# Extraction of Mineral Resources and Its Impact on Local Livelihood: A Case Study of Odisha

## ABSTRACT OF THESIS

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# ABSTRACT

## 1.1. The Context

Mineral resources are crucial for the today's modern society and it has significantly contributed for generating wealth and, being a part of major economic activity (Candeias et al 2017:1). These mineral resources which has positive and long-term positive relationship with economic growth because it provides raw material to our mineral based industry, and earn foreign currency through mineral exports (Sahoo et al 2014:27). On the economic perspective, development of mining sector has generated mineral revenue which can be used for physical and human capital expenditure (Tarun et al, 2020). On the social perspective, exploration of mineral through mining activity has generated employment, increased per capita consumption expenditure (Kutila AGN 2006). These developments are from the beginning of human existence and there is increase in demand for the ore consistently. This activity plays very crucial role for the survival of human and their development. On the other side, the over dependence of mining sector leads to neglecting the other sectors which also has significant contribution of economic growth. Because mining sectors has operated in fewer places and the employment generation is lower as compare to other sectors (David et al 2016:104). Mining projects are associated with environmental degradation and new mining projects have serious social disturbances. According to US Environmental Protection Agency (US EPA, 1982) "Mines or mining as area of land upon, or under, which minerals or metal ores are extracted from natural deposits in the earth by any methods, including the total area upon which such activities occur or disturb the natural land surface." It has broken the forest-

based livelihood, broken social orders, and decrease farming activity and shift farm based livelihood to non-farm based livelihood (Lahiri and Dutta 2007:60). Degradation or depletion of natural resources has been directly and indirectly affected our livelihood, health and quality of life. Extraction of natural resources (iron, coal, fuel, other metallic minerals) by mining activity pose a serious problem to the native people of that region (Rawashdeh et al 2015:1).

## 1.2. Review of Literature

Mining has played a significant role in the growth and development of the developing and developed counties. A study on South African Economy by Awolusi (2016:10) using GMM and OLS model of 14 countries of South African Development Communities (SADC) from year 1990 to 2014 observed that variables such as real mining growth, infrastructure development, growth of agriculture, human capital development and FDI has determined the economic growth of South African economy.

A study on 91 countries of high, low and middle resource countries by Atkinson and Hamilton (2003:1793-1807) and found that there were negative and significant relationship between natural resources abundance and economic growth because government was unable to manage large number of resources sustainably. Similarly, a study by Hlavova (2015:100-110) has taken 48 economies of Sub-Saharan Africa during 1995 to 2013 and examined the relationship between share of mineral export to total export and economic growth. The study had used World Bank database and used correlation and regression for the analysis. Finally, the study had

revealed that mineral resources in total export had partial effect on the economic growth of the countries.

A study based on Odisha (Hota and Behera 2019:267-278) entitled "Extraction of Mineral Resources and Regional Development Outcomes: Empirical Evidence from Odisha "examined the impact of natural resources dependency on economic development and growth. The study has revealed that there was inverse relationship between abundant of mineral resources and economic development in the districts of Odisha. However, in mining district some factors such as per capita income, alleviation poverty, per capita consumption and infant mortality rate has performed better than non-mining counter parts. Similarly, the study has identified that mining regions' performance was not good enough for communication facilities and nutritional facility as compared to non-mining districts of Odisha.

A study by Ware and Kutor (2015:3037-3045) examined the operation of mining ac The study revealed that food production had been decreased after mining activities and farmers had shifted their cultivation activities to mining activities in the Asutif district of Ghana.

Similarly, study on Keonjhar district of Odisha by Sahoo (2020:196-204) assessed the food security of mining and non-mining region by using food utilisation and accessibility dimension. the study has found that mining region has less intake of calorie from food as compared to that of non-mining region households, despite mining region has high food expenditure.

Neuberger et al (1990: 261-272) analyzed the effect of heavy metal mines on health problem in the Galena Region of Kansas. The multivariate techniques and

logistic regression model were used to measure the association between 16 independent variables and selected illness. Lastly, the study has found that there are association between environmental exposer through mines and illness, and mortality due to chronic diseases in Galena.

A study by Yadav et al (2019:24-41) analyzed the utilization of different capital assets in mining and non-mining region of Baghamara block of Dhanbad district of Jharkhand, India. The study had used five capital assets such as Financial, Social, Human, Physical, Natural capital assets for analysis. mining villages had more significant and positive association with utilization of livelihood capitals. From the bivariate logistic model, it was found that increase in household head Education and regular salaried household in mining affected village had utilize more livelihood capital than counterpart.

## 1.3. Research Gap

After review of literature, the chapter intents to capture the gaps or areas where substantial number of studies is not conducted. We found that there are lack of studies or studies did not capture substantially the issues related food security, health status and livelihood status in the mining areas. Similarly, most of studies have used mineral FDI and export on economic growth based on perspective of national and international level. However, none of the study discussed the link of mineral revenue on economic growth based on the regional level experience as mineral revenue is considered as an important channel of creating the financial assets for the countries and the local level government. So, the present study has given the utmost care to tackle these kind of weakness or gaps in the existing literature on mining sector.

## 1.4. Objectives of the Study

1. To find out the impact of mining sector on economic growth in the State of Odisha.
2. To assess the food security status of mining and non-mining households of Keonjhar district of Odisha.
3. To find out the catastrophic health expenditure and impoverishment effect on households in the mining and non-mining region of Keonjhar district of Odisha.
4. To find out the livelihood status of mining and non-mining households of Keonjhar district of Odisha.

## 1.5. Hypothesis of the Study

1. Mining sector is positively associated with the economic growth of Odisha.
2. Food security of non-mining households is better than mining households of the surveyed areas.
3. There is low catastrophic and impoverishment effect in non-mining households compared to mining households.
4. Finally, non-mining households have better livelihood status than that of mining households.

## 1.6. Methodology

### 1.6.1. Study Area

Indian states are diversified in term of demographic, geographic, climatic, economic and social aspects. They are contributing precious natural resources, especially

mineral resources, which has been playing pivotal role for our country's economic growth. According to report of Ministry of Mines, 2019, among these States & Union territories, there are few States such as Odisha, Rajasthan, Karnataka, Andra Pradesh, Chhatisgarh, Telengana, Gujurat have contributed larger portion of value of mineral production in all India level.

Ministry of Mines, Government of Odisha, 2019 reported that among leading mineral rich states, Odisha has contributed 25% of total value of mineral production in 2019-20, which is highest among all the states. Therefore, Odisha is being chosen as a state under this study. So far as Odisha is concerned, it is situated in the eastern part of India and divided into 30 districts. Among these districts, 24 are mining districts. According to Department of Steel & Mines, Government of Odisha, Keonjhar district has been well known for richness of its Iron ore, Manganese, Chromium, Pyrophilite and Lime Stone (District Handbook, 2019). According to the Report of Directorate of Economics and Statistics (2020), Keonjhar districts has contributed 76% of gross value added (GVA) in iron ore to mining sector and 35% of GVA in total mining sector among all the leading six-mineral rich districts in Odisha.

Further, Keonjhar district has contributed maximum area on mining across the state. As per Figure 1.3, it has contributed 31.33% of total mining area. According to Census 2011, 86% of total population live in rural area, 69% population live below poverty line (District Administration Site of Keonjhar district), and around 80% of workforce earn their livelihood through a traditional agriculture & vegetable cultivation. The district has famous destiny for tourists due to its widespread natural vegetation and biodiversity diversification. Administratively, the district is sub-divided in to 13 blocks (BLs), 297 Gram Panchayats (GPs) & 2132 Villages. Among

13 BL, there are 7 mining affected BL such as Joda, Keonjhar, Bansapal, Champua, Harichandan pur, Hatadhi, Jhumpura, and 6 non-mining BLs such a Ghatgaon, Telkoi, Anandapur, Ghasipura, Saharapada, and Patna. As per District Administration site Keonjhar, there are 491 mining affected villages. The present study has basically focus on open cast iron ore mining in Keonjhar districts, because, open cast mining has more harmful effect to the villagers than underground mining.

### 1.6.2. Types of Data Sources, Period and Variables

The present study has used both secondary and primary data to measure the above-mentioned objectives. The secondary level variables such as Mining Revenue, Non-Mining revenue, Net State Domestic Product, Social Sector Expenditure and Net Fixed Capita Formation collected from Odisha Economic Survey Reports for various years, Statistical Hand Book of RBI and National Account Statistics Data Base. All these secondary level data collected during the period of 1991 to 2020.

Lastly, a primary study was carried out in mining and non-mining regions of Keonjhar district by using the household level survey method through a predesigned questionnaire. These primary data were basically collected concerning to the households based on their socio-economic status, food availability and security, consumption expenditure and health expenditure, different livelihood assets. These primary data were collected during July to September, 2022.

### 1.6.3. Sample Design & Size

In order to design representative sample for the study, a multistage sampling method is used for selecting area and households for data collection. In first stage, Keonjhar district is selected due to maximum mining area among all mining districts in Odisha. In second stage, two mining blocks, viz., Joda and Banspal, were randomly selected

out of seven mining blocks. Further, one non-mining block, viz., Ghatgaon is randomly selected out of 6 non-mining blocks. In third stage, two villages from each of the mining block are selected on the basis of purposive sampling method i.e., proximity of village from iron mines based on pilot survey. Further, two villages were selected from the non-mining block, i.e., Ghatgaon based on simple random sampling method (Lottery method). In last stage, random sampling method is adopted to capture sample household from each village.

As per 2011 Census, there were 18,01,733 population & 4,03,869 households (HHs) in Keonjhar district. Out of total households, Joda, Banspal & Ghatgaon block had 21503, 28365 and 26882 households, respectively and the sub total in three blocks is 76,741 households. Based on Yamane (1967) formula (Singh & Masuku 2014:14), the number of sample households in each block is estimated as follows.

$$n = N/(1+N(e^2)$$

Where, e is the margin of error, N is population size and n is sample households.

Table 1.1: Estimation of Sample Size in the Study Area

| | **Population Size (in thousand HHs)** | **Error Margin** | **Sample Size** |
|---|---|---|---|
| Yamane's Method (95% Confidence) | 76,741 | 5% | 400 |
| | 76.741 | 6% | 277 |
| | 76,741 | 7% | 204 |

Source: Self Estimation based on Yamane (1967) Formula adopted from Singh & Masuku 2014:14.

Considering the estimation in Table1.1, the present study has taken 280 sample households from the three blocks as per convenience. In this study, two village are selected purposively from each block. The number of sample households in each Block is determined in proportion to total households of respective block (Table 1.2).

Similarly, number of sample households is collected from each village in proportion to the respective total households in each village (Table1.2).

Table 1.2: Sample Distribution of Study Area

| **Sample Block Selected** | **Households** | **Number of Sample Households Selected from Sample Block** | **Sample Village Selected from each Block** | **Total Households in a Village** | **Number of Sample Households Selected from Sample Village** |
|---|---|---|---|---|---|
| Joda (Mining) | 28,356 | **103** | Uchabali | 255 | 45 |
| | | | Jadibahal | 336 | 58 |
| | | | Total | 591 | **103** |
| Bansapal (Mining) | 21,503 | **79** | Suakathi | 701 | 54 |
| | | | Danla | 305 | 25 |
| | | | Total | 1006 | **79** |
| Ghatgaon (Non-mining) | 26,882 | **98** | Mukundpur Patna | 382 | 55 |
| | | | Sonatangri | 302 | 43 |
| | | | Total | 684 | **98** |
| Total | 76741 | **280** | Total | 2314 | **280** |

Source: Estimate from Field Survey Data, 2022.

### 1.6.4. Estimation Techniques

Both secondary and primary level data are processed through STATA 13 version. At the preliminary stage, descriptive statistical techniques such as mean, standard deviation, maximum and minimum, frequency distribution are estimated and shown in tables, graphs and charts in each empirical chapter based on the necessity. In the secondary level, the study has applied ECM based ARDL model to measures the long

and short-term effect of mining sector on economic growth in Odisha in chapter 3. The indicator-based index method has been used for the analysis of food security in chapter 4. Further, study has incorporated Xu (2005) methodology to measure the catastrophic health expenditure and impoverishment effect due to OOP health expenditure in chapter 5. The study also has used GSDP deflator techniques to measured poverty rate by taking Rangarajan committee poverty rate as a base, and used logistic regression model. Lastly, the study has used principal component based weighted indexing approach to measure the sustainable livelihood of households living in both mining and non-mining households. The details of each technique is analysed in their respective chapter.

## 1.7. Organization of the Study

The thesis is consists of seven chapters, which are follows.

The first chapter entitled "**Introduction"** captured the theoretical linkages of mining sector with economic development, positive and negative impact of mining sector on economic growth, significance of this study, objectives, hypothesis, and methodology.

The second chapter deals with a detailed "**Review of Literature**" covering international, national and regional level of exposure on various aspects such as mining and economic growth, food security, health status and livelihood status.

The third chapter entitled "**Mining Sector and Economic Growth: A Study of Odisha State**". This chapter has visualised the short term and long-term impact of mining sector on economic growth of Odisha by using the ECM version of ARDL model.

The fourth chapter entitled "**Mining and Food Security: Evidences from Households of Keonjhar District in Odisha".** This chapter attempts to reveal the food security status by measuring food security index of mining and non-mining households based on primary data. It further presents how socio economic factors have affected the food security of the region.

The fifth chapter entitled "**Catastrophic and Impoverishment Health Effect of Mining and Non-Mining Households: A Study of Keonjhar District in Odisha"**. This chapter has traced out different OOP based health costs involved by the mining and non-mining households. Based on the health cost this chapter has measured the catastrophic and impoverishment effect on households.

The chapter six entitled **"Sustainable Rural Livelihoods: A Study of Mining and Non-Mining Households in Keonjhar District of Odisha.**" It presents the livelihood status of mining and non-mining households by using various assets and estimated sustainable livelihood index by using the survey data.

Finally, the chapter seven entitled **"Major Findings and Conclusions.**" It includes chapter wise summary of findings, conclusions, major suggestions, and limitations.

## 1.8. Summary and Major Findings of the Study

The first chapter titled **"Introduction"** provided theoretical background and significance of the present study. In addition, it explored the linkages between mining sector and economic growth. Further, it explored the underpinnings of development theories related to natural resources and economic growth. Similarly, as usual

practice, the first chapter developed objectives, hypothesis, and a brief sketch of methodology of the study.

Chapter 2 entitled "**Review of Literature"** explored the previous studies covering international, national as well as on the context of Odisha. Based on previous literature, the present study has observed the following findings. Firstly, the study found that the revenue generated from oil sector is the main source for growth and it is the leading channel to financing government expenditure. Similarly, mineral export has positively impacted the economic growth and industrial production of nations**.** Secondly, however, revenue generated through mineral resources export to the total revenue generated through total export has meagre impact on the economic growth of a nation. A study by Pachauri (2004:703-713) found that the resource rich states such as Odisha, Chhattisgarh are preforming worse both in per-capita income, growth of state domestic product as compared to the state like Kerela, Tamil Nadu, Maharashtra, which are resources poor states. Due to weak monitoring by institutions and policy implementations, resource curse prevailed in Indian states. Further, the performance of mining districts in Odisha is not good enough for communication facility and eradicating malnutrition as compared to those of non-mining districts. Thirdly, a study has revealed that food production has decreased after mining activity as farmers have shifted their cultivation activity to mining activity in Asutif district (Ware and Kutor:2015 3037-3045). Similarly, mining activity has negatively associated with food security in Keonjhar district of Odisha (Sahoo 2020:196-204). Likewise, findings of numerous studies suggest that factors such as farm size, farm income and non-farm income, size of household, rainfall, temperature, literacy rate, government programmes have significantly affected the food security of the

households (Jatav et al 2022:1-17; Omotesho et al. 2006: 7-15). Fourthly, there are direct and significant association between environmental exposer through mining activities, and illness and mortality due to existence of chronic diseases (Neubrger et al 1990: 261-272). As a result, mining region households have incurred more health cost than that of non-mining households. Fifthly, mining households have better performance in financial and physical capital assets as compared with non-mining region, whereas mining region has negative association with social, human, and natural capital assets (Mishra 2015: 83-88). On the other hand, mining region households has better utilizations of capital assets than those of non-mining region (Yadav et al 2019: 24-41).

The third chapter, "**Mining Sector and Economic Growth: A Study of Odisha State**" presents the linkages of mining sector and economic growth of Odisha. For the analysis, five variables are used to understand the impact of mining sector on economic growth of Odisha. Where, economic growth is taken as dependent variable and other four variables such as mineral revenue, non-mineral revenue, government spending and domestic spending are considered as independent variables. All these variables are collected from secondary sources, viz., RBI data set, Economic Survey Report of Odisha and National Account Statistics. In preliminary level, the study has used descriptive statistics such as estimation of frequency (%) and mean, the extent and dimensions of mineral extractions and these are portrayed in diagrams, tables, and trend line of international, national, and regional level data (Odisha). Further, this chapter has also used error correction mechanism (ECM) version of the autoregressive and distributed lag (ARDL) model to determine the long run and short run effect of independent variables on economic growth. The study has used 30 years

data from 1991 to 2020 to analysis relationship between mining sector and economic growth. Based on the estimation, following results are observed from the chapter 3. Firstly, from year 1985 to 2018, Asia has been produced more mineral output than other sub-continents & contributed almost 50% of mineral resources production among the six continents. Extraction of mineral resources have been increasing over the years to meet the growing demand of large of population. Further, the share of developing countries is 57% followed by developed, transition and least developing countries of 30%, 12% and 1%, respectively. Hence, it is confirmed that developing countries are producing more mineral than that of developed countries. Secondly, the extraction of mineral resources in India has increased over the years, from 2013 to 2017. The growth rate of mineral extraction in India was 17.34%. In all India level, states having larger proportion of contribution to the national mining and quarrying sector are Rajasthan (15%), Gujarat (10.67%) and Odisha (10.31%). However, Odisha has contributed 25% of total value of mineral production, which is highest among all the states following Odisha, Rajasthan contributes (17%), Karnataka (9%), AP (8%), Chhattisgarh (8%), Telangana (7%), Gujarat (5%), UP (5%), MH (4%), Bihar (3%) in year 2019. Thirdly, the extraction of mineral resources in Odisha in year 1994-95 was 50 crores metric ton, and it has increased to reach 350 crores metric ton in year 2019-20. Similarly, the contribution of mineral revenue to state own sources revenue has increased over the years. In year 1991, State's own sources revenue was Rs. 930 crores (7. 74% share) out of which mineral revenue contributed Rs 72 crores (7.74%). But, in the year 2020, mining revenue has contributed Rs. 13918 crores (31%) to the state's own sources revenue, whereas state own sources revenue has increased to Rs. 44595 crores. Thirdly, the present chapter has conducted various diagnostic test such as CUSUM, CUSUM SQURE, JB, BG-LM and BPG test. All test has confirmed that

model is fit for analysis and satisfied the OLS properties of BLUE. Fourthly, the effect of mineral revenue in long run is negatively associated with economic growth, whereas, variables such as Domestic Investment, Non-Mineral Revenue has positively associated with economic growth in long run in Odisha. Nonetheless, in short run mineral revenue and domestic investment has promoted economic growth of Odisha, as it is positively link with the economic growth. Finally, in Odisha any short run disequilibrium takes 4 years to converge into long run path.

The chapter 4 entitled "**Mining and Food Security: Evidences from Households of Keonjhar District in Odisha"** attempted to measure the status of food security in mining and non-mining regions of Keonjhar district. The present chapter has used field survey data of four mining and two non-mining villages of Keonjhar district. Some socio-economic factors are captured in both mining and non-mining region for the present chapter. Total 280 households are surveyed for analysis of the results. The present chapter has used indicator based indexing method to measured food security index (FSI). The FSI has been constructed by using four dimensions (sub-components) of food security such as food availability, food utilisation, food accessibility and food stability. These four-dimensional Index is constructed by using 25 different indicators. Finally, the study has used logistic regression model to determine the factors which has affected the food security. On the basis of results of index and logistic regression, the following observation are derived. Firstly, the study found that the mean income of non-mining area is marginally higher than that of mining region. Following the same, the mean household's consumption expenditure of mining region is less than the non-mining region, as mean consumption expenditure of mining and non-mining region is Rs 44138 and Rs 48365

respectively. The mean land size of mining household is higher than that of the non-mining household whereas the mean land size of mining household is 1.138 acres while non-mining household is 1.071 acres. Secondly, the share of working population in mining and non-mining region to total population is 39.56% and 37.92%, respectively. The working population is maximum in study region as followed by student, housewife, non-school age children and unemployed person. Most of the people in study area are working as a daily wage and temporary worker. Thirdly, the present chapter has identified that low level of food security both in mining and non-mining region, where as mining region's food security is worse than that of the non-mining region. Because mining area's local people are basically engaged in mining related activities, the nature of job is mostly on daily wage and temporary basis. As a result, it is not sufficient for people to maintain their family consumption requirements. Fourthly, mining region has performed marginally better in terms of food availability index among the indices of four sub-categories as compared to that of non-mining region. Lastly, the study highlighted that socio-economic factors of households are positively linked with household's food security. As households living in mining area has low consumption expenditure, lack of regular income sources, low level of education leads to low food security as compared to those of non-mining households which is reflected in the logistic regression model. The study has also identified that higher household size leads to higher food security.

The fifth chapter, "**Catastrophic and Impoverishment Health Effect of Mining and Non-Mining Region: A Study of Keonjhar District in Odisha"** seeks to find out the catastrophic health expenditure and impoverishment effect of households in the mining and non-mining region of Keonjhar district of Odisha. The

present chapter has captured acute and chronic diseases and cost of illness due to OOP health expenditure in both mining and non-mining households of surveyed region. The Catastrophic Health Expenditure (CHE) is that if a household's total Out-of-Pocket (OOP) health expenditure is equal or exceed 40% of household's capacity to pay (CTP) (Xu 2005: 5; Xu et al 2007: 974; Rashid et al 2015: 528; Bindra et al 2015: 489). The present study has used the approach of Xu (2005) to measure the CHE of mining and non-mining region. Similarly, a household become impoverished when it falls into the poverty after the payment of OOP health related services (Xu 2005: 6). The chapter-5 has used Xu's (2005) methodology to estimate the impoverishment effect of households. In this chapter, the poverty line has been constructed by multiplying GSDP deflator. Further, the present chapter has used logistic regression model to find out the factors determined the low level of CHE. Based on the results of the estimation, the following observations are drawn from this chapter. Firstly, 87 percentage of households are fallen into the chronic illness, while 59 percentage of households are fallen in acute illness in mining villages. Similarly, in non-mining villages 80 & 52 percentage of households have suffered from acute and chronic illness. Further, the vulnerability of people in terms of health cost is highest in households those living in mining region compared to that of non-mining households. It is due to the fact that village or households living in nearby mining area has more connections with mining dusts. Secondly, fever, eye & skin illness, gastrointestinal and cardiovascular, asthma were the major illness among the people living in mining area, where as in non-mining region, fever, cardiovascular and gastrointestinal were the major diseases. Thirdly, it is observed that CHE is higher in the mining area as compared to that of the non-mining area. Because, there are variety of illness in mining area due to massive air and water pollution. Further, the proportion of

medicine expenses to the OOP health cost is higher in the mining region as compared with that of non-mining region households. Fourthly, this chapter has highlighted that impoverishment effect of OOP expenditure in both mining and non-mining areas. The impact of impoverishment has slightly higher in mining households than that of non-mining households. Because, the mean of OOP health expenditure is higher among the households lived in mining areas. Fifthly, the socio-economic variables such as family size, consumption expenditure, employment status of households' head, number of sick members in household are the determining factors for the OOP, CHE and impoverishment in a household. The household belongs to rich categories consumption quintile has less chance to fall in CHE.

The Chapter 6 entitled **"Sustainable Rural Livelihoods: A Study of Mining and Non-Mining Households in Keonjhar District of Odisha**" attempted to construct a Sustainable Livelihood Index (SLI) combining both mining and non-mining households of study region and then comparative analysis was done on the status of livelihood in these two regions. The SLI is constructed by taking the average of five livelihood capital indices such as physical capital, natural capital, financial capital, social capital, and human capital index. Principal Component Analysis (PCA) is used to construct the index which is based on the weighted average index. The study has used field survey data and different variables were collected based on respective capital index as per literature review. Based on above, the present chapter has derived the following results. Firstly, most of workforce are working as semi-skilled or unskilled wage labourer in the mining region, works in mining related activity, daily wagers agricultural labourer and skilled wage labourers. Similarly, the main sources of livelihood are cultivation and agricultural labourer, skilled and semi-

skilled labours in case of non-mining area. Further, in mining area, 7.54% of households engaged in agricultural activity, whereas in non-mining area, 17.93 % of households has main occupation in agricultural cultivation and 22.61% people said that mining has major sources of livelihood. Secondly, the SLI reveals that both mining and non- mining region has low level of sustainable livelihood. Whereas, mining region livelihood assets is worse than that of non-mining region, which is 0.191 and 0.261, respectively. Thirdly, the chapter identified that mining region has better performance in FCI, but non-mining region has performed better in all other four capital indices. Because, people have managed to earn regular income from mining and non-mining related activities in the mining area. In addition, the wages of causal mining workers is higher compared to others activities in rural area. In mining area, people have adopted alternative farming activities and other business, those helped them to earn additional income sources to meet their household livelihood. Fourthly, there are declining of social cohesion, increase of alcoholism and thriving, fragmentation of family structure, which eventually leads to major social problem in the mining households. Fifthly, ecosystem in mining area has been adversely affected due to mining activities and fertility of soil is degraded over the years as dust of mining mixed with air and damped in the nearby agricultural field. It leads to people who had been depending on agriculture and allied activities are facing a deteriorated livelihood status.

## 1.9. Policy Recommendations

The outcome of the study suggests the following important policy recommendations.

Firstly, as mineral is an exhaustible natural resource and, its price depends on demand and supply in international and national market. It leads to decrease of

revenue generated from the sector in long run and over dependency on the sector causes harmful effect of local economy. Therefore, the present study suggests that the revenue generated from mining sector should be invested in generating capital assets such as building market complex in rural area, build road and super specialist hospitals, build quality educational institutions and renovate the existing sanitation and water facilities in the locality instead of other unnecessary public expenditure.

Secondly, State Government should take a step to set-up own mineral based industries and use maximum raw minerals domestically, and produce semi-finished and finished goods and sell it to national and international market.

in mining region government should order the mining company to provide food grains to local people of mining region with subsidised rate two times in a day as per their CSR activity. Mining company should provide top priory to the employee's native people in mining area, so that regular income earned from mining and spent on consumption for goods.

Thirdly, Government should organise weekly medical camp in the mining regions, so that people can easily access the medical facility at free of cost. Special health card should be issued to the resident of mining households and government should provide special treatment facility in the private and government hospital free of cost for any type of diseases for this health card.

Lastly, to improve natural capital assets, government should declare no mining zone to some part of nearby mining area and promote afforestation activity in ordered to compensate forest land which is diverted to the mining activity. Government and mining company should set up cold storage facility among each block of mining and

non-mining area to preserve the food and other perishable goods, basically focused on small and marginal farmers.

## 1.10. Limitations of the Study

There are few limitations of the present study.

Firstly, the study has only used the mineral revenue for the study of mining sector and economic growth. Secondly, the study has used only 30 years of data on macro-economic variables for the analysis due to lack of mining sector data. Thirdly, the study has not incorporated the BMI, stunting, wasted, calories intake, poverty and unemployment rate for the estimation of food security index. Fourthly, the present study has not used indirect cost such as loss of work and health spending on acute diseases for estimation of catastrophic and impoverishment in the mining and non-mining region. Lastly, the study is based on the case study of Odisha state only, so the scope of the study is limited. Similarly, the policy suggestions is only applicable to the Odisha state.

## 1.11. Further Scope of the Study

There are lot of scope for the future research. There are few studies which are involved with regional level issues to link the mining sector's impact on per-capita income of the state and district level analysis. The research can include the various dimensions of mining sectors such as FDI to the mining sector, export to mining sector and mineral production to link with national, regional level economic growth and development. There are significant scope to analysis the impact of District Mineral Fund (DMF) on the upliftment of live and livelihood of rural people in the

mining area compared to that of non-mining area. As DMF has created in year 2015 to implement the scheme Pradhan Mantri Khanji Kshetra Kalyan Yojana (PMKKKY), where mining is carried out. Every mining district in the India has created DMF under the MMDR Act, 1957. The main propose of this fund is to implement welfare and development programme in mining affected area, to mitigate the unfavourable situation in mining area on socio-economic, health and environment in mining district, and use these funds to ensure long term sustainable livelihood of people living in mining area (Ministry of Mines Report, Government of India, 2015). Further, study should be carried out on catastrophic and impoverishment in mining and non-mining region by including all health cost including indirect cost of health.