands or rivers and are directly consumed, it will not be covered in the income of the household.

Because a large part of the goods which are used for the daily consumption by tribals are those which are procured from the natural resources for direct consumption (specially in the pre-mining period), income is not a suitable variable to capture the changes in the status of living of the people in a mining region.

Consumption expenditure of any household at any point of time gives the total money expenditure of households on consumption. Consumption expenditure does not give any information about the sources of the earnings which provide for consumption. The expenditure on consumption of a household might have its source in income earned by the household or it might be through a loan taken from others. If later is the case then the change in consumption expenditure will not depict the true picture of change in the status of living of a household.

Furthermore consumption expenditure ignores the savings of the household. It might be the case that the consumption expenditure is more or less same but the savings of the households have changed greatly.

The direct consumption of goods which are procured from natural resources and which do not have any market will also be left out of the calculation of consumption expenditure of a household in the mining region.

Wealth of a household can be defined and measured in different ways. In the simplest way it can be defined as the value of all the asset holdings plus the income of the household. If wealth is taken as a variable to capture the impact of mining on the local people it suffers from the same problem as was suffered by income i.e. exclusion of goods which are obtained from natural resources for direct consumption.

In this study livelihood is chosen as the variable to capture the changes in the status of living of the people in a tribal dominated mining instead of income, consumption expenditure or wealth. It is because it includes both the goods which are directly consumed from nature and the income earnings (either through labor work or by sale of goods obtained from natural resources) of a household in it. All other variables like income, consumption expenditure or wealth do not take

into account the role of natural resources as a source of living for the people. Livelihood changes on the other hand are directly linked with changes in the availability and access to natural resources. As tribal way of living is deeply interlinked with the natural resources in the region, livelihood is a better indicator for capturing the changes in their life and standard of living due to mining.

3.4.3 Net Livelihood Change in a Mining Region

Thus, in order to capture the impact of mining on the development of the local people we need to look at the changes in the livelihood over time for different households and for the region as a whole. We need to look at net livelihood change between two periods of time, the pre-mining period and the post mining period (the point of time at which the field survey was conducted).

In order to capture the changes in livelihood the changes in the access and availability of different livelihood sources (including natural resources) needs to be taken into account. In order to quantify the change in the capacity or ability of a household to provide for its consumption the changes in the availability of the goods which were procured through use of natural resources and the changes in the amount of money earned through application of labor needs to be calculated. The natural resources which are used for livelihood purposes can be divided into two parts. One is those which are common property resources from which the goods and services are freely available to all. This includes the forest resources, rivers, ponds, village grazing land etc. The second type is the resource like agricultural land which is distributed unevenly between different households on the basis of private ownership. The uneven distribution of agricultural land between different households results in differences in the agricultural produce obtained by these households both for direct consumption and for sale of it in the market.

3.4.4 Pattern of Livelihood before and after Mining

The beginning of mining in a tribal dominated forest region changes the pattern of livelihood in the region. Mining results in a change in pattern of livelihood in two ways. It does so firstly by changing the availability and access of the existing natural resources and secondly through introduction of new livelihood opportunities in the region.

Before the beginning of mining the main sources of livelihood in a tribal dominated forest region are agricultural land, forest, rivers and ponds and grazing land. The main activities which provide the livelihood are agriculture, agricultural labor work, forest product collection and sale, fishing, animal husbandry and any other kind of labor work (dependent on its availability).

Before mining land owning families used to grow paddy in the monsoon season. Those who had irrigation facilities used to grow vegetables as their second crop. Almost all families had a small vegetable garden in their backyard from where they used to get vegetables for their daily use. Households who had domestic animals like cows, bulls, goats and buffalos used them for livestock production and agricultural work. Many families had these animals and used livestock products for self consumption. Those who had domestic animals in large quantities used to sell surplus livestock products to others. People used to catch fish in the village pond for self consumption.

The Forest was used for collection and sale of timber and non-timber products. The main non-timber forest products were Mahul, Tol, Kendu leaves (Tendu leaves), Char, Neem seeds, Sargi seeds, particular kinds of grass, bamboo etc. Mahul is the flower of Mahul tree also called as Mahua and was used for preparation of locally made brew, for consumption. A large part of Mahul flower harvest was sold in the market after collection. Tol is the fruit of Mahul tree and was used mainly to make Tol oil which was used for cooking and soap making. Kendu leaves, also known as Tendu leaves, were mainly sold after collection. It is used for making Beedis. Char is another type of fruit the seed of which is generally used as dry fruit in making sweets. Earlier it was consumed, sometimes sold and sometimes exchanged for salt. Neem seeds and Sargi seeds were used for making soap. Another use of Neem seeds was for making medicines for domestic animals. Grass from the forest was used for making brooms. Bamboo was used for making many bamboo products like baskets which were mainly sold. Timber or wood from the forest was used as cooking fuel, building houses and furniture and for making agriculture appliances. Some households were engaged in making these things from wood and selling them. There were many other things collected from the forest which were mainly used for direct consumption like Mangoes, Bel (a type of fruit), some green vegetables etc.

Many people used to work as agriculture laborers in other people's farms. This kind of agricultural work was available from eight days to one month in a year (mainly in the season of harvesting).

Mining induces a change in the pattern of livelihood in the region. The new livelihoods opportunities which are introduced in the area through mining are jobs in the mining company as regular salaried work or as unskilled labor work on daily wage basis. Sometimes mining also brings other types of livelihood opportunities like unskilled labor work in construction sector, transport sector etc. Mining on one hand opens up new opportunities for earning income in the region but on the other hand it destroys some traditional sources of livelihood in the area. The land acquisition by the mining company converts a part of agricultural and forest land into mining site, waste land or land used for other types of mining related work and it no longer remains in a condition to be used for traditional livelihood purposes. So the people and families who were earlier dependent on this agricultural land are now deprived of it. Similarly the forest land acquired for mining and the deforestation associated with it results in a loss of all the goods which were available from the forest to the people in the region. The land acquisition of agricultural and forest land for mining also leads to a shortage of fodder for domestic animals. The shortage of fodder in turn and over time forces people to either sell the domestic animals or causes the animals to starve and perish. The availability of livestock products like milk, milk products, chicken, mutton, eggs etc which were earlier used for their own consumption and sale gets reduced. Some households which were earlier using livestock products from their own animals are now completely dependent on the market for its consumption.

The various forms of pollution from mining adversely affect resources like forest, water and soil and which in turn affect their capacity for providing various types of goods and monetary income through sale of these goods and through application of labor on these resources.

The main sources of livelihood after mining are work in the mining company either as regular salaried or as daily wage worker, work in construction or transport sector on daily wage and collection and sale of forest products (provided some forests are still there in the region) and cultivation on the remaining agricultural land.

The livelihood change measured in quantitative terms can be positive or negative in any period. Depending on the direction of change in livelihood it can be termed as livelihood gain or livelihood loss. For example in the field area of this study it was found that after the advent of mining Kendu leaves are no longer available in the forests. Thus the earnings through collection and sale of Kendu leaves are no longer available to the households engaged in it earlier and thus constitute a loss of livelihood due to mining.

Similarly if somebody got a job on a regular salary in the mining company the annual income from this job will be a livelihood gain. It is because in the pre-mining period this source of livelihood earnings was not available to the concerned household and thus the entire livelihood change on this head will be an addition to the livelihood of the household.

3.4.5 Calculation of Net Livelihood Change

The actual livelihood data for the villages under study for the pre-mining period are difficult to get. So, it was decided to interview the households and ask them to report their sources of livelihood and their quantities both at present and before mining (by memory). The information received through these interviews was then converted into the monetary equivalents (through the method described below) and livelihood change (loss or gain) was calculated for each household.

In order to develop a quantitative measure of net livelihood change for a household the changes in the quantity of goods freely available from nature and the changes in the earnings (in money terms) needs to be added together. In order to add the changes in these two components of livelihood the changes in the quantity of goods freely available from nature and used for direct self consumption needs to be converted into monetary values.

If there is a developed market for a good then the conversion of its real value into monetary value is not complicated. It can be done simply by multiplying the standard average prices of the good with its quantity. The problem with conversion of the real value into monetary values of the goods which are procured from natural resources and used in direct consumption arises from a lack of developed market for these goods in the pre-mining period. There are two possibilities. If it has a developed market now then the real value of it can be converted into monetary value by simple multiplication of quantity of that good with average current prices of that good in the market.

If the good does not have a market even after mining then the calculation of the change in the value of goods directly consumed is a bit difficult. If the concerned household is now buying substitute of this good from the market (have stopped its direct consumption from nature) then the current annual expenditure on the substitutes of the good can be taken as a proxy for the loss of the value of the good which was earlier directly consumed from the nature.

If the good with no market is still consumed by a household then for the conversion of change in the quantity of goods consumed can be done by taking average standard prices of its substitutes (if they are available in the market) and multiply the change in quantity with the prices of the substitutes to get an estimate of the value of livelihood change on this head.

Net livelihood change between pre-mining and post-mining period is a sum of change in monetary values of all its components including the goods and earnings from different livelihood sources which were available before mining and which became available after mining.

Net livelihood change= change in the value of agricultural produce sold in a year + change in the value of agricultural produce used for self consumption in a year + change in annual income from work as agricultural labor + change in annual income from Mahul + change in the value of Tol oil used for self consumption in a year + change in the annual income from Kendu leaves + change in the value of Char sold annually + change in the value of brooms made annually (both for self consumption and sale) + change in income from bamboo products annually + change in the annual value of chicken, mutton and fish (used for self consumption and for sale) + change in the annual value of milk and milk products (used for self consumption and sale) + change in the value of wood used as a cooking fuel + change in annual income from a job in the mining company + change in the income from any other kind of unorganized labor work in the region + change in annual income from any other occupation + change in the value of vegetables used for self consumption in a year + change in the value of soaps (made from different kinds of oil from forest products) used for self consumption in a year

In the above equation the term 'change in value' for different components of livelihood means a change in the value between pre-mining and post mining period. It may be positive or negative. All values of different components of livelihood are calculated for a year. In order to make the

comparison between pre-mining and post mining values of different components in the above equation and to calculate the change in values we need to standardize all values by taking the current year as the base year and convert all values in current money equivalents. This is necessary to rule out the impact of inflation on the changes in monetary values of different components of livelihood.

Two methods are used for calculating the change of livelihood at current money equivalents. There are certain items which are available only in money terms like the income from working as agricultural laborers. The method used here is to inflate all the income data for the period before mining by a factor equal to the ratio between the values of the consumer price index for agricultural workers for the present year and the year immediately before the commencement of mining. For other losses which can be quantified in real terms and for which the data regarding their current prices in the region is available another method is used. This method involves finding out the loss of particular commodity in quantity terms and multiply it with the current prices of that particular commodity to estimate the value of its loss at current money equivalents.

There are certain forest products like Mahul, Tol, Kendu leaves, Char, grass for making brooms, bamboo, wood, Neem and Sargi seeds for making soaps, which were available freely before mining. Similarly chicken, mutton, fish, milk and other milk products, vegetables and rice were available for direct consumption and sale for those who had domestic animals. Some of these goods were exclusively used for self consumption and some were also sold into the market in return for money. Some of the components of livelihood in the above formula are no longer available in the post mining period; some were not available in the pre-mining period and Some components in it are those which were available both at pre-mining and post mining period but there has a been a change in the monetary value of the livelihood earning from these components after mining.

For the components of the livelihood change which are no longer freely available at present, the current expenditure on those items or the current expenditure on their substitutes is taken as a proxy for the change in their value after mining.

For example take the case of consumption of Tol oil. Tol oil is used as cooking oil. Before mining many of the households were using the Tol oil for cooking purposes. The amount of it

which was available from the forests was sufficient to fulfill the requirements of cooking oil for a year and thus for many households there was no monetary expenditure on cooking oil. But now Tol is no longer available in the forests. Thus most of the households are now buying Mustard oil or refined oil for cooking purposes. In the above calculation of net livelihood change the annual expenditure on cooking oil of a household is taken as an estimate of the annual value of Tol oil which is lost after mining began.

For the goods like the rice produced in a year the situation might be a bit different. If a household is still engaged in agriculture then the change in value would comprise of the change in annual production of the rice. Suppose before mining the quantity of agricultural production was such that it was sufficient to provide consumption of the household for the whole year but there was no surplus over and above it to be sold in the market. If after mining the annual produce of rice has fallen and now the concerned household has to buy rice from the market for its consumption. Now the rice produced from their field is sufficient to fulfill the needs of the household only for ten months. In that case the change in the value of rice from pre-mining to post mining period is the value of the quantity of rice which was consumed in two months by the household before mining. Generally it is found that the people do not remember the quantity of any good consumed when it is available freely from the nature. Even though in case of rice there is some cost of production involved in its production since it was available from their own farm people treat it like freely available good and are unable to tell the quantity of rice which was produced and consumed annually. If the quantity of rice produced earlier by the household for self consumption can be found out the value of rice produce lost after mining can easily be calculated by multiplying the quantity of rice for two months by current price of rice. But since it is not possible to do so a proxy for it is used. The current expenditure of the household on rice to fulfill the consumption needs for two months will be taken as the proxy for current value of loss of rice produce which was earlier sufficient to meet the demand of the household for two months.

Another component of the livelihood change is the change in the value of Mahul. Now Mahul is a forest product which has not completely vanished from the forests after the beginning of mining, although there has been a reduction in its availability. It is a forest product which was exchanged for money in the market. So the people are able to tell the average quantity of it which was collected and sold before mining and after mining. In order to find out the changes in

its value from pre-mining to post-mining period the change in the quantity collected and sold by a household is calculated and is multiplied by the current average price of Mahul in the local market to find out the change in monetary value of earnings from Mahul due to mining.

A change in annual income from agricultural labor work is one of the components of livelihood change. The income from agricultural labor work is most of the time available in money values. The information is provided by the households regarding the annual income from agricultural labor work in the pre-mining period and the annual income from agricultural labor work in the post mining period (provided they are still working as agricultural laborers). The income from agricultural labor work before mining will be in terms of the pre-mining prices. But over the years because of inflation the current value of that income is less than what it was in the pre-mining period. So in order to compare the pre-mining income from agricultural labor with the current income from it the pre-mining income from agricultural labor is multiplied by a ratio of consumer price index for agricultural laborers of the current year to the consumer price index for the agricultural labors of the pre-mining year.

In a similar way all other components of the livelihood change are measured. All the components of the net livelihood change which are used in the formula fall in category of one of the four examples given above with small variations.

Let us denote the current (2010-11) consumer price index for agricultural laborers for Odisha as cpi_1 and the Consumer price index for agricultural laborers for Odisha for the year just before mining as cpi_2 .

There are two sets of villages in the sample. First are those which were displaced in 1996 i.e. Tikalipada and Khamharpada. The other is Sardega which was displaced in 2005. So for the families from Tikalipada or Khamharpada cpi_2 will be the value of the consumer price index for agricultural laborers for the year 1995-96 and for the families from Sardega village the value of cpi_2 would be the value of the consumer price index for agricultural laborers for the year 2004-05.

Let $cpi = cpi_1 / cpi_2$

For the components of livelihood change the pre-mining data for which is available in money terms like income from agricultural labor work, the pre-mining data is inflated by multiplying it with cpi to convert its value in terms of current money equivalents.

3.4.6 Limitations of the methodology

The calculation of net livelihood change is dependent on the nature and availability of data regarding the consumption of goods directly obtained from nature and income earned through sale of goods procured from nature and through labor work. Generally for the goods which are provided by nature for direct consumption there is no account of the quantity or monetary value of consumption of such goods. This lack of any account or data (even in the minds of people) makes it difficult to calculate the change in value of this type of livelihood components. In some cases we have tried to estimate the change in values of these livelihood components by taking some kind of proxies by the present consumption expenditure of the household on same goods or on their substitutes. But this kind of estimation is bound to have some degree of error involved.

Furthermore for some households there is an underestimation involved in the calculation of livelihood loss. These are the households which were before mining consuming goods available from the natural resources and who have stopped consuming them in the post mining period due to various reasons (mainly because of unavailability and lack of access to earlier resources which were providing these goods). If they do not correctly remember or keep account of the quantity or value of the goods which were consumed by them before mining then there is no possible way for us to calculate currently the loss of livelihood due to this.

For example take a household which had hens and goats before mining. The family was using the eggs, chicken and mutton from their hens and goats for their own consumption. They didn't have surplus amount to sell it to others. Since they were not selling it they didn't remember or kept account of the quantity of eggs, chicken or mutton which they were using for their own consumption. Suppose that after mining all the hens and goats of the family died due to shortage of fodder. Now eggs, chicken or mutton can only be part of their consumption if they buy it from the market. But suppose they don't have enough money to buy eggs, chicken or mutton from the market. So on one hand they are unable to report the quantity of these things consumed by them before mining and on the other hand any proxies for their pre-mining consumption cannot be

used as now they are not consuming these things at all. Thus the earlier methods used for calculating the loss of livelihood on such heads are not applicable in this case. Thus the loss of value of eggs, chicken or mutton which was consumed by this household before mining cannot be calculated for this household.

In this calculation of net livelihood change two methods are used for conversion of values of livelihood components into current money equivalents. One is through use of ratio of the values of consumer price indices and another is the use of current prices of particular commodities in the local market. The consumer price indices for agricultural laborers are available through government documents at the state level for the state of Odisha. They may not exactly reflect the changes in prices at local level. But since price indices are not available at sub-state, regional level, we had to use the state level index.

One source of error is the memory. The households were asked to report quantities of their income, procurement and direct consumption some 7 or 15 years ago, which was difficult for them to exactly remember. Generally they seem to have under reported them and to that extent, the livelihood loss has been underestimated.

But given the difficulties and circumstances, with no other alternative ways, the methodology used here is the best way to assess the impact of mining on the livelihood of local people.

3.5 Sample Characteristics

There were total fifty four households which were interviewed from the two villages Sardega and Tikalipada. In Tikalipada village households from both Tikalipada and Khamarpada bastis were included in the sample. Out of these fifty four households twenty three households belonged to the Sardega village, twelve to the Tikalipada basti of Tikalipada village and nineteen households were from Khamarpada basti of Tikalipada village. An attempt was made to see that the major caste groups of each village are represented proportionately in the sample taken from that village, but within each caste group, households are selected at random.

The survey was conducted at household level. Generally one individual from a household was interviewed regarding the livelihood earnings and changes in it for the whole household. But in

some cases when one individual was not able to answer all the questions several members of the family were interviewed to get the relevant information.

The households covered in the sample were interviewed in detail regarding their livelihood changes from pre-mining to post-mining period. In our study livelihood comprises of all the goods which are acquired by different households through use of natural resources and of the money which is earned through application of labor. In order to find out the changes in livelihood due to mining the information and data regarding the changes in the quantity of goods acquired through nature and changes in the amount of money earned from pre-mining to post-mining period needs to be collected for each household of our sample.

Thus questions were asked regarding the changes in the quantity of the forest products collected by them, in the quantity of crop or cereals produced and sold, in the quantity of vegetables, in the quantity of livestock products etc. Questions were also asked regarding the changes in amount of money earned through various sources before and after mining.

The questionnaire used in interviews can be divided into five parts. The first part of the questionnaire relates to the personal information of the family like the total number of members in the family, the number of earning and dependent members, the social caste group of the family, the number of unemployed persons in the working age group in the families etc.

The second part of the questionnaire is based on the questions related to the agriculture and agriculture related activities. It includes questions on the amount of land owned by the family before and after mining, the number of crops in year, the total agricultural produce in a year, and its division between self use and for sale, the availability of agricultural work in other people's farm in the area, the duration, wages etc of agricultural labor work.

The third part of the questionnaire pertains to the questions regarding forest products and the changes in their availability, collection and earnings. The respondents were asked to give information about the quantity of different forest products collected by the family before and after mining, the nature and specific use of each forest product by the family, if it was used by the family for the self consumption than the time duration of its use and if it was sold in the market than the quantity which was sold before and after mining etc.

The third section of questionnaire relates to the before and after mining availability and use of livestock products and fish by a household. The number of domestic animals owned by a family, changes in it from pre-mining to post mining period, the livestock products and their quantity used by the family before and after mining for self consumption and sale were the main points on which questions were asked. Similarly there was a set of questions relating to the fish consumption before mining, the source of it, whether it was freely available or was bought from the market before mining, after mining source and availability of fish for self consumption etc.

The fourth part of the questionnaire relates to the current expenditure of the family on items which were earlier freely available from the various resources but now they are or their substitutes are bought from the market by the family. If there were forest products reported by a family which were earlier used by it but now do to various reasons it is not doing so than the questions were asked relating to the alternatives to such forest products and what is the annual expenditure of the family on such alternatives or substitutes. It was found that there were two main forest products whose substitutes are now used by many families. These are Tol oil as cooking oil whose substitutes now in use are Mustard oil and refined oil and wood as firewood whose substitutes are now either coal or cooking gas. In case of livestock products like chicken, mutton, milk etc many families which were getting this from their own domestic animals and now buying it from the market. Similar is the case with fish. The questions were asked relating to the quantity of these products which was consumed by the households and by multiplying it with the standard current prices of these products the current annual expenditure of the families on these items was found out. If the family was getting vegetables before mining from their own vegetable gardens then the present weekly expenditure of the family on vegetables from the village market is enquired to get an estimate of monetary values at current money equivalents of loss of livelihood due to loss of self grown vegetables to the family. Similarly the current expenditure on rice by the families who were earlier eating rice from their field is enquired about.

The last part of the questionnaire relates to the present income earning activities of the family and its members. The questions in this part are on the occupations of different family members, do they have a job in the MCL, how many members of the family have a job in MCL, what is their monthly pay, whether it is a permanent job or a temporary job, are there any kinds of

unorganized labor work in which some family members are engaged, what is the daily wage and duration of this kind of labor work, any other occupation from which the family is getting an income etc. The reason behind getting or not getting a job in the MCL, if any, is also enquired about.

3.5.1 Sample Composition

The a priori division of different households in the villages in the sample is done on the basis of social group of different households in the village. The other factors which affect the livelihood change like the land holdings of different households, the compensation package received by a household, the nature of job etc for different households can be found out only after the interview and discussion with different households. That was the reason why the random sample from each village was chosen in proportion to the major social groups existing in the village.

Thus the distribution of households in the sample across different social groups gives an idea about the representation of different social groups in the sample.

Table 3.1 Distribution of Households across Social Groups in the Sample

Social group	Number of households in the sample	Percentage of the total number of households in the sample
ST	28	51.9
SC	16	29.6
OBC	10	18.5
Total	54	100

The region is a tribal dominated area and thus in the sample more than fifty percent households belong to the schedule tribes category.

The two main economic factors which are expected to determine the pattern of net livelihood change are the pre-mining quantity of land owned and the compensation package received by different households.

The various agricultural classes on the basis of size of their own landholdings before mining and the distribution of households in the sample across these classes are given in the following table.

Table 3.2 Distribution of Sample Households across Classes based on Size of Landholdings before Mining

Agricultural classes (based on the size of own landholdings)	Number of households	Percentage of the total number of households
Only lease land	1	1.9
0-1 acre	6	11.1
1-3 acre	20	37.0
3-5 acre	14	25.9
5-10 acre	6	11.1
10-15 acre	2	3.7
Not responded	5	9.3
Total	54	100

The agricultural class ‘not responded’ refers to those households who were not able to give the information about the pre-mining size of their landholdings. It can be seen from the above table that there are five such households in the sample.

The whole sample can be divided into four categories on the basis of compensation package received by a household after mining. These are the households which got ‘job and monetary compensation’ or ‘only job’ or ‘only monetary compensation’ and those which got ‘neither a job nor money compensation’. The ‘job’ in this categorization means a regular salaried employment in MCL. It includes both permanent and temporary job with regular monthly salary. But it does not include unskilled labor work in MCL in which workers are paid on daily wage basis.

On the basis of types of compensation package received the distribution of the households in the sample is given in the table below.

Table 3.3 Distributions of Sample Households across Compensation Types

Compensation type	Number of households in the sample	Percentage of households in the compensation types	Cumulative percentage of the households in the sample
Job and monetary compensation	25	46.3	46.3
Only job	11	20.4	66.7
Only monetary compensation	10	18.5	85.2
No job and no monetary compensation	8	14.8	100
Total	54	100	

From the table it can be seen that 66.7 percentages of the households in the sample have received a job in MCL after the complete or partial loss of their land in mining and 14.8 percentages of households are those who have not received any kind of compensation.

3.6 Analysis of Net Livelihood Change among Households

The net livelihood change was calculated for the sample households using the methodology explained in section 3.4. The information gathered from the village people was used in this calculation. One quantitative estimate of net livelihood change in this study is used as a proxy for the impact of mining on the local people.

In this section of the chapter the objective is to analyze the impact of mining and net livelihood change among households on the basis of different criteria and find out if some general conclusion can be drawn from this analysis or not.

The first subsection gives the general trends and pattern of net livelihood change among different households. It also looks at the overall impact of mining in terms of its distribution effect on the total livelihood earnings of different households. Specifically it looks at the impact of mining in changing the distribution of livelihood earnings (estimated in terms of current money equivalents) in the sample population.

The second subsection identifies the general factors determining the pattern of net livelihood change among different households of the sample. The calculation of net livelihood change is used to find out the general impact of different factors on net livelihood change. In the latter part of this subsection the partial impact of the factors i.e. by controlling for other factors, is looked upon by singling out the significance of specific factors in the determination of net livelihood change.

The third subsection gives the general finding and conclusion of the analysis of net livelihood change among households.

3.6.1 Overall Impact of Mining in Terms of its Distributional Effects

Looking at the net livelihood change simply among the households in the sample it can be seen that out of the fifty four households of the sample 17 have a net livelihood loss and 37 households have a net livelihood gain.

Table 3.4 Net Livelihood Change for the Households in the Sample

Net livelihood change	Number of households	Percentage of households
Net livelihood gain	37	68.5
Net livelihood loss	17	31.5
Total	54	100

This is according to the estimated value of net change in the livelihood earnings from the pre-mining to post mining period. It is determined by the sign of net livelihood change whether it is positive or negative. If the sign of net livelihood change is positive than there is a net livelihood gain and if it is negative than there is net livelihood loss for any household.

One important part of developmental impact of any economic activity is its impact on the distribution of income among the population. In this study livelihood is used instead of income to represent the development status of different households in a mining region. In order to look at the impact of mining on the development of the local people it would be interesting to look at its distributional impact. For this we have estimated the livelihood earnings of different households before and after mining and divided in into three categories. Then the distributional impact of mining is analyzed by looking at the movement of households from one livelihood earning class to another. The livelihood earning classes in rupees are lower livelihood earnings (0-30000), middle livelihood earnings (30000-100000) and higher livelihood earning class (above 100000).

Table 3.5 Distribution of Number of Households by Livelihood Earning before and after Mining

Post-mining livelihood earning(in rupees)	Pre-mining livelihood earning (in rupees)			Total
	0-30000	30000-100000	above 100000	
0-30000	11	4	0	15
30000-100000	7	2	0	9
above 100000	15	11	4	30
Total	33	17	4	54

Table 3.6 Percentage Distribution of Households by Livelihood Earnings before and after Mining

Post-mining livelihood earnings	Pre-mining livelihood earnings (percentage of households)			Total
	0-30000	30000-100000	above 100000	
0-30000	33.3	23.5		27.8
30000-100000	21.2	11.8		16.7
above 100000	45.5	64.7	100	55.6
Total	100	100	100	100

From the table 3.5 and 3.6 it can be seen that most of the households in the sample experienced an upward mobility in their livelihood earnings except four households belonging to the middle livelihood earning class before mining. These are the households who experienced a downward mobility and moved to the lower livelihood earning class after mining. The percentages of households who have experienced an upward mobility for the pre-mining lower and middle livelihood earning classes are almost same.

In the pre-mining lower livelihood earning class 21.2 percentage households have moved to middle livelihood earning and 45.5 percentage households have moved to higher livelihood earning class. In the middle livelihood earning class the majority- almost 65 percent households have moved to the higher livelihood earning class after mining.

Thus on the basis of this it can be said that inside the livelihood earning classes the larger percentage of the pre-mining middle livelihood earning class has moved to the 'above 100000'

class compare to that of lower livelihood earning class. It means that proportionately mining has benefited more households in the middle livelihood earning class than those in the lower livelihood earning class. It can also be seen by taking into account the percentage of households who have remained in the same class in the two above two categories. It is 33.3 for lower livelihood earning class as compare to 11.8 for middle livelihood earning class. One third of the households in the pre-mining lower livelihood earning class have remained in the same class after mining.

3.6.2 Factors Determining the Pattern of Net Livelihood Change

In this section the major factors which in some way affect the livelihood change of the households in a mining region. In the first sub-section choice and discussion of these factors is done on the basis of information provided by the local people in the interviews and informal discussions. In the second sub-section the results of the calculation of net livelihood change are used to discuss the important factors and their contribution in the analysis.

The various factors which play a role in the determination of net livelihood change are the size of land owned before mining, the amount of land gone into mining, the dependence for livelihood on the natural resources like forest, water etc and the compensation package provided by the mining company.

Before going into detailed discussion it is important to specify here the basic division of households and the criteria which was used by MCL to provide compensation to different households who were displaced or affected by the mining.

For the purpose of deciding the compensation package the MCL classified households into four categories according to a specific criteria.

The categories on the basis of which the compensation was decided were as follows:

A: Families whose total agricultural and home land was taken away in mining and who had 'patta' for these lands.

B: Families who have not lost total agricultural/ home land but the land lost to mining is 3 acre or more than three acres and they had 'patta' for the land lost to mining.

C: Families who have not lost total agricultural/home land but the amount of land lost to mining is less than one to three acres.

D: Families who have not lost total agricultural/ home land and the amount of land lost is less than one acre.

According to the compensation policy used by MCL it had a provision of one job per family along with monetary compensation to all the households who come under the category A or B. Households coming under the category C or D were provided only with monetary compensation.

3.6.2.1 Land Holdings of Different Households before Mining and Net Livelihood Change

Before mining the basic division of people can be done on the basis of the privately owned quantity of agricultural land. The land distribution between different households in the region was not same between different households. The differences in the land distribution tend to affect the livelihood of different households if the agricultural produce provided a significant proportion of livelihood earnings*. If the livelihood earnings across households varied significantly with the size of landholdings before mining than the size of landholding of different households and the amount of land lost in the mining will be expected to have significant impact in determining the trend and pattern of net livelihood change.

In this study the sample households have been divided into seven classes on the basis of land owned³ by them before mining.

The field area chosen for this study was basically a non irrigated area growing a single crop in a year. Most of the households were engaged in subsistence agriculture and very few, mostly with large landholdings, were engaged in selling of crop.

³ In the entire discussion the land owned by a household included that land for which the household had a 'patta'. It is because in the cases where the households have land which they are using for agriculture but do not have 'patta' the household will be treated as the household with 'no land' and will be given no compensation. This is the criterion which was used by MCL and for the sake of clarity and to relate the impact of rehabilitation package and size of landholdings it is also used in the analysis.

Let us see the impact of land owned by different households on the livelihood change. The general or overall impact of size of landholdings on the livelihood change can be seen by looking at the net livelihood change across various agricultural classes.

From table 3.7 it can be seen that all the households which didn't own any land but were farming on leased land had a net livelihood loss. This is because the rule used by mining company for compensation gave recognition only to the loss of land which was private property of the farmer and for which the farmer had a proper 'patta'. In the class 0-1 acre majority of the households have lost due to mining.

Table 3.7 Net Livelihood Change across Classes based on Size of Own Landholdings before Mining

Classes based on size of own landholdings	Percentage number of households within agriculture classes having		Total
	Net livelihood gain	Net livelihood loss	
Only lease land	(0)	100.0(1)	100.0(1)
0-1 acre	33.3(2)	66.7(4)	100.0(6)
1-3 acre	85.0(17)	15.0(3)	100.0(20)
3-5 acre	78.6(11)	21.4(3)	100.0(14)
5-10 acre	66.7(4)	33.3(2)	100.0(6)
10-15 acre	50.0(1)	50.0(1)	100.0(2)
Total	71.4(35)	28.6(14)	100.0(49)

Note: This table does not include those households who were not able to give the data regarding the size of their landholdings before mining. The number of such households is five. For this table the effective sample size is 49 instead of 54. The number inside brackets denotes the number of households in the sample falling in that class.

The largest percentage of households experiencing a net livelihood gain is in the category of '1-3 acres' compare to households in all other agriculture classes. After that the percentage of families having a net livelihood gain due to mining steadily decreases as we move towards larger landholdings.

A better idea about the pattern of net livelihood change can be obtained by comparing the share of households in various categories having net livelihood gain with the share of households in the total population who are having net livelihood gain. For the land classes '1-3 acres' and '3-5 acres' the share of such households is more than that of the total sample population. But for the land classes '5- 10 acres' and '10-15 acres' this share is less than the share of sample population. So the households in the land categories between one to five acres have benefited more as compare to the rest of the population from mining.

Another determinant of net livelihood change related to the size of landholdings in the mining regions is the amount or proportion of land which was acquired in the case of various households. The proportion of total land which is taken away by the mining company will determine the extent of loss of livelihood earnings from agricultural related activities.

In the survey information about the exact amount of land taken away by mining for different households was not available. But the households were able to give information whether the entire landholding or partial amount of it is being acquired by the mining company.

Based on that information the different households are analyzed as follows.

Table 3.8 Land Lost to Mining for Households in the Sample

Land lost to mining	Number of households	Percentage of households
Whole land lost to mining	39	72.2
Partial land lost to mining	13	24.1
No land lost to mining	1	1.9
Not responded	1	1.9
Total	54	100

Table 3.9 Land Lost to Mining across Pre-mining Landholding Classes

Classes based on size of own landholdings	Percentage number of households in the agricultural classes for which			Total
	whole land lost to mining	partial land lost to mining	no land lost to mining	
Only lease land			100(1)	100.0(1)
0-1 acre	83.3(5)	16.7(1)		100.0(6)
1-3 acre	80.0(16)	20.0(4)		100.0(20)
3-5 acre	64.3(9)	35.7(5)		100.0(14)
5-10 acre	66.7(4)	33.3(2)		100.0(6)
10-15 acre	50.0(1)	50.0(1)		100.0(2)
Total	71.4(35)	26.5(13)	2.0(1)	100.0(49)

From table 3.8 it can be seen that in the sample households 72 percent households lost their complete land to mining while 24 percent lost their land partially. In all the agricultural classes except 'only lease land' the proportion of households who have lost complete land to mining is at least fifty percent. The proportion of households losing their whole land to mining declines as we move to larger land holdings. Except for in land class '5-10 acres' where this proportion shows a marginal increase from the various classes this trend continues. By comparing the table 3.7 and table 3.9 it can be noticed that in all the agricultural classes except the '0-1 acre' the percentage of households who have lost their complete land in mining and those who experienced a net livelihood gain are more or less same.

3.6.2.2 Dependence on Natural Resources and Livelihood Change due to Mining

In computing the livelihood change due to mining level of dependence on common property resources before mining and level of access and availability of it after mining plays an important role. In estimating net livelihood change for a household the composition of livelihood in relation to various natural resources emerges out to be a relevant factor. The pre-mining level of dependence of a family on agriculture, forest and water resources and on agricultural labor work decides to an extent the livelihood loss from the mining.

The proportion of earnings obtained from different resources is different. The resource can be divided into two parts land and resources like forest, water etc. If the proportion of livelihood earnings obtained from resources like forest, water i.e. common property resources is higher for a household as compare to agriculture and agriculture related activities than the loss of livelihood would be much higher for these households.

In the compensation package given by a mining company only the loss of land is taken into account. The compensation package (in terms of both job and money) will be given only in proportion to the loss of self owned land (with 'patta'). So the group of households for which the forest and other common property resources are much more important in terms of livelihood earnings the loss of livelihood is higher and gain in livelihood in terms of alternative livelihood opportunities is lower. This is in comparison to others who are relatively less dependent on common property resources for livelihood.

In the absence of any other livelihood opportunities natural resources (common property resources) act as a 'natural security net'. The people who have difficulty in fulfilling their basic needs from other available occupations depend on the common property resources specially forest products to meet these needs. Often this is the work which is done by the female members of the family. It gives employment to the female members who are not engaged in other occupations. It simultaneously provides a supplementary but important source of livelihood.

In the absence of these natural resources and access to it by the local affected and displaced population in the post mining period the impact of mining on their livelihood would be worse.

3.6.2.3 Types of Compensation Package as a Factor in Determination of Net Livelihood Change

The compensation package provided by the mining company to the displaced and affected population determines the new livelihood opportunities in the region. The nature of compensation package, the differences in it across various households and its time duration and the income or livelihood earnings obtained from it are the factors which affect the role of it in determining the net livelihood change of the households.

In the region where the field work was undertaken the mining company was a public company Mahanadi Coalfield Limited. It chose a particular kind of compensation rule regarding the provision of jobs to the families displaced or affected by the mining. The criteria or rule has been briefly explained in the beginning of the section. The two main components of the compensation package were a job in the mining company and monetary compensation⁴.

In each family belonging to categories A and B a job was given to the father and to each male members of the family who had obtained working age and was married at the time of displacement. A male child of working age who was not married at the time of displacement didn't get a job. Furthermore female child of working age was generally not considered for job. Only in the rare situation where there was no male child in the family and the father was old or unfit for the job did a female child get a job in the company.

The monetary compensation paid to different households was different. It was dependent on the quality and quantity of agricultural land owned by different households. Also the rate of monetary compensation for agricultural land and home land was different.

The total households can be divided into four categories depending on the compensation package received by a household. The net livelihood change across these four compensation categories is as follows.

⁴ It needs to be clarified here that when we talk about job in the mining company as part of the rehabilitation package it is regular salaried job given to the displaced/ affected population. It means that the person is getting a salary at a monthly basis. It is different from a person who is being paid at daily wage basis.

Table 3.10 Net Livelihood Change across Types of Compensation Package

Compensation package type	Percentage number of households within compensation type having		Total
	Net livelihood gain	Net livelihood loss	
Job and monetary compensation	92 (23)	8 (2)	100 (25)
Only job	100 (11)		100 (11)
Only monetary compensation	10 (1)	90 (9)	100 (10)
No job no monetary compensation	25 (2)	75 (6)	100 (8)
Total	68.5 (37)	31.5 (17)	100 (54)

From the above table it can be seen that all the households in the 'only job' category are having a net livelihood gain. In the 'job and monetary compensation' more than 90 percent of households are having a net livelihood gain. In the 'only monetary compensation' and 'no job no monetary compensation' categories almost all households are having a net livelihood loss. Only one household in the third and two households in the fourth compensation categories have a net livelihood gain.

The important conclusion which can be drawn from this table is that while 'job' in the mining company signifies positive effect on the net livelihood change. Getting only monetary compensation on the other hand does not seem to have this positive impact on net livelihood change. This can be said as general total effect of compensation package when we are not controlling other factors which might be affecting net livelihood change like size of landholdings before mining.

It seems that compensation money is not an important factor in deciding the net livelihood change for the people. It was found from the interviews and discussion with the people that in almost all the households the money which was paid by the company was not used productively. It was not used in a manner which generates livelihood for a long time period. At the most you find that people have bought four wheelers which they are using as transport vehicles on rent. Usually you find that the compensation money was used for building of houses, purchasing motorbikes and on alcohol consumption. This was a region where earlier people didn't have much use for money and most of their necessities were available from their own land, the forests or from the village economy. In such situations when people suddenly get a lot of money they don't know how to use it productively for livelihood for a longer time span. There are also not

many options and opportunities available for the investment of the compensation money for livelihood purpose

Table 3.11 Distribution of Jobs in MCL across Households in the Sample

Compensation type	Number of households in the sample	Percentage number of households
Job in MCL	36	66.7
No job in MCL	18	33.3
Total	54	100

By comparing table 3.11 with the earlier table 3.3 showing the composition of net livelihood change in the sample households it is observed that the number of households who received a job in MCL and who experienced a net livelihood gain are almost the same. There is only one household who have not received a job in MCL but still has a net livelihood gain. This is an exceptional case.

Together with the provision of job in the mining company the nature of this job is also important. There are two types of job which were provided by MCL to the displaced/affected population- permanent and temporary. Both are regular salaried job but permanent job holders are better paid than the temporary employees, they get a lot of other benefits like of that of free treatment in the mining company's hospital, a subsidized education for their child in the company sponsored school and the benefit of pension, provident fund and other retirement benefits which are not available to the temporary employees⁵.

The number of people in a family getting a job is another factor which affects the net livelihood change especially in large families. Due to MCL's particular compensation policy regarding the provision of jobs in the company, there are many families with unemployed family members in the working age group.

⁵ This discussion on the differences in the nature of permanent and temporary jobs in the MCL above is based on the information provided by the respondents in the sample during interviews.

3.6.3 Partial Effects of Different Factors on Net Livelihood Change

In the earlier sub section the discussion and analysis was centered on various factors which affect the pattern of net livelihood change in a mining region. The pattern of net livelihood change for different variables was looked upon to find out the effect of the variable on net livelihood change. But this effect is actually a total affect which may also be because of some other variable. In order to separate out the effect of a particular variable on net livelihood change the other significant variables needs to be controlled. This kind determination of effects of particular variables is called as partial effects of different variables. This gives a better idea about the effect of a particular variable in determining the net livelihood change and the level of importance of it as compare to other variables.

From the discussion of total effects of different variables in determination of net livelihood change it can be seen that two main economic factors which seems the most important are agricultural classes before mining and the type of compensation package of different households. The total effects of these variables have already been discussed in the last sub-section. In this sub-section we are going to look at the partial effect of these two variables by controlling the other variable.

3.6.3.1 Partial Effect of Pre-mining Landholding Sizes on the Net Livelihood Change

Controlling for the compensation types, the net livelihood change across various agricultural classes is as follows.

Table 3.12 Net Livelihood Change across Classes based on Size of Own Landholdings in Various Compensation Types

Compensation type	Classes based on size of own landholdings before mining	Percentage number of households in agricultural classes having		Total
		Net livelihood gain	Net livelihood loss	
Job and monetary compensation	0-1 acre	66.7 (2)	33.3 (1)	100.0 (3)
	1-3 acre	100.0 (9)		100.0 (9)
	3-5 acre	100.0 (8)		100.0 (8)

	5-10 acre	80.0 (4)	20.0 (1)	100.0 (5)
	Total	92.0 (23)	8.0 (2)	100.0 (25)
Only job	1-3 acre	100.0 (7)		100.0 (7)
	3-5 acre	100.0(1)		100.0 (1)
	10-15 acre	100.0 (1)		100.0 (1)
	Total	100.0 (9)		100.0 (9)
Only monetary compensation	0-1 acre		100.0 (2)	100.0 (2)
	1-3 acre	50.0 (1)	50.0 (1)	100.0 (2)
	3-5 acre		100.0(2)	100.0 (2)
	5-10 acre		100.0 (1)	100.0 (1)
	10-15 acre		100.0(1)	100.0 (1)
	Total	12.5 (1)	87.5 (7)	100.0 (8)
No job no monetary compensation	Only lease land		100.0 (1)	100.0 (1)
	0-1 acre		100.0 (1)	100.0 (1)
	1-3 acre		100.0 (2)	100.0 (2)
	3-5 acre	66.7 (2)	33.3 (1)	100.0 (3)
	Total	28.6 (2)	71.4 (5)	100.0 (7)

Looking at the distribution of net livelihood change across different classes of landholdings in each compensation category of the above table certain trends emerge. Majority of households in all the landholding classes in the 'job and monetary compensation' and 'only job' categories are having a net livelihood gain. But this trend is almost reversed in the third and fourth categories of compensation. Inside the 'only monetary compensation' compensation type, except for the households in the '1-3 acres' landholding class all the households in across all the landholding classes are having a net livelihood loss. similarly inside the 'no job no monetary compensation' category except for the households in '3-5 acres' landholding classes all the households have a net livelihood loss.

Two points come out of the observation of the above table. One is the complete reversal of the trends of net livelihood change across different agricultural classes as we move from compensation types having job to the compensation types without job. Second is lack of any kind of variations in net livelihood change across agricultural classes (ignoring the exceptional cases) in all the compensation types. These two together suggest that the provision of job or not in the compensation package is responsible for the pattern of net livelihood change across agricultural

classes. It seems that classes based on size of own landholdings is not a significant factor in determining the pattern of net livelihood change across households.

3.6.3.2 Partial Effect of Compensation Types on the Net Livelihood Change

In the table below the size of landholdings owned by a household are controlled for and to find out the partial effect of compensation type, the net livelihood change across compensation types in each agricultural class is computed.

From the table 3.13 it can be observed that in the 'job and monetary' and 'only job' categories majority of the households have a net livelihood gain. This is true for all classes of landholdings.

Table 3.13 Distribution of Net Livelihood Change across Compensation Types in Various Classes based on Size of Own Landholdings

Classes based on size of own landholdings before mining	Compensation type	Net livelihood change		Total
		Net livelihood gain	Net livelihood loss	
Only lease land	No job no monetary compensation		100.0 (1)	100.0 (1)
	Total		100.0 (1)	100.0 (1)
0-1 acre	Job and monetary compensation	66.7 (2)	33.3 (1)	100.0 (3)
	Only monetary compensation		100.0(2)	100.0 (2)
	No job no monetary compensation		100.0 (1)	100.0 (1)
	Total	33.3 (2)	66.7 (4)	100.0 (6)
1-3 acre	Job and monetary compensation	100.0 (9)		100.0 (9)
	Only job	100.0(7)		100.0 (7)
	Only monetary compensation	50.0 (1)	50.0 (1)	100.0 (2)
	No job no monetary compensation		100.0(2)	100.0 (2)
	Total	85.0 (17)	15.0 (3)	100.0 (20)
3-5 acre	Job and monetary compensation	100.0 (8)		100.0 (8)
	Only job	100.0 (1)		100.0 (1)
	Only monetary		100.0 (2)	100.0 (2)

	compensation			
	No job no monetary compensation	66.7 (2)	33.3 (1)	100.0 (3)
	Total	78.6 (11)	21.4 (3)	100.0 (14)
5-10 acre	Job and monetary compensation	80.0 (4)	20.0 (1)	100.0 (5)
	Only monetary compensation		100.0 (1)	100.0 (1)
	Total	66.7 (4)	33.3 (2)	100.0 (6)
10-15 acre	Only job	100.0 (1)		100.0 (1)
	Only monetary compensation		100.0 (1)	100.0 (1)
	Total	50.0 (1)	50.0 (1)	100.0 (2)

Similarly in the ‘only monetary compensation’ and ‘no job no monetary compensation’ categories except for 3 households all the households in all the landholding classes have a net livelihood loss. Among the three exceptional households two belong to the ‘no money no job’ category in the ‘3-5 acres’ class of landholdings and one belong to the ‘only monetary compensation’ category of ‘1-3 acre’ landholding class.

The analysis of the above table has an important implication. The effect of different compensation categories is similar in all the classes of landholdings. This indicates that the type of compensation package is a significant factor in determination of net livelihood change.

It also indicates that the changes in size of landholdings do not have any significant impact on the relationship between compensation type and net livelihood change. This further supports the findings of the last sub-section i.e. size of landholdings owned before mining is not a significant factor in determining the net livelihood change in a mining region.

Specifically it can be seen that it is the *provision of job* in a compensation package which emerges as the most important factor in deciding the net livelihood change for a household.

3.6.3.3 Role of Compensation Types in the Changes in Distribution of Livelihood Earnings

In the last section it was seen that the compensation types and specially the provision of job in MCL is the most important factor in determining the pattern of net livelihood change. If a person

gets a job in compensation the probability of the concerned household having a net livelihood gain is very high and vice versa.

In this section we are looking at the impact of different compensation types on the distribution of livelihood earnings of a household. The importance of compensation types is already established. This analysis is trying to check whether the change in distribution from one livelihood earning class to another after mining is also determined by compensation types or not.

In the table 3.14 each pre-mining livelihood earnings class is taken and the movement of households from the pre-mining livelihood earning class to a different post-mining livelihood earning class is looked upon with respect of the different compensation provided to the households in that class.

Table 3.14 Different Compensation types and Changes in Distribution of Livelihood Earnings

Pre-mining livelihood earnings	Compensation types	Post –mining livelihood earnings			Total
		0 - 30000	30000- 100000	Above 100000	
0-30000	Job and monetary compensation		14.3	85.7	100
	Only job	14.3	57.1	28.6	100
	Only monetary compensation	85.7	14.3		100
	No job no monetary compensation	80.0		20.0	100
	Total	33.3	21.2	45.5	100
30000-100000	Job and monetary compensation			100	100
	Only job			100	100
	Only monetary compensation	100			100
	No job no monetary compensation	33.3	66.7		100
	Total	23.5	11.8	64.7	100
Above 100000	Job and monetary compensation			100	100
	Only job			100	100
	Total			100	100

It can be seen from the above table that in all pre-mining livelihood earning classes almost all households which received jobs and monetary compensation almost all are in the higher livelihood earning class (above 100000) after mining. Households in the pre-mining lower and

middle livelihood earning class who have got this type of compensation have experienced an upward mobility while those who were in the higher livelihood earning class before have remained in it after mining.

The households who have received 'only job' are also in the higher livelihood earning class after mining except for the pre-mining lower livelihood earning class. In this class majority of the households who have received this type of compensation have moved to the middle livelihood earning class and around 28 percent have moved to higher livelihood earning class.

Similarly all the households in all pre-mining livelihood earning classes who have received only monetary compensation are in the lower livelihood earning class after mining. The households in the lower livelihood earning class with this type of compensation have remained in the same class after mining while those who were in the middle livelihood earning class have experienced a downward mobility.

For the households who have received 'no job no monetary compensation' the situation is a bit different. The majority of households with this type of compensation have remained in their pre-mining livelihood earning class. Those who were earlier in lower livelihood earning class 80 percentages of households have remained in the same class after mining while 20 percentages of them moved to higher livelihood earning class. In case of households in the middle livelihood earning class almost 67 percent of household remained in the same class but the rest moved to lower livelihood earning class.

Sometimes it seems that the condition of households with 'no job no monetary compensation' is slightly better than those who are in 'only monetary compensation' category. It is because many times those who are in 'no job no monetary compensation' categories are those who have not lost their earlier sources of livelihood or are still using a major part of it. While those who are in 'only monetary compensation' category are those who have lost their earlier sources of livelihood to mining but because of several reasons has not received job in the company. As we have already explained that money does not seem to have any significant affect on livelihood earnings, this group of households seems to have no proper source of livelihood after mining (which can restore back the livelihood earning lost due to mining).

3.7 Conclusion

The objective of this chapter was to develop a methodology for the calculation of net livelihood change and analyze the pattern of net livelihood change which emerges after the calculation of estimates of net livelihood change for the households covered in the sample.

In the beginning of the chapter an overview of the study area was given to provide an overall picture of the region on which this study is based on. The qualitative analysis provides further information and insights into the changes in the region which have brought by mining. The agriculture, the land use pattern, occupational structure and the use and access to natural resources in the region has changed after mining. The health condition of the residents has worsened, the prices of things have increased in the local markets, and the dependence on market has increased. But one thing which seems to have improved is the connectivity to other parts of the state through road and the availability of education through schools.

The choice of livelihood over other variables to assess the impact of mining is based on the link of the pattern of living of the local people with the nature. This link and specially the goods available from nature for direct consumption are not captured in any other variable. Thus net livelihood change appears to be the best measure to estimate the impact of mining.

The development of methodology for calculation of net livelihood change required a detailed information and discussion about the pattern and sources of livelihood before and after mining. This methodology covers the changes both in the goods available for direct consumption and monetary earnings from different sources of livelihood between the pre-mining and post-mining periods. In case of monetary earnings of a households and changes in it over time the calculation was direct and simple. The only significant calculation which was required was the conversion of the pre-mining monetary earnings into current money equivalents by using a ratio of values of consumer prices indices of the current year and the immediate year before mining.

In case of the goods which were earlier available from different natural resources for direct consumption the estimation of the change in livelihood earnings from them is a bit difficult. We have used two methods for this purpose. In case of those goods for which the quantity of change in use is available it is multiplied with its current prices to get the value of livelihood change on this head. Goods for which the quantity of use before mining is not known (as it is in case of

many goods used for direct consumption) the current expenditure on these goods or their substitutes is taken as the proxy for the loss of livelihood on these heads.

The methodology adopted here uses the information provided by the households in the sample. This becomes the limitation of this methodology as the estimation of livelihood change is not possible on those components of livelihood earnings on which the information about the earlier use (in terms of quantity or their monetary equivalents) is not available. Especially for those goods which are not in use by the concerned households.

The sample characteristics give information about the sample which is used for the calculation of net livelihood change using the methodology developed in the earlier parts of the chapter.

The net livelihood change calculated is analyzed in terms of various factors which play an important role in determination of the direction and pattern of its change. Before going into detailed analysis the change in distribution of sample households before and after mining is looked upon. It is found that most of the households in the entire livelihood earning classes have experienced an upward mobility. The only exception is some 23.1 percentages of households in the middle livelihood earning class who have moved to lower livelihood earning class after mining. The benefit of mining in terms of movement to higher livelihood earning class is more pronounced in case of middle livelihood earning class.

The three main factors which affect the pattern of net livelihood change are the size of landholdings before mining, the dependence on natural resources and the changes in its access and availability and the compensation type received by a household. The trends of net livelihood change across size class of landholdings is looked upon and it is found that in the land class '0-1 acre' the percent of households having net livelihood gain is highest. For the higher size classes of landholdings after this size class it declines slowly.

The net livelihood change across various compensation types gives a clear result. The households who have received either 'job and monetary compensation' or 'only job' in the mining company majority of them have a net livelihood gain. The other two categories of compensation types who have not received a job in MCL have a net livelihood loss after mining.

To separate out the affect of the size of landholding before mining and compensation type the partial affects of each of these on net livelihood change is looked upon by controlling the other variable. In the partial analyses it was found that the effects of size of own landholdings before mining on net livelihood change are not significant. On the other hand the effect of compensation types on net livelihood change is very significant.

Most importantly, it is the availability or non availability of job in the mining company which completely determines the net livelihood change for a household. It can be further seen by the comparison distribution of livelihood earnings pre-mining and post mining across various compensation types.

So, as a conclusion it can be said that the provision of jobs in the mining company makes the most significant difference in the net livelihood change of the households who are displaced or lose their sources of livelihood in mining.

CHAPTER 4

A PROCESS OF CIRCULAR AND CUMULATIVE CAUSATION IN A MINING REGION

4.1 Introduction

In the last chapter we calculated net livelihood change for the sample households and the pattern of net livelihood change was analyzed. It was found that getting a regular salaried job in the mining company is the most significant factor in the determination of the pattern of net livelihood change from the pre-mining to post mining situation. Depending on whether members of a household receive a job in the mining company or not, the concerned household will have a net livelihood gain or loss after mining. If the net livelihood change is taken as a proxy for the development or underdevelopment at any point of time then the direction of change in the standard of living of different households can be gathered from the calculated data. Almost one third of the total households in the sample experienced a net livelihood loss after mining. It can be said that this indicates a decline in their standard of living over time. Based on this it can be said that at least for those proportion of households (that are experiencing a net livelihood loss due to mining), mining might be a cause of underdevelopment instead of development.

In the backdrop of the findings of the last chapter, this chapter aims to explore and explain the process of underdevelopment in a mining region. If mining is the cause of underdevelopment, in this chapter we try to find an explanation of the interactions between the main factors in the mining region initiated by the process of mining and the path which this process of underdevelopment takes as a result of these interactions. The process of circular and cumulative causation has been used to explain the process of underdevelopment in a mining region.

The first section of this chapter provides a brief summary of Gunnar Myrdal's theory of circular and cumulative causation as an explanation of the underdevelopment of certain regions and their relationship with the economic development of other regions in the country. The second section contains the theoretical exercise of application of the concept

of circular and cumulative causation in a mining region. The third section provides the modifications of the basic theoretical analysis of circular and cumulative causation process with relaxation in some of the assumptions. The fourth section analyses the basic theoretical model (analysis) with reference to the findings of the field survey and check its validity. The fifth section provides inter-generational comparisons of livelihood changes for different cases and its implications for our basic theoretical analysis of underdevelopment. The sixth and last section gives the conclusion of the chapter.

4.2 A Brief Summary of Gunnar Myrdal's Idea of Circular and Cumulative Causation

Gunnar Myrdal used the theory of circular and cumulative causation as an explanation of underdevelopment in certain regions especially in a developing economy. Myrdal explained the underdevelopment of certain regions inside a country in terms of backwash and spread effect of development of industrial centers in that country. When industrial centers are developed, a process of migration of labor and capital movement takes place, from the backward regions of the country towards the developed industrial centers of the country. This has a negative impact on the development of the backward regions and is termed as backwash effect. Also due to development of industrial centers, the surrounding get lots of economic benefits in terms of infrastructure, skilled labor and easy access to market and credit. This is called the spread effect. These processes and effects are continuous and cumulative in character. The development of any backward area depends on the net result of the backwash and spread effects. But in the case of developing countries the backwash effects are stronger than spread effects. Thus the process of industrial expansion and economic development results in a process of underdevelopment in the backward regions of the country. This process of underdevelopment is a cumulative process and unless and until some other counteracting changes occur in the system this process of underdevelopment of certain areas inside the country will continue along with industrial expansion and development around the industrial centers of the country.

This theory of Myrdal presented a contradiction to the neo-classical belief that there is a tendency towards automatic self stabilization in economic and social system. According

to Myrdal there is no reason to believe that any diversion from the position of equilibrium will initiate such forces or processes in the economy which will move it in a direction opposite to the initial change and will restore the system back to its position of equilibrium. To quote Myrdal,

“Behind this idea is another and still more basic assumption namely that a change will regularly call forth a reaction in the system in the form of change which on the whole go in the opposite direction to the first change.” (Myrdal, 1957)

“In the normal case a change does not call forth countervailing changes but, instead, supporting changes, which move the system in the same direction as the first change but much farther.” (Myrdal, 1957)

The following points explain and distinguish Myrdal’s theory of circular and cumulative causation. One is that it is a circular process where there is a relation of interdependence and positive feedback from one factor to another. Secondly it is a dynamic and cumulative process where the positive feedback of one factor over another amplifies the initial change and the system moves in the direction of initial change, further and further away from the initial point. Furthermore this process characterizes an implicit instability and path dependence in the social and economic system. After Myrdal the concept of cumulative causation has been used by many economists and sociologists in different contexts.

We are trying to use this concept in analyzing the relationship between livelihood and natural resource base surrounding a tribal society in a mineral rich region.

4.3 Process of Circular and Cumulative Causation between Tribal Livelihood and Natural Resource Base

In order to analyze the impact of mining in a region as a dynamic process of underdevelopment a theoretical exercise is undertaken using Myrdal’s idea of circular and cumulative causation.

4.3.1 Important Assumptions

Every theoretical exercise is based on certain assumptions. Assumptions provide the basic framework for logical reasoning within any theoretical exercise or model and therefore are in the base of all of the conclusions which are logically derived from the particular theoretical exercise.

As there are a large number of variables interacting with each other at the same time in the real world, the relationships and the implicit mechanisms are very complex and are not very easy to explain. In order to explain the relationship and the underlying mechanism of the variables in which we are interested certain assumptions are necessary.

The important assumptions taken in the theoretical analysis are as follows.

1. There is mutual interdependence and harmony between the environment or natural resource base and the livelihood of tribals. The tribal livelihood and the natural resource base are affected by many other factors. We will concentrate on the interaction between the two main variables for the main argument of the model. The two main variables are the livelihood of tribals and natural resource base in the area.
2. This is a *self sustaining* system where any change in one factor affects the other. If for any reason the environment is affected it will affect the livelihood of tribals. Similarly if the livelihood practices changes it will affect the environment.
3. There is no external support system for the livelihood of tribals. By external support system we mean alternative livelihood opportunities provided by the government, mining company or any other agency.
4. There is an immediate net livelihood loss for tribal households due to mining in the region.
5. There is no significant outward migration from the region after the mining activity starts there.
6. We are taking into consideration a tribal dominated region which initially (before mining) was secluded from the outside world and market economy.
7. There is no intervention by the government, no changes in the policy or any institutional changes.

8. The mining industry is a highly capital intensive, mechanized industry with large scale operations.
9. The aim of a mining company is the maximization of its own profit.
10. The other industries which come into the region due to mining are also highly capital intensive industries.

4.3.2 Analysis of the Impact of Mining on Tribal Livelihood and the Natural Resource Base

Before the beginning of mining in a mineral rich tribal dominated region the main sources of livelihood for tribals are the natural resources of the area. The mineral rich regions are also regions with dense forest covers. In such a region the tribal livelihood¹ depends on agriculture², forest products collection and sale, animal husbandry, fishing etc. Thus the natural resources³ which are used for livelihood consist of forests, river and ponds, and land (including agricultural and grazing land). This is a region which was secluded from the outside world and market economy before mining. Thus all the

¹ Livelihood refers to the capacity or ability of a household to provide for its consumption. Tribals use the natural resources existing in the nature for their livelihood purposes. The term 'tribal livelihood' is used as a general term denoting a particular way of life in which all the tribal households in the region use a similar set of resources for their livelihood. Although the exact proportion of livelihood earnings (both in the form of goods and money) from different resources may be different for different households. In a mineral rich region forests are the main source of livelihood. Thus for each tribal household the livelihood earnings from forest will be a significant part of their total livelihood.

² In this analysis agriculture include the production, use and sale of crops and the agriculture labor work. Generally the agricultural labor work refers to labor work available in other people's farms in the village or in the surrounding villages. In this analysis all the earnings related to agriculture related activities of a household in one's own farm or in other people's farm are clubbed together as the livelihood earnings from agriculture for a household.

³ The natural resources can be divided into two parts: the privately owned natural resources and common property resources. Based on this division the livelihood of tribals can also be divided into two parts. The first is the livelihood based on privately owned natural resources which are mainly land and the livelihood source is agriculture. The second type is the livelihood based on common property resources which are forest, water resources and community land like the land used for grazing of animals. The sources of livelihood based on the common property resources are sale and collection of forest products, fishing and secondary products made from forest products. Animal husbandry comes in between of these two categories. For animal husbandry and livestock production the village people use both the privately owned land in terms of fodder from the crop and common property resources in the form of grazing land, forest etc.

households were dependent on the natural resource base⁴ of the region for their livelihood.

In the pre-mining situation the natural resource base surrounding a tribal community supports and sustains it and is a source of livelihood for them. In turn the tribal community's lifestyle is such, that they use this natural resource base for their livelihood but do not overexploit it. Traditionally there exists a balance between the use of natural resource by them and the natural process of regeneration and maintenance of the environment. It can be said that there exists a relation of mutual interdependence between tribal livelihood and the natural resource base in the region.

Now consider a change in this situation of mutual interdependence and sustenance resulting from the discovery of mineral reserves in the region and the beginning of mining in the area. Mining affects both of the main variables of our model.

The impact of mining on the natural resource base can be divided into two parts. One is the immediate impact which is in the form of deforestation, diversion of surface water resources and digging of mountains (in cases where the mineral reserves lie inside the mountain). This leads to direct destruction of the natural resource base. The other impact consists of various kinds of pollution; pollution of water bodies, soil erosion and soil degradation, air pollution through emission of harmful gases or particles in the air etc.

The absolute loss of a large quantity of natural resources due to mining leads to an immediate loss of livelihood for the local population (which is predominantly tribal). Apart from the destruction of a big part of the natural resource base, mining also results in a loss of agricultural land owned by the tribals. So the total loss of livelihood in the immediate period after mining is a combined result of the above two effects of mining.

⁴ It needs to be specified in our case that when we say the natural resource base it refers to the common property resources (not including privately owned agricultural land). The reason behind focusing on common property resources is the tendency of the people to use more of these resources in the case of deterioration in their standard of living (net livelihood change) and an absence of any other livelihood opportunities. This is an important aspect of analyzing the impact of mining on tribal livelihood.

There is also a livelihood gain due to beginning of mining and new industries and services in the area which are dependent on mining. In order to see the overall impact of mining on livelihood the net livelihood change as a result of mining needs to be looked into (whether it is positive or negative).

In this model it is assumed that there is a net livelihood loss due to mining for the tribals in the mining region. When we say net livelihood loss in the region we mean that there is a net livelihood loss for a significant proportion of the households who get displaced and/or lose their sources of livelihood due to the commencement of mining in the region.⁵

Mining, by destroying the natural resource base destroys the livelihood of tribal communities and disrupts the interaction and flow of services between the natural resource base and the tribal population. The earlier system of mutual interdependence in which nature provided services for the livelihood of tribal communities and in turn a tribal community conserved the nature and did not overexploit it, is disturbed by the mining activities in the area.

The absolute loss of a large quantity of natural resources due to the immediate and direct impact of mining reduces the quality and quantity of natural resource base and thus reduces the capacity of the natural resource base to support the livelihood demands of tribals.

4.3.2.1 Process of Circular and Cumulative Causation

The process of circular and cumulative causation in the mining region is initiated by the beginning of mining can be studied in the following way.

Suppose in any time period after the beginning of mining there is a net livelihood loss due to mining. In the absence of an external support system for the livelihood of

⁵ The assumption of net livelihood loss due to mining means that a significant proportion of the households in the region lose their sources of livelihood and experience a net livelihood loss compared the pre-mining livelihood earnings. The proportion of households experiencing a net livelihood loss should be such that it leads to an overexploitation of the natural resources base in the region due to the increased dependence of the local people on it.

displaced tribals the net livelihood loss will mean their increased dependence on the remaining natural resources to compensate this loss of livelihood in order to reach their pre-mining standards of living.

Mining results in a reduction in the capacity of natural resource base to support the livelihood of tribals. In the post mining situation because of its reduced capacity and due to the increased dependence of the tribals, the remaining natural resource base will not be able to fulfill the increased demand of livelihood of the tribals. In turn tribals will not be able to compensate their loss of livelihood by using the natural resource base.

So the inability of tribals to reach their pre-mining level of livelihood and the corresponding standard of living by accessing the natural resource base will result in a further loss of livelihood for them in the next period.

The increased dependence of tribals for their livelihood on the remaining natural resource base, when the amount and capacity of it both have declined due to mining, will result in an over-exploitation of the natural resource base. This will further reduce its capacity to support and sustain the tribal population in the future.

In the beginning of next period there is a reduction in the capacity of natural resource base to support tribal livelihood and a net livelihood loss for tribals.

In the absence of external livelihood support systems the net livelihood loss will result again in an increased dependence on the remaining natural resources in the next period. This will result in a further reduction in the capacity of natural resources.

Due to this reduction in capacity of natural resources in the next period natural resource base again fails to meet the livelihood demand of the tribal population and results in a further loss of livelihood for the local tribal population.

In this way the process of circular and cumulative causation will go on period after period with successive rounds of net livelihood loss, increased dependence on natural resource base and reduction in the capacity of the natural resources to support this livelihood.

One of the major requirements for the operation of the process of circular and cumulative causation is increased dependence of local people on natural resource base as a result of net livelihood loss due to mining.

Increased dependence means that due to loss of their other sources of livelihood the intensity of the use of natural resources by the local people increases after mining. The importance of natural resources as a source of livelihood increases due to loss of their other sources of livelihood (mainly agriculture).

The increase in intensity of use along with the reduced amount and capacity of natural resources to support livelihood demands of tribals due to mining results in over-exploitation of these resources. This will further reduce the capacity of the natural resource base. Consider for example⁶, the wood collected from forest for use as cooking fuel. Before the beginning of mining people were taking dry wood for this purpose and were mainly collecting it for their own use. Mining has resulted in deforestation in the region. The reduction of forest area due to deforestation has resulted in decreased availability of dry wood to be used as cooking fuel. So some people now cut green trees to get wood for the cooking fuel purpose. On the other hand in the absence of other livelihood options and loss of former sources of livelihood some people have started selling wood by cutting down green trees⁷ to earn monetary income through it. The cutting down of green trees both for self use and for sale will result in further deforestation in the region.

There are many other examples which can be cited here to show this increased dependence and its impact on the capacity of the natural resource base. It can take the form of people plucking un-ripe fruits from the forest, cutting down the branches of the tree or the full tree containing fruits or other products which are used for self consumption and are also sold. It can also be seen in the form of overgrazing of fields by animals. This can be a direct result of the loss of village lands available earlier for

⁷The emphasis on green trees is to point out the difference between the pre-mining and post-mining use of forest resources by the tribals. Before mining they tend to collect wood either by picking up branches or logs which have fallen to the ground or by cutting down only those trees which have become dead or dried up from inside. The green or live trees are cut down only in exceptional cases.

grazing of animals. There is intense competition between households for the use of remaining natural resources which results in an over-exploitation of it and adversely affects the regeneration process of natural resources. It can be said that the rate of exploitation and use of natural resources by local people exceeds the rate of regeneration of it under such circumstances and results in a reduction in the capacity, quantity and quality of natural resources.

4.3.2.2 Effect of Pollution from Mining on the Process of Circular and Cumulative Causation

Mining affects environment in two ways. One is through destroying a whole part of the natural resource base in the region. Secondly it does so through the pollution from mining. Often the acquisition of whole part of natural resources for mining is limited to the period immediately after the beginning of the mining process. On the other hand the pollution of the environment by mining continues for large periods of time sometimes as long as the process of mining continues sometimes even after mining in the region is stopped.

Thus the direct adverse effect of mining⁸ leading to the reduction in the capacity of natural resource base through destruction of a whole section of natural resources takes place only in the immediate period after the beginning of mining⁹ while the reduction in the capacity due to pollution from mining continues over time.

This has important implications for the process of circular and cumulative causation between tribal livelihood and natural resource base. At any point of time in the process of circular and cumulative causation the reduction in the capacity of natural resource base is more than what it would only be because of its overexploitation by the tribals to compensate for their loss of livelihood due to mining.

⁸ Not including the effect of mining on environment through the process of circular and cumulative causation.

⁹ We are considering the case where there is no increase in the rate of extraction of minerals over time in the region.

ult, in each period the loss of livelihood of tribals due to the inability of the resource base to meet their livelihood demand will also be more than what it is in the absence of pollution of environment from mining.

continuous process of pollution from mining accelerates the process of circular cumulative causation between livelihood loss and reduction of natural resources in forward direction. In our model after the initial loss of quantity and quality of resource base in the mining the further decline in it is caused by the pollution mining and due to increased dependence and overexploitation of these natural resources by local people for their livelihood.

Process of Circular and Cumulative Causation in the Nearby Regions

Impact of pollution from mining company and its impact on natural resources is not dependent on the mining process but is independent of the process of circular and cumulative causation between livelihood and natural resources.

that even if there is no increased dependence on the part of local people on natural resources the loss in the capacity of natural resource base to support tribal livelihood due to pollution from mining will continue. This in turn will result in a loss of livelihood from natural resources for all those who are dependent on it for livelihood even when there is no increased dependence on it.

This phenomenon has an important implication. The population living in the nearby region which is not directly displaced and does not lose its sources of livelihood to mining but is near to the mining region might also be affected by the mining process. The pollution from mining affects the natural resources not only in the mining region but also in the natural resources of nearby regions. The pollution from the mining will affect over the capacity of such resources to support the livelihood of the population in these nearby regions. There might be a livelihood loss for the population in the nearby region due to pollution from mining even when they do not lose their sources of livelihood to mining.

This indirect loss of livelihood in the nearby villages does not happen immediately after the beginning of mining. This may take some years to come into effect. This is because the impact of mining on the natural resource base through pollution is a slow process and these regions are at some distance from the direct mining site.

Agricultural production in an underdeveloped country, especially in a tribal region also depends more on natural resources specially the water resources and the nature. If the pollution from mining is of a nature which adversely affects agricultural production and land productivity then it may become more difficult to obtain a livelihood from agriculture over time in the nearby regions. So there might be two types of livelihood loss due to mining for the people living in nearby regions. One is from the adverse impact of pollution on forest and water resources and resultant loss of livelihood directly obtained from these natural resources. The other is the livelihood loss due to loss of agricultural produce as a result of pollution from mining. If both these kinds of livelihood loss continue over time then there may come a time when their magnitudes becomes so substantial that these results in a net livelihood loss for the people residing in the nearby regions.

Since these people are not directly displaced or lose their sources of livelihood directly to mining there will be no compensation and alternative livelihood opportunities provided by the government or the mining company to them. So if there is a net livelihood loss for them in any period this will generate a process of circular and cumulative causation between the livelihood of the people and natural resources for the people in the nearby regions.

Thus mining not only generates a process of circular and cumulative causation with successive rounds of livelihood loss and environmental destruction in the mining region, it can also generate or initiate such a process in nearby regions where land and livelihood is not directly lost.

4.3.2.4 Significant Proportion of Households required for Triggering the Process of Circular and Cumulative Causation

One main question which is central to this theoretical analysis is the proportion of households having a net livelihood loss in the region which would trigger this process of circular and cumulative causation.

It in the main analysis it has been assumed that a significant proportion of households having a net livelihood loss that results in overexploitation of the natural resource base, is required to trigger the process of circular and cumulative causation. This raises the question that how do we define a significant proportion of households. There is no easy answer for this question.

The significant proportion of households in this analysis would be that proportion of households' overexploitation of natural resource base by whom will result in a reduction in the capacity of it to support the livelihood demands of tribals.

There are two main factors which play an important role in deciding the significant proportion of households to have a net livelihood loss for the operation of the process of circular and cumulative causation in the region.

The first is the level of overexploitation which will lead to reduction in the capacity of natural resource base. Second is the level of existing capacity of natural resource base at any point of time which due to increased dependence of tribals will result in a further reduction in it¹⁰.

The level of overexploitation which is required to trigger the process of circular and cumulative causation depends on the level of dependence¹¹ of different households (especially those households which have experienced a net livelihood loss due to mining)

¹⁰ At any point of time the increased dependence of tribals on existing natural resource base will result in further reduction in the capacity of it if the rate of regeneration of the natural resource is less than the rate of exploitation by the tribals for their livelihood.

¹¹ The level of dependence refers to the proportion of livelihood earnings from natural resources in the total livelihood earnings of a household.

on the natural resources in the pre-mining situation and the changes in it over time. It also depends on the level of livelihood earnings available from agriculture before and after mining to the households in the region.

In some cases the level of dependence of households which experience a net livelihood loss, might be so big in the pre-mining situation that after mining the more intensive use of the natural resources by them may result in a reduction in resources' capacity triggering the process of circular and cumulative causation.

The second factor in the determination of significant proportion of households with net livelihood loss is the level of destruction of natural resource base caused by mining. After the one time destruction of a part of natural resources by mining in the beginning, further reduction in the capacity of natural resources occurs through different forms of pollution from mining. This process is a continuous process independent of the interaction between local people and natural resource base. So if the reduction in the capacity of natural resources due to mining is such that at any point of time the overexploitation of natural resources by the tribals results in further reduction in its capacity the process of circular and cumulative causation will start.

The changes in the capacity of natural resource base follow their own trajectory which is a combined result of adverse impact of mining and exploitation or use by tribals for livelihood purposes. At any point of time the exploitation of natural resource base will turn into overexploitation if the level of capacity of natural resource base is such that the rate of regeneration of the natural resources is lower than the rate of exploitation by the tribals.

So the significant proportion of households having a net livelihood loss cannot be determined a priori for any mining region. It is decided depending on the interplay of the above mentioned two factors necessary for triggering the process of circular and cumulative causation and may have different values for different mining regions.

4.3.2.5 Some Additional Points about the Process of Circular and Cumulative Causation

There can be two variations in this model of cumulative causation. In one case the mining activity starts and continues over time but there no increase in the rate of extraction of minerals in the region.

In the second scenario there is an increase in the rate of extraction of minerals. In such a case the negative impact of mining would be more both on livelihood and on the natural resource base. This would tend to accelerate the process of circular and cumulative causation between loss of livelihood and destruction of natural resource base.

In this basic model that we are considering the first case, where mining commences with the opening of a new mine in the area that it is being operated with a constant rate of extraction. This makes easier to analyze the impact of mining on tribal livelihood and natural resource base. Due to the assumption of constant rate of extraction of minerals, after considering the one time immediate impact of mining we can concentrate on the interactions between tribal livelihood and natural resource base. The only way in which mining further affect the process of circular and cumulative causation is through the pollution from mining.

The mining process which starts to take place in the area is controlled by outside factors and the profit or earnings from the process also go out of the tribal-livelihood-natural resource base system. The local population has no control over the mining activity in the region. The downward directed process of circular and cumulative causation between livelihood of tribals and environment does not affect the process of mining in any significant manner. It may affect it if there are widespread protests against mining activity which force the government to intervene in the situation and control or regulate mining in the region. But in the absence of any such protests and any kind of external intervention there is no feedback of the interactions between livelihood and environment on mining.

Mining or extraction of minerals is a finite process i.e. it can go on only as long as there are mineral reserves. The process terminates with the extinction of mineral ore in the

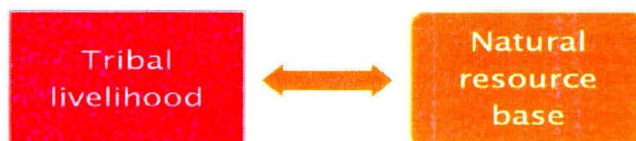
mines under consideration. Whatever livelihood generating possibilities mining might have produced end with the end of the process itself. In the meantime the process of cumulative causation between livelihood of tribals and environment resource base in the downward direction initiated by the process of mining continues.

This process of circular and cumulative causation goes on until some external changes take place which results in counteracting reactions and start a process in the opposite direction.

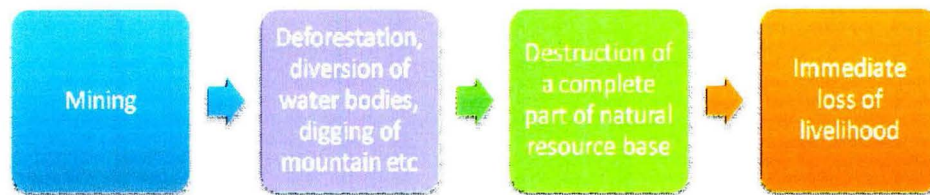
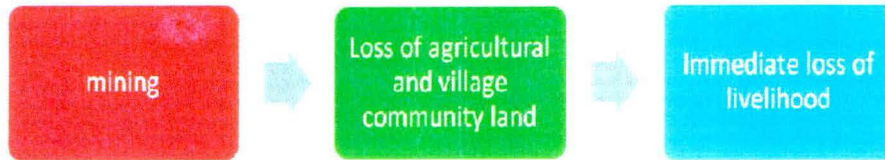
One important source of external change which may stop or reverse this process of cumulative causation in the downward direction is the government intervention in the form of creation of alternative livelihood opportunities and legal regulation of mining activities which aims to minimize its adverse affects on livelihood and environment. Bu in the absence of any outside intervention by government or other exogenous factors this process will continue until either the situation of the local people become so dire that they are forced to starve, out migrate or come out in protest against mining. Alternatively it may happen that the environment is so severely destroyed by mining that some environment disaster takes place putting a stop or reversing the process of circular and cumulative causation.

4.3.3 Process of Circular and Cumulative Causation through Flow Charts

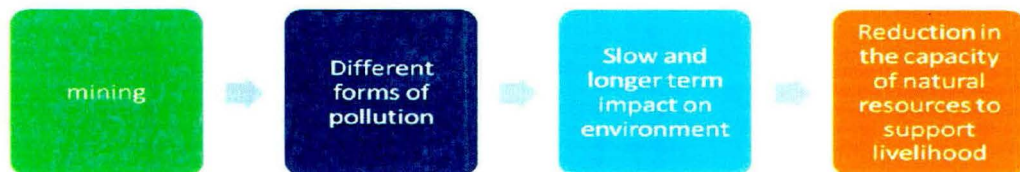
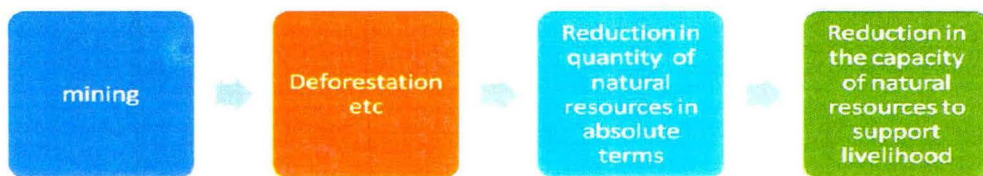
Relationship of mutual interdependence before mining



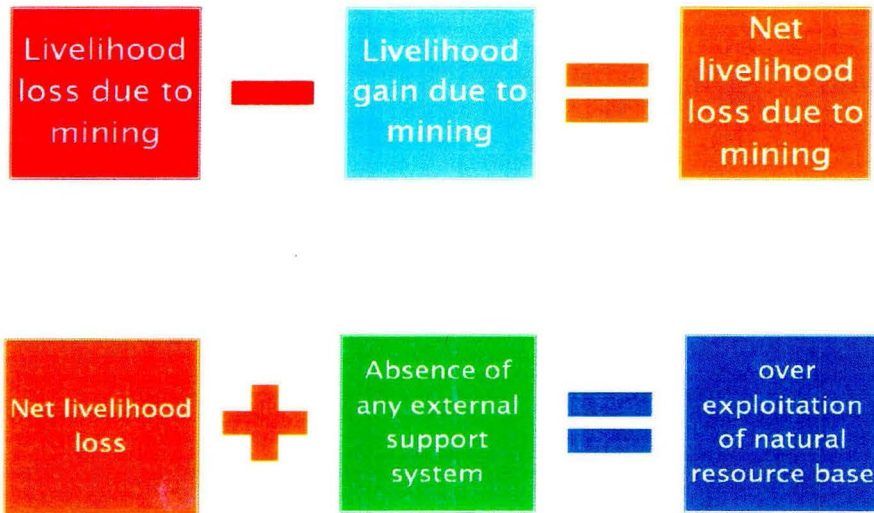
After mining the immediate impact on livelihood



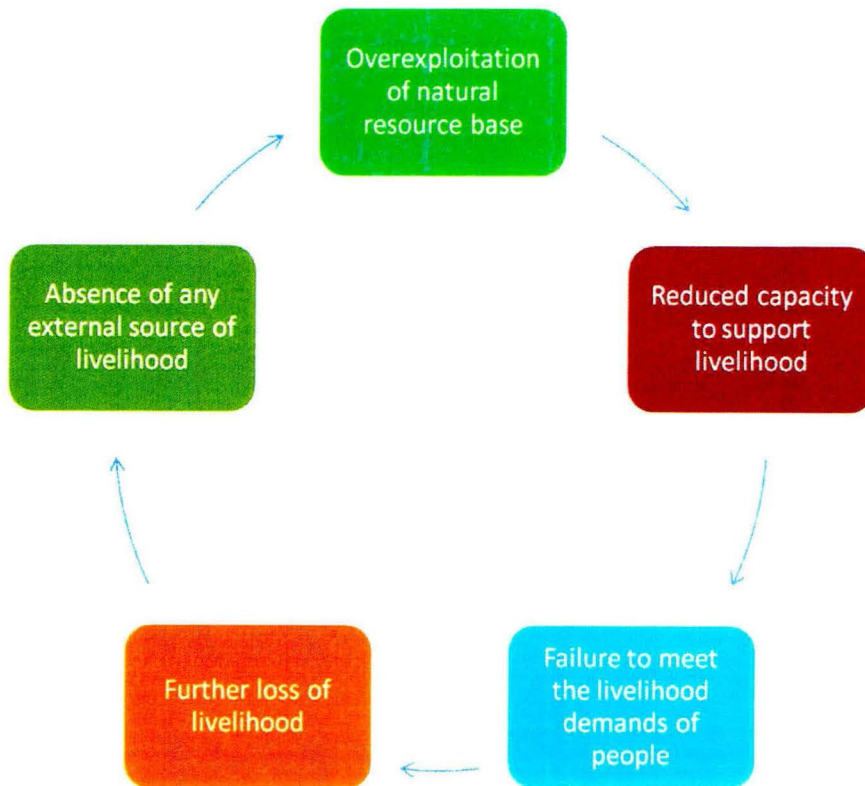
The impact of mining on the natural resource base in the region



Basic conditions leading to the circular and cumulative causation



The vicious circle of livelihood loss and environmental destruction



Process of circular and cumulative causation in the downward direction



4.4 Process of Circular and Cumulative Causation with Relaxation of Some of the Assumptions

The objective of this section is to analyze the process of circular and cumulative causation with the relaxation of some of the assumptions of the basic model. We would like to observe the changes brought in the model by the change in the basic assumptions and its implications for our overall analysis.

The assumptions of absence of alternative livelihood opportunities, net livelihood loss and no outward migration are relaxed and their implications for the model are discussed.

The first two assumptions are chosen for relaxation in this section because they are crucial for the operation of the process of circular and cumulative causation in a mining region. Third assumption of no outward migration is chosen because of its complimentary nature to the assumption of absence of alternative livelihood opportunities in the region.

The outward migration of people from the region after the beginning of mining will provide alternative livelihood opportunities to the people but outside the mining region and will affect the process of circular and cumulative causation by doing so.

4.4.1 Outward Migration of the People from Mining Region

Let us relax the assumption of no outward migration. Let us suppose that there is a possibility of outward migration from the region after the mining begins there.

After relaxing the assumption of no migration we can envisage two situations. One in which the outward migration from the region starts soon after the beginning of mining. The second in which the outward migration from the region starts some time after mining began in the area.

The first situation is a bit unrealistic because generally if there were no migration from the region earlier (before mining) the chances of outward migration just after the commencement of mining are very little.

The outward migration from mining region after mining depends not only on the livelihood loss and lack of alternative livelihood opportunities in the mining region but also on the availability of jobs or livelihood opportunities outside the mining region.

Normally even if there is outward migration in the immediate years after the beginning of mining the outward migration will be small in size and mostly in the form of seasonal migration. Seasonal outward migration from the region helps the local population, to an extent in their living as an additional source of income. However as long as the migration takes place on a small scale and is seasonal in nature it will not affect the process of circular and cumulative causation between the loss of livelihood and the degradation of the natural resource base. Since the sources of livelihood provided by natural resources in terms of goods and services are seasonal in character¹², income from seasonal migration acts as a complementary source of livelihood for those who are dependent on forest resources for their livelihood. But it does not affect the overall relationship of dependence between tribal livelihood and natural resource base. Thus seasonal outward migration does not affect the process of circular and cumulative causation in any significant way as long as the volume of migration remains small.

¹² There are some exceptions to this statement. There are certain goods and services provided by natural resources which are used by the local people all over the year like the wood for cooking fuel. But the major sources of tribal livelihood from natural resources are seasonal in nature.

In the second situation, sometime after the advent of mining in the region, an increasing loss in net livelihood occurs in the region with the continuation of the process of circular and cumulative causation in the downward direction. In this process a time comes when individuals and households start searching for livelihood options outside their region due to continuous loss of livelihood and the consequent fall in their standard of living. At this stage the outward migration of individuals and families start from the region. Large scale outwards migration from the region will start only when due to this process of circular and cumulative causation the livelihood loss and fall in standard of living is so large that people are fighting for survival. They are in such a dire situation that they fail to even meet the needs of subsistence and have no option but to migrate if they want to survive. In such a situation the availability of employment outside the mining region does not remain a deciding factor for migration. In such a situation there will be a tendency for large scale permanent outward migration from the mining region.

This point of time where people feel so desperate that they start moving outside the region for employment can be different for different families and individuals. But it is only when the majority of households are in this situation, will there be large scale outward migration from the region. This will interrupt the process of circular and cumulative causation in the downward direction.

There is a limit to which standard of living of the people can fall in any situation. People are not able to survive if their standard of living falls below a minimum level of subsistence. There is a floor to fall in net livelihood loss and decline in standard of living. If it falls below this minimum level people are forced to take some alternative measure for their survival. The most common form this alternative measure takes is migration to some other region; nearby cities or to big metropolitan cities. So the process of circular and cumulative causation goes on till the livelihood loss reaches a level where the people are surviving at the minimum possible level of subsistence and any further fall will lead to possible starvation or total destruction of life conditions. In such a situation the people are forced to migrate somewhere else. In such cases the process of circular and cumulative causation is interrupted at least for the people living in the mining region.

4.4.2 Availability of Alternative Livelihood Opportunities and Net Livelihood Gain

There are two assumptions which are crucial for the process of circular and cumulative causation to begin and continue in a mining region. One is the net livelihood loss in the initial period just after mining begins and the other is the assumption of the absence of alternative livelihood opportunities in the region. If either one of these two are not satisfied the process of circular and cumulative causation does not happen or stops.

These two assumptions are linked with each other. If one is true the other also tend a to be true and vice versa. If alternative livelihood opportunities exist in the mining region it may compensate for the loss of traditional sources of livelihood and result in net livelihood gain for the households in the region.

The process of circular and cumulative causation may stop if any alternative sources of livelihood are available in the region. The livelihood opportunities in the mining region can be provided by the government or by the mining company. The alternative livelihood opportunity might take form of a job in the mining company or provision of some other assets like land to the local people which might act as a source of livelihood.

If the mining company is in the public sector and enacts a policy of job provision to every family displaced or affected by mining then this process of circular and cumulative causation may not occur. But the necessary condition for such a situation is that a significant proportion of the total households that are displaced or affected by mining must be provided with a job in the mining company. Furthermore these must be well paid jobs with security of tenure for a long time.

The provision of land to the displaced population for agricultural purposes may also lead to a net livelihood gain in the region. But the necessary condition for this to happen is the availability of sufficient quantity of good quality land which could compensate the livelihood lost due to mining. Again the displaced and affected families should be provided with this alternative source of livelihood i.e. land in such a way that a sufficient proportions of households experience a net livelihood gain required to prevent the process of circular and cumulative causation in the region. The alternative livelihood

opportunities inside the mining region may also take the form of some other livelihood program by the government which creates jobs or livelihoods in the region.

The alternative livelihood opportunities and the resulting livelihood gain from it must be sufficient to counteract the livelihood loss due to mining and generate a net livelihood gain. Furthermore the alternative livelihood source should be such that this net livelihood gain is sustained over a period of time. If that is not the case the process of circular and cumulative causation may begin again.

There might be availability of alternative livelihood opportunities outside the mining region. That happens only if there is a high rate of employment generation in other sectors of economy in other parts of the country¹³. Livelihood opportunities outside the mining region cause outward migration.

4.5. Applicability of the Model

A field survey of the Basundhara coal mines in Sundargarh district of Odisha was done to find out the impact of mining on the local people and calculate the net livelihood change for the sample of households for whom the data was collected. The general observations and discussions with the local people gave us an idea about the impact of mining on the livelihood and natural resource base in the region. The discussion here is done on the basis of information gathered from the local people and the observations made by the researcher.

4.4.1 Fulfillment of the Assumptions of the model in the Field Study Area

According to the residents of the region before the beginning of the mining, the region studied was a tribal dominated region largely secluded from the market economy and outside world. There were no proper roads linking the present mining region to the

¹³ Here we are not considering the generation of livelihood opportunities outside the region through deliberate efforts of the government. It is because if there is a deliberate effort by the government to generate livelihood opportunities for the displaced population it most probably will be inside the mining region and not outside.

district headquarter and other nearby towns. Earlier the regional economy was more or less based on agriculture and collection, use and sale of forest products. The region was covered with dense forests and had access water sources like Basundhara river and village ponds. People were dependent on natural resources for their livelihood and they were more or less living in harmony with the nature. So the basic premise of the model of a relationship of mutual interdependence between livelihood of tribals and natural resource base appears to be applicable in this situation.

There is no out migration from the region. In fact there is large scale in migration in the region both from outside Odisha like Jharkhand and Bihar and from other parts of the Sundargarh district. This influx of a large migrant population in the region increases the pressure on the remaining natural resources. Even when they do not use it for direct income earning purposes they are dependent on it for other facilities and services like for drinking and washing purposes, for building houses etc. If we taken into account the introduction of a migrant population into the region as a result of mining our analysis shows that this increased burden on the remaining natural resource base tends to accelerate the rate of circular and cumulative causation in the downward direction.

The mining company operating in the study area is a public sector company and did provide jobs to some of the people displaced by mining in the beginning. This is different from other private mining companies which don't guarantee jobs in the company for the displaced population as part of their rehabilitation package. This proved to be a source of alternative livelihood opportunities for those who got job in the mining company.

Apart from the provision of jobs to a part of the affected population in the mining company there are no other alternative livelihood opportunities in the region. In fact apart from mining there is no other livelihood option left for the people. In the neighboring areas where mining is not carried out taken place agriculture is badly affected due to pollution from mining and some people have simply stopped working on their agricultural land and left it barren. Agricultural production has become so low for these people that it is more profitable for them to leave this land barren and do something else for their livelihood.

The assumption of the net livelihood loss is one of the basic assumptions of the model. It forms the base of the cumulative cycles of livelihood loss and environment destruction in the successive periods. It has been discussed in an earlier section of this chapter that for the triggering off of the process of circular and cumulative causation a significant proportion of the total households should have a net livelihood loss. This significant proportion is such a number of households which results in an overexploitation of natural resource base and a consequent reduction in the capacity of natural resource base.

It was seen in the last chapter that the net livelihood change of a family in the region was determined by the type of compensation provided to the family by mining company. The households, which fell in the compensation category containing jobs in the mining company as part of their rehabilitation package, have a net livelihood gain. Similarly the households that didn't get a job in the mining company have a net livelihood loss due to mining.

From the field survey and the calculation of net livelihood change of the sample households it was found that 37 households (68.5 percentages) have experienced a net livelihood gain while 17 households (31.5 percentages) have experienced a net livelihood loss in the sample.

The one third of the total households in our sample which have experienced a net livelihood loss can be considered as a significant proportion of households provided it results in overexploitation and reduces the capacity of natural resource base. This point will be discussed in detail in the next section.

4.4.2 Analyzing the Conditions in the Field in terms of the Effect of Mining on Livelihood and Natural Resource Base

In the area of the field study it was found that there has been an immediate loss of livelihood for the local residents through acquisition of their agricultural land and through destruction and pollution of the natural resource base.

A net livelihood loss due to mining means a fall in the standard of living of a family. It means that the families which have a net livelihood loss due to mining have experienced

a fall in their standard of living over time. Majority of the households which have experienced a net livelihood loss are those which have not got a job in the mining company.

Information gathered from the sample households shows that the people from the families who don't have jobs in the mining company are using forest resources for earning their livelihood¹⁴. Since the forest which surrounded the village area earlier is destroyed now, they travel a large distance to go to nearby forests to collect forest products for sale¹⁵. Now they are using the forest more intensively, which was earlier used sparsely to make up for the livelihood loss due to mining¹⁶. Therefore in a sense the overall dependence on the forest resources has increased. This has put more pressure on the remaining forest resources.

Also in the region, a comparison of pre-mining and post-mining situations for these households show that their other sources of livelihood like agriculture and animal husbandry have been destroyed due to mining and they are more dependent on the livelihood obtained from the forest for their survival.

Before mining began in the region, agriculture and forests were used as sources of livelihood, which were more or less complimentary to each other. Forest products especially non-timber forest products are available at particular times of the year and for a limited time periods. So the collection of such products both for self consumption and sale can be done only in those periods of time. Therefore livelihood based on forest resources can only provide a seasonal livelihood earning. Earlier agriculture used to provide livelihood for the rest of the year. Now in the absence of agriculture and a proper

¹⁴ In the sample collected it was found that some of the families who got a job in the mining companies are still engaged in collection, use and sale of forest products. But their dependence on forest products is not for survival as it is for those who have not got a job in the mining company.

¹⁵ Many people used to collect some forest products like Mahul from the Mahul trees on their agricultural land. Acquisition of their agricultural land for mining has resulted in a loss of income earned from the sale of Mahul collected from Mahul trees. It has also entailed a loss of Tol (fruit of Mahul tree) and Tol oil which was used as cooking oil by the local people.

¹⁶ Here the operation of process of circular and cumulative causation in the field area is analyzed in terms of forest resources.

job, the members of these households are mostly engaged as daily wage workers in different types of labor work in mining and mining related construction or transport sectors¹⁷ apart from the sale and collection of forest products. Since majority of the households in this category are having a net livelihood loss due to mining it indicates that the different kind of labor work in which they are engaged is not providing them with enough income to cover up the livelihood lost in the mining.

The annual produce from the forest for local people is less than what it was in the pre-mining situation. This in many cases it can be seen as a direct result of mining and mining induced pollution (based on account given by local respondents). Local people report that after the beginning of mining there has been a decline in the capacity of forest resource to support their livelihood requirements¹⁸.

The overall picture which emerges from the study of the field area in terms of the impact of mining on the relationship between livelihood of local people and the natural resource base can be summarized in the following way.

For the families which have suffered a net livelihood loss, the alternative sources of livelihood available in the post-mining situation have not had any significant effect on their standard of living and as a result their dependence on the forest resources has increased.

The capacity of the forest resources to support the livelihood of the local people has declined. This implies that the forest resources are not able to meet the livelihood demand of the families falling into the net livelihood loss category.

¹⁷ The male members of the family work as unorganized sector daily wage workers and female members in particular seasons go to the nearby forests and collect and bring non-timber forest products for sale and household consumption.

¹⁸ The forest produce has declined from the remaining forests but it is difficult to say whether it is more because of the pollution from the mining or it is because of increased number of people using the same forest resources for earning their livelihood. The pollution from the mining is more evident and is on such a large scale that its adverse affect on forests is more visible.

This will tend to have a further implication for the livelihood of the people in the next period. Following the logic used in our theoretical analysis these families will tend to have a further loss of livelihood in the next period, unless some new opportunities of livelihood are made available to them which significantly alter their livelihood earnings.

The dependence of local people on the forest resources in the region has increased. This increase in dependence can be clearly seen in the case of households with net livelihood loss. For the initiation of the process of circular and cumulative causation we need to show that this increased dependence on forest resources results in an overexploitation and reduction in its capacity to provide for the local livelihood.

There are certain indications of increased dependence on the forest resources like the cutting down of live trees for selling it as cooking fuel in the market by the local residents. Local people were not engaged in such activities before mining. This surely has an adverse impact on the forest resources. More information and observation of the field area is required to completely ascertain the reduction in the capacity of forest resources due to overexploitation of it by the local people.

4.6 Inter Generational Comparison of the Livelihood Changes

Land as a source of livelihood is passed from one generation to another in a family. It has a livelihood potential or the ability to provide livelihood to many generations. When the land owned or used by a family to earn their livelihood is lost, it results in a livelihood loss. The loss of livelihood which one can see and try to measure is; only the current loss of livelihood measured by comparing the present period with the pre-mining period. But implicit in this loss of land is also the loss of livelihood for future generations.

Similarly the natural resources which were and are used by the tribals for their livelihood exist for thousands of years. If there would have been no mining they might have been used by many coming generations of the families in the region for earning their livelihood. Thus the loss of these natural resources due to mining also entails a loss of livelihood for many future generations.

The measure of the actual loss of livelihood should take into account the present loss of livelihood plus the loss of livelihood for the future generation for which the land and

natural resources which are lost would have acted as a source of livelihood. But calculating or even making an estimate of these future livelihood losses is very difficult. It is difficult for three main reasons. First simply because it is in the future we don't know what it would be actually. Secondly we don't know exactly for how many years these resources are going to last and thirdly if we try to estimate the amount of the future livelihood loss by using some of the prevalent methods we face the problems of discounting and choice of proper discount rates.

The main objectives of this section is to make comparisons and analysis of the net livelihood changes of present and future generation across households which have got alternative livelihood opportunities in the present generation and those which have not. Such an exercise is undertaken in order to include the implications of future livelihood losses in the analysis of the process of circular and cumulative causation in a mining region.

Suppose the mining operations in a tribal dominated mineral rich region start in the present generation's time¹⁹. The families which lose their sources of livelihood directly to mining receive different types of compensations from the mining company. One types of compensation include provision of regular salaried jobs in the mining company and the other type of compensations does not include it.

It was seen in the previous chapter (by calculating the net livelihood change for the sample households) that those families which fall under the 'job in the mining company' category experienced a net livelihood gain and those who didn't get a job in the mining company experienced a net livelihood loss.

Thus in the present generation's time those who have received a job in the mining company tend to have a net livelihood gain while those who didn't get a job tend to have a net livelihood loss.

¹⁹ Alternatively it can also be said that the generation present when the mining starts in a region are termed as the present generation. These are the people who are in the working age group at that time and are the recipient of different forms of compensation provided by the mining company. They are the people who are the earning members of the family at that time.

If no alternative sources of livelihood become available in the mining region in the future generation's time then the families which didn't get a job in the mining company in the present generation will tend to have a net livelihood loss for their future generations too.

For the families who have now got a job in the mining company the net livelihood change of the future generation will depend on a various factors. The future generations of the households which got a job in the mining company now will also be without a job in the future. It is because the job in the mining company as part of the rehabilitation package is provided for only one generation of the concerned household unless one dies in an accident in the mining company²⁰.

Thus if no alternative sources of livelihood become available to the local population as they move from one generation to another than it is logical to assume that the future generation of the families who now have got a job in the mining company will have a livelihood loss due to the loss of the income earned from their job in the present generation's time.

On the other hand the improvement in the standard of living of the families who have got a job in the mining company in present generation's time may have some positive impact on the earning capabilities of their future generations. The future generations of these families might have a better education because the present generation can spend more on their education, can send them outside the mining region for studying etc. This may open up new livelihood opportunities for the future generations of these families.

Furthermore mining may result in an improvement in the physical and social infrastructure in the region²¹. In the mining region which was covered in the field survey it was found that mining has resulted in connecting the mining region with other parts of the state. This increased connectivity of the mining region with outside world may have some positive impact on the opportunities for livelihood for the future generations. The

²⁰ The entire analysis in this section is based on the findings of the field survey of the Basundhara coal mines undertaken by the author.

²¹ This is more probable in the case of Public Sector mining companies.

improvement in the education facilities in the mining region ²² may also have a positive impact on the livelihood of the future generations by endowing the future generations with capabilities and different types of technical skills.

The aggregate impact of improvement in the physical and social infrastructure and of the present generation's higher level of standard of living on the future generation will be in the form of increase in the income earning potential of them and by availability of greater opportunities for jobs compare to the present generation.

The positive impact of mining on the future generation's livelihood even when they are not directly provided by a job in the mining company will be in the form of a livelihood gain for them. If this increase in livelihood is greater than the loss of livelihood for a family due to loss of job which was provided to it in the present generation's time then the concerned family will have a net livelihood gain even for its future generation. But this result depends on the future generation's acquiring a well paid job which covers the loss of livelihood of present generation.

But the availability of jobs for the future generation is determined by the rate of generation of employment in the economy. So the net livelihood change for the future generations of those who have got job in the present generation's time is dependent on the rate of employment generation outside the mining region and in the availability of jobs inside the region and the income earning potential of them (dependent on their level of education and acquired skills).

But if the rate of generation of employment outside the mining region is low then it might be the case that even with better education and skills the future generation of the present generation families, who have got jobs, might not be able to secure well paid jobs outside the mining region.

If the rate of generation of employment generation in the other sectors of economy is low and there are no alternative sources of livelihood in the future generation's time then it might be the case that the future generations of families with job in the present generation

²² There were some indicators of this occurrence in the field area of the study.

will tend to have a net livelihood loss as their present generations loss their jobs in the mining company due to completion of their tenure.

The data collected from the field survey showed that out of the fifty four surveyed households' only one household has children who are getting higher education outside the region which by improving their capabilities may allow them to get a well paid job in the future²³.

On the basis of the above discussion and the data from the field survey can be said that unless an alternative source of livelihood is made available to the future generations of those households who have got jobs in the present generation or the rate of employment generation changes significantly, they will tend to have a net livelihood loss in the future.

So for the present generation who experienced the direct loss of livelihood due to mining the process of circular and cumulative causation between livelihood loss and environment destruction will depend on the number of households which received a job in the mining company and the number of those who didn't. This will decide the proportion of the households who have a net livelihood gain and those who have a net livelihood loss due to mining in the present generation's life time. If the increased dependence of those who have not got a job is not sufficient to result in a further loss of capacity of natural resource base than there will not be a process of circular and cumulative causation in the present generation's life time. But if there are a significant number of households who do not get a job in the mining company than depending on the reduction in the capacity of natural resource base it might trigger a process of circular and cumulative causation in the present generation's life time.

Moving from the present generation to the future generation²⁴ both the type of households who got job after displacement and who didn't, become jobless. Now there

²³ The children of this family were pursuing engineering and MBA courses in Bhubaneswar. Other children who are studying outside the region are generally pursuing their school education which in India does not guarantee a well paid job in the future. Engineering and MBA also does not guarantee a job in the future but chances of getting job after completing these courses is higher.

²⁴ The present and future generations can also be termed as first and second generations. What we actually mean by the present and future generation is that the generation who experienced the beginning of mining and initial loss of livelihood due to it and the generations which come after the beginning of mining in the

can be two situations. One in which there is a high rate of employment generation in the future generation's life time and the other situation in which the rate of generation of employment is low.

If the rate of generation of employment in the future generation is low and there are no alternative sources of livelihood in the mining region then all the people in the region at this point of time become dependent on forest resources and different forms of unorganized sector labor work (depending on their availability in the region) for their survival. Based on our earlier results both of these groups of people will now have a net livelihood loss. In the absence of alternative livelihood opportunities it will mean an overall increased dependence on the remaining natural resource base and will initiate a process of circular and cumulative causation between livelihood loss and environment destruction in the downward direction.

Under certain conditions in the future generations' time the process of circular and cumulative causation may start in the region either just after mining or after a time lag which consist of moving from present generation to future generation.

So unless a sustainable source of alternative livelihood needs to be provided to the displaced families which ensures livelihood for present generation as well as future generations there are high chances of a process of circular and cumulative causation starting in the region.

4.7 Conclusion

The theorization of the process of underdevelopment in mining region, under the assumption of net livelihood loss and absence of alternative livelihood opportunities mining generates a cumulative process of net livelihood loss and reduction in the capacity of natural resource base. After the initiation of this process by mining in each successive period through series of interactions between each other net livelihood loss and reduction in the capacity of natural resources base takes place. This keeps on happening until some

area in the future. Furthermore we refer to a time period of a generation to be the time when he/she reaches the working age till the end of his/her life.

changes occur in the region which puts a break or stops this process of circular and cumulative causation.

Net livelihood loss in each successive periods means that there is a worsening of the standard of living of the people in the region over time. Thus if mining generates a process of circular and cumulative causation between livelihood of tribal population and the natural resource base in the downward direction then it can be said that mining leads to a dynamic process of underdevelopment in a mining region.

For the net livelihood loss in a mining region, a sufficient proportion of households with net livelihood are required. The numbers of households who by having the net livelihood loss increase their dependence on the natural resource base and result in a reduction in the capacity of natural resource base to support the livelihood of the local people are termed as a sufficient proportion of households needed to fulfill the assumption of net livelihood loss in the region. In the sample households almost one third of them were having a net livelihood loss.

By checking the applicability of the process of circular and cumulative causation to the area of the filed study it was found that the capacity of the forest produce to support the livelihood demands of the people have declined after mining. But the reduction in the capacity of forest resources due to increased dependence of the people could not be ascertained on the basis of the available data from the field.

CHAPTER 5

CONCLUSION

5.1 Introduction

The word 'mining' is often used with different types of connotations. Sometimes it is used with economic growth, sometimes with export, employment, environment pollution and sometimes with the process of economic development. In recent years mining in India is usually not been linked with underdevelopment of the regions wherein mining takes place. It has been observed that the mining regions are either underdeveloped or backward regions in the country. Thus whatever may be the effect of mining on the level of economic growth and development at the national level concerns have been raised that it may not be beneficial for the people residing in the mining regions.

One of the primary studies which has tried to establish some sort of linkage between mining and underdevelopment in India is the report 'Rich Lands Poor People: Is Sustainable Mining Possible?' published by the Centre for Science and Environment (CSE 2008). The findings of the report supported the claims which are being made by several people who resisted the mining projects in the country. The nationwide protests of local residents against the mining projects seem to provide a clear indication that mining adversely affected the lives of several people.

This report and the protest of the local people against mining projects in the country prompted the author of this dissertation to look into the problem of mining and underdevelopment in greater detail. In this dissertation we have tried to go beyond the observation of the co-existence of mining and underdevelopment in the country.

The main objective of the study was to look into the impact mining had on the development of the local people residing in a mining region. In order to study the relationship between mining and underdevelopment, several reasons wherein mining affect the local people and their livelihood needs to be examined. The different activities through which mining induces changes in the livelihood pattern of local people in a mining region are displacement, resettlement and rehabilitation of the displaced population, deforestation, water and other forms of pollution and overall employment generation in mining region. In this study the net impact of all these forms

of changes was examined by using the available secondary data. It also examined whether mining has led to development or under development in mining regions. The livelihood of the local people in a mining region is the key to understand and assess the developmental impact of mining in these regions. Therefore in order to capture the developmental impact of mining in these regions the changes in the livelihood of the local people induced by mining needs to be calculated. This was done in this study by developing a measure of net livelihood change due to mining. This measure was developed and applied to a coal mining region i.e. Basundhara coal mines in Sundargarh district of Odisha. The pattern of net livelihood change emerged from the field survey by the application of the measure of net livelihood change was analyzed in terms of different factors affecting net livelihood change of different households in the sample. Since net livelihood change is taken as a proxy for the development of a mining region the analysis of net livelihood change across different factors have special implications on the development of the region.

If mining results in underdevelopment of the region then the mechanism or exact process through which it happens is studied by applying the Gunnar Myrdal's (1957) concept of circular and cumulative causation between livelihood of tribal (as majority of the population in many mining regions in India are tribal population) and the natural resource base existing in a region. The applicability and validity of this theoretical analysis of the underdevelopment of a mining region as a process of circular and cumulative causation is assessed on the basis of the data collected from the field survey in Basundhara coal mines in Odisha.

This chapter provides a conclusion to the dissertation which has been written researching the question of 'mining, livelihood and underdevelopment' in a region. In this chapter the first section provides an introduction of the chapter. The second section discusses summary of the findings of this dissertation outlining the different objectives which we want to study through this dissertation, the efforts undertaken in different chapters to accomplish these objectives and the results conclusions obtained as a result of these efforts. The third section explains the implications of the result obtained in different chapters and the last section provides the limitations of this study and the scope for further research.

5.2 Summary of the Findings

In the first chapter of the dissertation this study was started by discussing the motivations behind choosing a specific set of problems for research. The motivation behind choosing the particular topic of dissertation lies in the inadequacies of the existing literature to address the problem of mining and underdevelopment in a comprehensive way. The existing literature on the impact of mining on the development of the mining regions suffers from several limitations. Firstly, the existing literature of 'resource curse' which has tried to link resource dependence with poverty of resource rich nations concentrates only at the national level growth and development of different nations. The existence of regional disparity between nations and the fact that economic growth does not always leads to development of all the regions within a country compel us to look into the impact of mining on a regional level. Secondly in the study which concentrates on the regional and micro level impact of mining, the impact of mining on the local people is often looked upon by using specific indicators like health, education, environment degradation etc this method of study provides only piecemeal nature of information and analysis. Thirdly the studies which have attempted to look at the overall impact of mining by using different indicators have used only such changes in the standard of living of people which are monetary in nature like income. The standard of living of people residing in mining regions majority of whom belongs to the tribal populations use many of the products in their day to day life which are directly available from nature. The inclusion of only monetary aspects of livelihood of local people in the estimation and calculation only provides a partial measure of development of mining. Fourthly the studies which have looked at the impact of mining on livelihood and are often explanatory in character does not provide us with a measure to capture the change in livelihood due to mining. Fifthly the study which links mining with underdevelopment of the local people does not explain the mechanism or the process through which the process takes place.

Thus the study of mining, livelihood and underdevelopment is an effort to fill the existing gap in the literature by observing, measuring and explaining the process of underdevelopment in a mining region through its impact on the livelihood of the local people.

The second chapter aimed to establish the existence of a relationship between mining and underdevelopment using the available secondary data sources.

In this chapter the impact of mining was looked upon in terms of displacement of people from their land, the resettlement and rehabilitation of the displaced people, the deforestation and pollution of rivers, overall employment generation by mining and the changes in the livelihood of local people as a result of all the above effects of mining in the region. Side by side the coexistence of mining and underdeveloped regions in the country was checked using the available data with a case study of Odisha.

On the basis of secondary data available from various sources it was seen that the mining projects over the year have displaced a lot more people than they have resettled and rehabilitated. The adverse impact of mining in terms of resettlement and rehabilitation is much more on the tribal population compared to the rest of the population. The employment generation from mining has declined over time and the large scale deforestation and water pollution due to mining has adversely affected the livelihood of the people residing in mining regions especially the tribal population. There is some evidence for the coexistence of mining and underdeveloped region in the country. This can be seen from the comparisons of the backward and mining districts in the country and by looking at poverty rates of the fifty most mined districts in the country. Evidence for geographical overlapping of the backward and mining regions in the country was found which indicates an underdeveloped status of the mining regions. So the available secondary data suggests the existence of a relationship between mining and underdevelopment in India and it might be the case that mining is leading to the underdevelopment of mining regions.

After saying that there is an existence of a causal relationship between mining and underdevelopment in order to look at the developmental impact of mining at any point of time a measure or indicator is needed so that this impact of mining can be captured in quantitative terms. In the third chapter the first part was to develop a measure of net livelihood change to assess the developmental impact of mining in a region. The second part of the third chapter involves an application of this measure of net livelihood change in the Basundhara coal mines in Sundargarh district and analyzes the net livelihood change of the region in terms of different factors which may determine the pattern of net livelihood change. The Basundhara Coal mines

was chosen for the field survey and for the development and application of the measure of net livelihood change because Odisha is one of the most underdevelopment but mineral rich state in the country. The choice of Basunadhara coal mines Sundargarh district of Odisha was governed by the fact that it is one of the districts wherein mining activity is neither too recent nor too dated and thus makes calculating impact on livelihood in every possible way. Furthermore Sundargarh district is a region covered with dense forests and have large tribal population. This makes it as an ideal choice for the study of livelihood change due to mining and for the development, calculation and application of the measure of net livelihood change.

The third chapter is based on the field survey of Basundhara coal mine in Sundargarh district of Odisha. The net livelihood change was calculated at the household level. The measure of net livelihood change was developed firstly by dividing the livelihood of a household into two parts. First part consisting of goods which were/are directly consumed from nature. The second part consists of those livelihood earnings which are available in monetary terms. The first part consists of goods which are available from forests, water resources etc for direct consumption. The second part consists of income earned from various forms of labour work and monetary earnings by sale of products available from natural resources in the region. In order to calculate net livelihood change of a household the changes in both of these components of livelihood needs to be calculated. The main difference between net livelihood change and any other measure of developmental lies basically in the inclusion of products available from nature and are used by direct consumption. These products, changes in their availability and its impact on the standard of living of those people generally left out of the other development indicators which only include the monetary aspects of livelihood.

On the basis of the calculation of net livelihood change for different households in the sample it was found that around one third of the households are having a net livelihood loss while two third populations is having a net livelihood gain due to mining. Different households were provided with different types of compensation. The net livelihood changes across different households in the sample depending on the type of compensation provided by the mining company. Looking at size of landholdings owned before mining and the compensation type and their impact on net livelihood change it was found that the size of own landholdings before mining is not emerging as a significant factor in determining the net livelihood change in this

study. While the compensation types come out as the most significant factor in determining the pattern of the net livelihood change.

One set of families in the area received a job in the mining company as a part of their compensation while the other set did not receive a job as part of their compensation. The provision of job is the single most important factor in deciding the net livelihood change of a family. If the changes in the distribution of different households across different classes of livelihood earnings from pre-mining to post-mining periods is looked upon it is again seen that in almost all cases the households who have received a job in the mining company are those who have experienced an increase their livelihood earnings after mining. While those who have not received a job have either remained in the same livelihood earning class or have experienced a decline in their livelihood earnings after mining.

By applying the measure of net livelihood change in capturing the changes in the standard of living of the households in the Basundhara coal mines it was found that this measure is a better indicator of the development in the region than other generally used indicators. It is because within it captures the changes in livelihood based on goods directly consumed from nature. For many households the livelihood earnings from such components of livelihood have been changed after the beginning of mining in the area. The measure of net livelihood change in the field study area thus gives a better indication of changes in the standards of living of people due to mining studied in Basundhara coal mines of Sundargarh district of Odisha.

In the fourth chapter the impact of mining on the relationship between livelihood of tribal population and natural resource base was analyzed through a process of circular and cumulative causation. If this process of circular and cumulative causation can be looked upon as a dynamic process of underdevelopment then this dissertation aims to check the applicability of this process of circular and cumulative causation in a mining region.

In the fourth chapter a theoretical analysis of the impact of mining on the relationship between tribal livelihood and natural resource base is carried out. This theoretical analysis is accomplished by using the concept of circular and cumulative causation. The two main assumptions on which the theorization is based are the assumptions of net livelihood change in the region and the absence of alternative sources of livelihood after mining. Under specific

assumptions mining disrupts the relationship of mutual interdependence between tribal livelihood and natural resource base. By doing so it initiates a process of circular and cumulative causation between livelihood and natural resource base in the downward direction.

Using the data and information gathered from the field survey the applicability and the validity of the process of circular and cumulative causation initiated by mining can be checked. In the last chapter the provision of jobs in the mining company comes out to be the most important factor determining the pattern of net livelihood change. In this respect an inter generational comparisons of net livelihood change and its implication for our theoretical analysis is carried out in those cases wherein the present generation a part of the affected and displaced population is provided with jobs in the mining company.

The process of circular and cumulative causation leading to livelihood loss and reduction in the capacity of natural resource base in the successive periods in a mining region can be explained as a dynamic and continuous process of underdevelopment initiated by mining. The successive cycles of livelihood loss and environment degradation results in a net livelihood loss in each period. The net livelihood change is taken as a proxy for measuring the level of development or underdevelopment in a region. The net livelihood loss period after period means that there is a process of continuous deterioration of the standard of living of the people in the region. Thus theoretically it can be seen that under certain assumptions a process of underdevelopment in the region gets initiated by mining and operates through a process of circular and cumulative causation.

Using the data and information collected from the field survey it was found that for the application of the process of circular and cumulative causation the assumption of net livelihood loss needs to be satisfied. For which we need a significant proportion of households with a net livelihood loss due to mining in the region. But the determination of significant proportion of households depends on various other factors which may vary across different mining regions. The proportion of households having a net livelihood should be such that it results in increased dependence on the natural resources of the region. In the field area of the study one third of the population is having a net livelihood loss. It can be taken as a significant proportion required for triggering of the process of circular and cumulative causation if the increased dependence by

them results in a reduction in the capacity of natural resources to support the livelihood of the people.

The study of the impact of mining in the field area for the purpose of checking the validity of our model gave mixed results. The loss of earlier sources of livelihood due to mining has resulted in an increased dependence on the forest resources. The capacity of the forest resources to support the livelihood of people has declined over time. This fulfils the first part of the process of circular and cumulative causation and this will tend to result in a further loss of livelihood for the local people using forest resources for their livelihood. The other part which is needed to complete the process of circular and cumulative causation is the reduction in the capacity of forest resources as a result of increased dependence on it by the local people to compensate their livelihood loss due to mining. There are indications of increased dependence in the form of cutting and selling of trees in the market by the local people along with evidence of a reduction in the capacity of forest resources. But we cannot ascertain on the basis of available data from the field that a reduction in the capacity of natural resource base in the region has happened as a result of the increased dependence of households with net livelihood loss due to mining.

5.3 Policy Implications

The conclusions derived from this research have some important policy implications regarding the resettlement and rehabilitation of the people displaced by mining projects in India.

It can be said on the basis of this study the developmental impact of mining depends to a large extent on the provision of jobs in the mining company as part of the resettlement and rehabilitation package of the population who lose their earlier sources of livelihood in mining.

The families which do not get a job experience deterioration in their standard of living while those who got a job improved in their standard of living. Almost all of the households who received only monetary compensation in the rehabilitation package provided by the MCL experienced a net livelihood loss after mining. The variations in the amount of money between different households do not seem to affect their net livelihood change. People in the field area informed that most of the amount of monetary compensation was not spent in a productive way so that it can generate alternative source of livelihood for them.

So even if a large amount of monetary compensation is paid to the displaced persons it will not have any significant impact on their level of livelihood and thus leading to a deteriorating standard of living. Therefore compare to the monetary compensation provisions, jobs in the mining company seems a better alternative in terms of providing alternative sources of livelihood to the displaced and affected population.

In India the provision of jobs as a part of the rehabilitation package is provided mostly by the public sector companies and among them the Coal India Limited holds a central place¹. Normally the monetary compensation is the preferred mode of compensation (Centre for Science and Environment, 2008). Another type of compensation can be of providing tracts of land to the local population who lose their sources of livelihood in mining. Land can provide a sustainable source of livelihood for the displaced population. But in India this type of compensation is rarely offered and whatever offered has been of inferior quality (Centre for Science and Environment, 2008).

However in the present scenario in the country it seems that the provision of jobs in the mining company is the only form of compensation through which the adverse impact of mining on the livelihood can be controlled to some extent.

In recent years the resettlement and rehabilitation policy of CIL has also undergone a change and this have serious implications for the job provision in the CIL and its subsidiaries and thus for the livelihood of displaced population in coal mining regions.

For the first Coal India limited time formulated its resettlement and rehabilitation policy in 1994. Following that it's Resettlement and Rehabilitations policy has been in operation with modifications from time to time. In recent years the Coal India Limited has changed its resettlement and rehabilitation policy. The latest Resettlement and Rehabilitation policy of CIL which was in operation was the Coal India Limited Resettlement and Rehabilitations policy 2008 and now they have proposed a Coal India Limited Resettlement and Rehabilitation policy 2012. With regard to provision of jobs to the displaced population CIL stated in their 2008 policy

¹ Coal India Limited provided 74 percentage of total employments in the mining sector in 2007 (Centre for Science and Environment, 2008).

document that the jobs will be provided to those who have lost their cultivation land. 'Subject to the suitability and availability of vacancies...'

Furthermore they have stated that 'the actual land losers will be provided employment or monetary compensation'.

These statements show that the CIL and its subsidiaries are keeping the option of not providing the employments to the displaced populations with them as an option. At any time the non-availability of vacancies can be taken up as a reason for not providing jobs to the displaced populations.

After liberalisation there has been a trend of sub-contracting of the work by the CIL and its subsidiaries to other small private firms. This was combined with the non-compulsory nature of the provision of employment to the displaced population in their Resettlement and Rehabilitation policy indicate a possible reduction in the job provision by the CIL and its subsidiaries in the recent years.

In its Resettlement and Rehabilitation policy 2008 CIL divides the total persons affected by mining into four categories. The person from whom land is acquired, persons from who homestead (home land) is acquired and project affected persons (which contain the rest of the two categories; the sharecroppers, land lessees, tenants and day laborers; and landless laborers and tribals dependent of forest products). The provision of jobs is only for the first category of people. The second category gets either monetary compensation or an alternative plot of land for house purposes with some financial assistance for relocation. The project affected persons do not have any provision either the job or of monetary compensation in the R&R policy of CIL. The project affected persons are those who were more dependent on CPR's for their livelihood. So they are the persons who are worst affected by mining.

The job in the mining company, monetary compensation and resettlement is given only to those persons who lose their agricultural lands with proper 'patta' for it. Rest of the displaced and project affected persons who lose their sources of livelihood in the mining by losing agricultural land (without 'patta') and CPR's (Common Property Resources) do not get any resettlement and rehabilitation benefits.

Thus the resettlement and rehabilitation policy should not only incorporate job provision in the mining company as the main form of compensation, it should also provide jobs to all the people who lose their sources of livelihood in mining including those who don't have 'patta' for their land and others who don't own any land but are dependent on the Common Property Resources for their livelihood.

Accepting that the jobs in the mining company as a part of the compensation offered to the affected population is a way of ensuring the development of the local population. It is important to note that it can only act as an interim measure. The destruction of the natural resource base leads to loss of livelihood for many future generations. The earlier existing sources of livelihood were sustainable sources of livelihood. Since jobs in the mining company is provided only for one generation for sustainable development of the local population in a mining region other sources of livelihood are needed which can provide livelihood for upcoming generations without deterioration in their standard of living.

5.4 Limitations of the Study and Scope for further Research

One of the main limitations of this study is the limitations of the methodology used for the calculation of net livelihood change. The nature and availability of data regarding the consumption of goods directly obtained from nature limits the calculation of net livelihood change. Due to the lack of account or data on the quantity of goods consumed directly from nature before mining, it becomes difficult to calculate livelihood change on such components of livelihood. Especially in the case of such goods which were earlier directly consumed by a households and now are no longer available from nature. The loss of livelihood on such accounts is calculated by using the current expenditure on their substitutes which is bound to have some amount of error involved in it.

In the calculation of net livelihood change there are certain heads of livelihood on which the change from pre-mining to post mining periods was included in the calculation. It was so in the case of two types of goods. Firstly those which were directly consumed from nature by a family before mining but after mining because of its unavailability from nature the family has stopped its consumption. They are also not consuming it by purchasing it or its substitutes from the market. Secondly there are certain goods due to their unavailability from mature after mining

most of the households are now not using. They are also not purchasing it or its substitutes from market. In both of these cases it is not possible to include the loss of livelihood on these heads into the calculation of net livelihood change unless some other information becomes available from various other sources.

The data collected for the calculation of net livelihood change is based on the memory and recollections of the people and there is an amount of error involved in it.

But given the difficulties and circumstances, with no other alternative ways, the methodology used here is the best way to assess the impact of mining on the livelihood of local people.

There needs to be more empirical studies relating to the calculation of net livelihood change due to mining in other regions of the country wherein mining has affected the livelihood of local population through its impact on the natural resources of the region. This study is a micro-level study based on a field survey of Basundhara coal mines in Odisha. The need of an additional empirical study of mining regions is also required for checking the applicability of this measure of net livelihood change in terms of capturing the developmental impact of mining in other mining areas.

The measure of net livelihood change and its calculation can be improved by using control villages² in the region and estimating the pre-mining values of certain goods in the mining region which are now no longer available, by taking the comparable values of such goods in the control villages as proxy measures. This will in some way help to overcome the limitations of the measure of net livelihood change which are faced in this study.

Furthermore the theoretical analysis of the process of underdevelopment in a mining region as a process of circular and cumulative causation between tribal livelihood and environment degradation needs to be looked upon with respect to the other mining regions in the country in order to check its applicability and validly. May be application of it in a region where the compensation to the displaced and affected population is provided mainly in the form of monetary compensation will give deeper insight into the process of underdevelopment in a mining region.

² Villages situated in the nearby regions where mining has not affected the livelihood of local population and which has similar livelihood pattern and characteristics as the mining affected villages.

Appendix 2.1 Social and Economic Indicators of top 50 Mining Districts in India, 2011

State	District	Value of minerals	Poverty rate	ST+SC Population	Area under forest(as % of total area)	Area under mine leases
Chhattisgarh	Korba	9121	38.32	51.5	50.8	10321
Odisha	Kendujhar	7370	57.41	56.1	38.9	3860
West Bengal	Bardawan	4184	23.74		3.7	8510
Chhattisgarh	Dantewada	3961	98.4	81.9	64.4	15075
Karnataka	Bellary	3957	83.2	36.4	9.1	11980
Jharkhand	Dhanbad	3760	35.45	24.4	6.8	16595
Madhya Pradesh	Sidhi	3392	79.79	41.7	39	9563
Goa	North goa	3091	27.02	2.3	49.8	9843
Odisha	Anugul *	3049	77.6	28.9	41.9	13907
Goa	South goa	2790	21.5	1.2	65.4	21614
Odisha	Sundargarh	2705	88	58.8	41.8	991
Uttar Pradesh	Sonbhadra	2507	55.43	42	37.4	12313
Tamil Nadu	Cuddaore	2485	51.07	28.3	12	8001
Maharashtra	Chandrapur	2382	47.85	32.5	35.6	10986
Andhra Pradesh	Karimnagar	2213	29.57	21.2	14.2	10387
Jharkhand	Hazaribag	1895	34	26.8	34.2	67218
Madhya Pradesh	Chindwara	1776	60.51	46.3	38.4	5359
Madhya Pradesh	Shahdol	1729	91.13	51.8	27.4	3291
Andhra Pradesh	Khammam	1702	46.76	43	44.4	9011
Maharashtra	Yeotmal	1390	62.87	29.5	19.2	6325
Odisha	Jharsuguda *	1324	87.16	48.4	14.4	6198
Maharashtra	Nagpur	1318	74.26	28	20.5	4295
Jharkhand	Pashchimi Singhbhum	1195	63.17	58.2	38.7	6491
Rajasthan	Bhilwara	1151	30.01	24.7	2.1	11489
Odisha	Jajapur *	1149	24.94	30.8	8.8	1100

Jharkhand	Chatra	1083	89.65	35.8	47.8	14604
Chhattisgarh	Surguja	1081	68.74	59.4	45.6	518
Jharkhand	Godda	1041	50.91	32.2	18.9	28724
Andhra Pradesh	Adilabad	997	55.76	35.3	37.7	6690
Andhra Pradesh	Anantpur	975	60.72	17.6	2.2	4361
Jharkhand	Bokaro	953	64.95	25.6	29	4195
Chhattisgarh	Koriya	778	79.62	52.6	62.3	3909
Karnataka	Chitradurga	741	68.8	39.7	5	4744
Madhya Pradesh	Balaghat	600	82.09	29.5	54.1	2282
Jharkhand	Ranchi	541	39.84	47	24.7	13700
Rajasthan	Udaipur	513	54.13	53.9	23.2	11917
Chhattisgarh	Raigarh	494	43.27	49.6	36.2	6362
Rajasthan	Chittorgarh	491	35.96	35.4	15.6	5848
Gujarat	Kutch	458	63.56	20	5.1	8539
Madhya Pradesh	Betul	395	80.95	50	35.6	1203
Chhattisgarh	Durg	366	66.06	25.2	9	7032
Karnataka	Raichur	330	74.83	37.2	0.4	994
Andhra Pradesh	Cuddapah	329	32.25	18.1	22.2	5981
Maharashtra	Bhandara	318	74.85	26.4	24.8	850
Madhya Pradesh	Umaria	294	92.7	50.9	49.9	464
Jharkhand	Palamu	250	73.53	44.4	40.7	6565
Jharkhand	Deoghar	202	65.9	24.8	6.8	74279
Chhattisgarh	Koraput	191	94.1	62.7	19.1	28798
Gujarat	Surat	187	56.03	31.6	17.1	1511
Rajasthan	Sirohi	171	51.38	43.9	17.9	1826
Rajasthan	Pali	170	48.97	23.6	5.3	3458

Appendix 3.1

Questionnaire Used in the Field Survey

1. Personal Information:

Name	Age	Sex (M/F)	Marital status	Number of Family members		Category (SC/ST?OBC?GEN	Main occupation	Job in MIL*
				Earning	Non- earning			

*Mahanadi Coalfield Limited.

2. Assets/Natural resources.

	Before the start of Mining in the Area.	After Mining
Land Owned		
Livestock		
Forest Area		
Water Sources		

3. Agriculture

3.1 Agriculture before the commencement of mining.

Irrigated/non irrigated	One crop/two crops/Veg.	Total annual produce	For self consumption	For sale	Agri. Labour (Income)	Lease Land	Production/ Consumption From Lease land	Vegetable produce in the backyard, If any

Availability Of lease land: for how many Months?

3.2 After Mining:

Irrigated/non irrigated	One crop/two crops/Veg.	Total annual produce	For self consumption	For sale	Agri. Labour (Income)	Lease Land	Production/ Consumption From Lease land	Vegetable produce in the backyard, If any

Availability Of lease land: for how many Months?

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3.2 Agricultural Labour.

Before the start of Mining.				After Mining			
No. of Employment Days	No. of Members Employed	Distance	Rate of Payment	No. of Employment Days	No. of Members Employed	Distance	Rate of Payment

4. Compensation received.

- A. Total land taken by the company- _____
- B. The Year of Acquisition(s)- _____
- C. Total Compensation received (For Agricultural Land)- _____
- D. Total Compensation received (For House Land) - _____

5. Forest Produce –

Product	Before Mining				After Mining			
	Amount	For consumption	For Sale	Price	Amount	For Consumption	For sale	Price
Mahul								
Tol								
Kendu Leaves								
Kendu Fruit								
Char								
Lasa								
Sargi Oil								
Neem Oil								
Karanj Oil								
Grass								

5.1 What were the uses of the wood gathered from the forest? What are the alternatives for that now?

5.2 What is the total annual expenditure on the alternative of wood/alternative arrangement of wood? (Monthly/Annual)

6. Livestock

Before Mining					After Mining				
Animal	Numbers	Products	Quantity of products		Animal	Numbers	Products	Quantity of products	
			Self	Sale				Self	Sale
Cow									
Goat									
Hen									

7. Fish/river products

Before Mining					After mining			
Species	Quantity (self)	Quantity (sale)	Rate of sale	Total Earnings	Quantity (Self)	Quantity (sale)	Expenditure In buying from Market	Total Loss

8. Present Livelihood Sources.

8.1 What are the sources of Income now?

- a. Job (In MCL)
- b. Job (In other Company of the Region)
- c. Daily Wage Labourer
- d. Self Employed
- e. Agriculture
- f. Other

8.2 What is the monthly income, if employed in MCL? _____

8.3 Where do you travel for work?

8.4 What is the daily/monthly income?

8.5 How many people of the family are employed?

8.6 What is the income from the business, if Self Employed?

9. Market and expenditure.

What products are bought from the market now (Post Mining Period) which earlier were available locally and didn't have to be bought?

Expenditure (Monthly)

Product	Quantity	Price	Total expenditure

10. Social/health related information.

10.1 How has mining affected general health of people?

10.2 Has the expenditure on health increased due to adverse effects of mining?

10.3 Has there been difference in the health expenditure before the start of mining and now? How much is the difference?

10.4 How have the education facilities changed after the start of mining? Has the cost of education increased? If yes then how much?

10.5 If you have a job in (MCL/Other), What is the nature of the job? (Permanent/Contract).

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