Environmental Impact of Industrialization: A Study on Balasore Alloys Industry, Odisha

DISSERTATION

Submitted To

BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY

(A CENTRAL UNIVERSITY)

LUCKNOW

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प्रज्ञा शील करुणा

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Submitted By :

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Under the Supervision of :

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DEPARTMENT OF ECONOMICS

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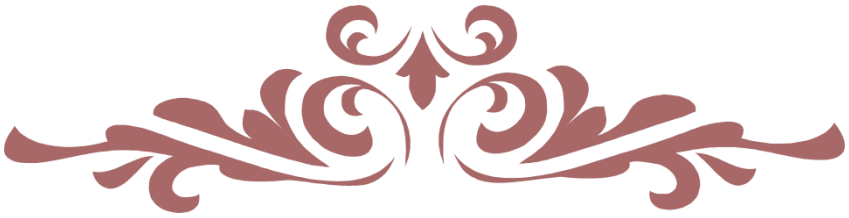

Dedicated To
Maa (Suyamani, Papa (Laxman)
And My
Family Members

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CERTIFICATE

This is to certify that the Dissertation entitled "Environmental Impact of Industrialization: A Study on Balasore Alloys Industry, Odisha" submitted by Mr. Subrat Kumar Malik in partial fulfilment of the requirement for the award of Master of Philosophy in Economics has been carried out under my supervision and no part of the dissertation has been submitted for any degree or diploma to any other University.

The dissertation is forwarded for the submission to Babasaheb Bhimrao Ambedkar University for the award of Master of Philosophy in Economics.

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DECLARATION

I hereby, declare that this Dissertation entitled "Environmental Impact of Industrialization: A Study on Balasore Alloys Industry, Odisha" submitted to Babasaheb Bhimrao Ambedkar University in partial fulfilment for the award of Master of Philosophy in Economics is my original work. It has not been submitted in part or full for any other diploma or degree of any other University.

This study is carried out under the supervision of Prof. Sanatan Nayak, Department of Economics, Babasaheb Bhimrao Ambedkar University, Lucknow-25.

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Subrat Kumar Malik

Content

List of Acronyms

ATSDR	Agency for Toxic Substances and Disease Registry
BLS	Balasore
BAL	Balasore Alloys Limited
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
COI	Cost of Illness
CPCB	Central Pollution Control Board
CPCBO	Central Pollution Control Board of Odisha
DO	Dissolved Oxygen
FAO	Food and Agricultural Organisation
GOI	Government of India
GOO	Government of Odisha
MOEF	Ministry of Environment and Forest
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WCED	World Commission on Environment and Development

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Chapter-I

Relevance of Industrialization for Economic Development

1.0 Industrialization and Economic Development

Industrialization has come to be regarded as synonymous with economic growth and development. No country desirous of rapid economic progress can afford to neglect industrialization. Industrialization can help the progress of agriculture, trade, transport and all other economic activities. Industrialization is the key to economic development. All advanced countries of the world are industrialized. It will make the best possible use of our human and physical resource. Therefore, the industrialization is regarded as a total process, impact on society through an unprecedented increase in goods and services. For this reason, it is often assumed that there is a close link between industrialization and development. Development theory in the 1950s and 1960s often implicitly defined developments and increase in GNP, and assumed that the increase in wealth associated with industrialization would trickle down to the bulk of the population. Definitions of development now often includes attention to basic needs such as decent healthcare, education, income for all and environmental sustainability. For instance, the Human Development Index (HDI) measures development according to life expectancy, educational attainment and real GDP per capita **(**UNDP 1995; p.12).Industrialization can be defined in three ways, such as, Firstly production of all material goods not grown directly on the land. Secondly, as the economic sectors are comprising mining, manufacturing and energy. Third, as a particular way of organizing production and assumes a constant process of technical and social change which continually increases society's capacity to produce a wide range of goods (Hewitt et al. 1992; p.36).

Industrialization plays a major role in the economic development through rising income, changing the structure of the economy, meeting high-income demands, raise in capital formation, and optimal use of economic resources, generating more employment, solving BOP problem, agricultural improvement, stable economic growth and alleviation of poverty. Economic development of any nation is depending on industrial development. Without industries, economic development is not possible. A growing industrial sector is crucial to greater economic development and takes in a number of areas as a country develops. A well-developed industrial sector, covering various different areas is vital to the economic development of a country. It also keeps in view the integrated development of all other sectors, viz., agriculture, power, transport and other services. Industrialization

not only provides better employment opportunities to the people, it also leads to expansion of infrastructural facilities and stimulus growth of other sectors (Chenery, H. B., 1955, p.40). Industrialization is a process that happens in countries when they start to use machines to do work that was once done by people. Industrialization is part of a process where people adopt easier and cheaper ways to make things using better technology; it becomes possible to produce more goods in a shorter amount of time (Maddish. A., 2007, p. 382). The first industrial revolution stated in United Kingdom and the second industrial revolution was started 100 years later in Germany and USA. It involved new products and processes. The countries did not start industrialization, until the 20^{th} century tended to generate neither new products nor processes. These late industrialization, raised their income and transformed their productive structures using borrowed technology (Amsden, A, 1989; p.379; Gerchenkron, Alexander, 1962; p.354). Our concern with industrialization in general and manufacturing specifically is based on the recognition with the traditions of endogenous growth theory, evolutionary economics and institutional economics that manufacturing sector is important for economic development (Szirmai, 2012; pp.1-50). Further, technological progress is in turn, necessary for successful industrialization (T. Von 1997; p.37, Cornwell, 1977, p.68). The great aim of programmes of industrial development is to provide more and more of the goods and good things of life. The citizens of an industrialized community will have different values, different ways of thought, and living their everyday lives (Walter.C. Neale, 1956; pp. 353-354). Industry induces productivity growth the industrial structure towards the activities that will ensure sustainable economic development and social well-being (Rodrik, 2009; Wade, 2012; Aiginger, 2014; pp.15-32). However, the process of industrialization has side-effects, by products which change the whole tenure of life and thought.

1.1 Development of Industrialization in India

Industry refers to an economic activity concerned with the processing of raw materials and manufacture of goods in factories. Industries are often classified based on their principle product, e.g., steel industry, automobile industry, textile industry etc. The Indian Government has been trying to promote rapid industrial growth since, Independence. As a result of the various efforts, the industrial sector in India has grown in multifarious dimensions.

Industrialization in India can well be marked under three periods, viz., Pre-British Period, British Period and Post-Independence Period or Modern Industry.

1.1.1 Pre-British Period

India was famous for her handicrafts right from pre-British times. During the Mughal Period, India has a considerable variety of arts and handicrafts. One of the important reasons for decline of indigenous industries was the industrial revolution of England. On this score one can remark, firstly, that these phenomena had been in evidence in India even at an earlier period, and were also to be found in Medieval Europe, though there they merely resulted in personal 'swings' by individual merchants and bankers in the ruling camp and did not result in the feudalisation of merchant capital. Secondly the periodical incursions by the feudal powers (investment by Mughal noble like Mir Jumla) into the sphere of trade usually went hand in hand with proclamations of their mono- poly rights to the purchase and marketing of the most profitable goods. The' Indian rulers' inclination to engage in trade sprang from the concentration in their hands, through feudal rent, of vast amount of surplus product, and their ability to secure their trade operation by force of arms. So there was no concerted effort to divert the surplus product for productive investment where the returns may not have been greatly profitable (Gupta. S. 2014; p.473)

1.1.2 British Period

The British rule in India can be divided into two periods such as (a) the rule of the East India Company from 1757 to 1858, and (b) the rule of the British Government from 1858 to 1947.

The British interests in India were governed by the requirements of the Industrial Revolution which is started in Britain in the middle of the 18^{th} century and then spread to other regions of Europe. To fulfil of these objectives, they adopted numerous measures which proved devastating for the Indian economy. They are adopted in commercialization of agriculture, introduction of feudal land system, decline of handicrafts, occurrence of famines and scarcities, unbalanced occupational structure (Chatterjee, A., 2012; pp. 2-5).

1.1.3 Post-independence Period

In 1951 India's Prime Minister Jawaharlal Nehru announced that India had to become industrialized, and that as fast as possible. While the politicians have done everything they could since then, including Soviet-like planning, to industrialize the country, India has yet to become a manufacturing powerhouse like China. India's post-independence

development plans emphasized industrialization as a very important instrument for sustained growth. Industrial development is considered necessary to achieve high rate of economic growth, to provide for the basic needs of population, to lead to an increasingly diversified economy and to give rise to social psychology and institutional changes. Globalization happens through mainly two channels in industrial sectors in trade liberalization and liberalization in movement of capital. After nearly more than two decades of reforms, a question is raised that what is the effect of these economic reforms measures on the performance of industrial sector in the post-reform period in India. To know the answer, the present paper attempts to present the industrial development of India in pre reform and post reform period, and investigate the impact of globalization on industrial sector in India (Sharma. R. K. 2001; pp.1-7).

1.1.4 Industry in Odisha

Odisha has abundant natural resources and a large coastline. Odisha has emerged as the most preferred destination for overseas investors with investment proposals. It contains a fifth of India's coal, a quarter of its iron ore, a third of its bauxites reserves and most of the chromite. Rourkela Steel Plant is the first integrated steel plant in the public sector in India, built with collaboration of Germany. It is the home to public sector enterprises like HAL, Sunabeda (Koraput), NALCO (Anugul, and Damanjodi in Koraput). Odisha receives unprecedented investments in steel, aluminum, power, refineries and ports. Odisha is also the first state in India to begin with privatising its electricity transmission and distribution businesses. Between 1994 and 2000 Odisha's former state electricity board (SEB) was restructured to form GRIDCO. This corporation was then divided into Transco and a collection of distribution companies. The central government has agreed to accord SEZ (Special Economic Zone) status to eight sites in Odisha, among which are Info city at Bhubaneswar and Paradip. But all these plans are facing massive resistance from the people of the state who mainly depend on agriculture for their livelihood.

Odisha's share was 12.6 per cent in total investment in the country. It received investment proposal worth □. 2, 00,846 crore during the last year. In the five-year period between 2004 and 2005 and 2008–09, Odisha's GDP has grown by a stunning 8.74 per cent way beyond the definition of 7 per cent of growth. It should be noted that the all-India growth during this period was 8.49 per cent. In this period, Odisha was the fourth fastest growing state, just behind Gujarat, Bihar, and Uttarakhand (Nandy, A.K., 2016). Industrial promotion and development is the key activity of the Industries Department. The State

Government is keen to create an enabling atmosphere for growth and development in industry sector with an aim to maximize value addition, employment generation and revenue augmentation. In order to broad base the industrial growth, enhance share of manufacturing in State Gross Domestic Product and boost export, various policy measures are being declared by the State from time to time. State Government drives the Make in India programme launched by Government of India and implements the Ease of Doing Business (EoDB) in the state. The state has achieved in 7th place in the World Bank ranking of EoDB assessment. Further the Govt. has setup online processing of Combined Application Forms (CAF) for industries under e-Biz platform of Government of India (GOO, Industries Department; 2015-16, pp.1-27).

1.1.4.1 Industrial Zone

The implementation of the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies. It also provides for industries and associated uses in specific areas where special consideration of the nature and impacts of industrial uses is required or to avoid inter-industry conflict. There is a between the Industrial 1 Zone or Industrial 2 Zone and local communities, which allows for industries and associated uses compatible with the nearby community. Which is allow limited retail opportunities including convenience shops, small scale supermarkets and associated shops in appropriate locations. It ensures that uses do not affect the safety and amenity of adjacent, more sensitive land uses. The most important industrial area is Balasore district of Remuna block are three major industries has sets up in which is the Pulp and paper, Rubber Industries and Ferro Alloys.

1.1.4.2 Alloys Industry in Balasore

Balasore Alloys Limited (BAL) a member of Ispat Group, which was commissioned in 1985, is situated at Balgopalpur Industrial Zone of Remuna Block of Balasore Districts of Odisha. It produces high carbon Ferro-Chrome and required chrome ore is resourced from own Captive mines, Sukinda, Jajpur. Other raw material as reductants is purchased from indigenous sources and imported. Fluxes and electrode paste are also taken from indigenous sources. Water is withdrawn from ground and electricity is taken from government power supply, (Odisha Power Transmission Corporation Limited*)* OPTCL. Major part of the production of BAL (Balasore Alloys Limited) is exported mainly to Japan, china, Korea, Europe, Turkey, Chile and Iran & Taiwan. BAL has got 5 numbers of Submerged Eclectic Arc- Furnaces. Balasore Alloys like High Carbon FeCr, SiMn,

FeMn etc. Basing on the market and produce about 95,000 TPA (Total Product Assessment) altogether. The production of different products depends upon market demand and availability of raw materials. Ferro-Alloys are used by the steel plants for production of steel as deoxidiser and alloying element. During this year BAL has produced High Carbon Ferro Chrome (FeCr) (OPCB; Balasore, pp.1-21).

1.2 Industrialization and Environment

Numerous environmental issues are raised at a global level like depletion of natural resources, water pollution, air pollution, toxic chemicals and soil pollution, ozone layer depletion, global warming, and loss of bio-diversity (Anand, S. Vijay, 2013; p.56). Economic development pursues increase in per capita income and an equitable distribution of income. Increase in national income, results only from increased economic activities i.e., production, consumption and exchange. There are various approaches regarding relationship between economic development and environmental quality. At an end, it is assumed that, increase in economic activities requires larger inputs of energy, raw materials entering the processing and production system, and generates larger quantities of waste by products and residues (Kneese A. V., et. al., 1995; p.445). Economic development pursues increase in per capita income and an equitable distribution of income. Increase in national income, results only from increased economic activities, i.e., production, consumption and exchange. There are various approaches regarding relationship between economic development and environmental quality. At an end, it is assumed that, increase in economic activities requires larger inputs of energy, raw material entering the processing and production system, and generates larger quantities of waste by products and residues (Kneese A. V, et al., 1995, p.445). The positive impact of industrialization is most effectively parameters that are the low cost of production, self-sufficient, employment, improved agriculture, defence and security. Kuznets (1955; p.445) predicted that the changing relationship between per capita income and income inequality is an inverted-U-shaped curved. As the per capita income increases, income inequality also increases at first and then starts declining after a turning point. But origin of this point of environmental Kuznets curve hypothesis appear to be with various studied conducted simultaneously in early 1990s. This study has cross sectional analysis of air quality measures and economic growth (Grossman & K, 1992, pp.1-118) across 42 countries. Later, (Panayotou, 1995; pp.1-118**)** provided most explicit explanation of Kuznets type bell-shaped relationship between rate of environmental degradation and level of economic development. The EKC phenomenon has been

empirically observed in a cross countries with different income groups to their corresponding emission levels. Assuming that all countries follow the same EKC pattern, countries with low level of income shape the initial stage of EKC, the developing countries approaching towards peak or starting to decline and the rich countries produce the falling stages of EKC (Dinda. S, 2004; p. 436). The relation between economic and environmental quality has been constant sources of debate since decades. The early 1970s marked an extraordinary upsurge in public awareness for the environment (list, J.A., et. al, 2000; p. 267**).** On the other hand, it is believed that increase in economic activities lead to over exploitation and thus depletion of environmental resources. On the other hand, it is stated economic development eventually solves all the environmental problems **(**Shafik, N. 1994; p. 757).

1.2.1 Industry and Natural Resource Degradation: Evidences

In this chapter, we can analyze the numerous studies on industry and natural resource degradation, which is the pollution, health hazards, livelihood and impact on soil and agricultural production.

1.2.1.1 Pollution

Air pollution refers to introduction of particulate matter or other harmful gases into the atmosphere. Some of the major pollutants are sulfur oxides, nitrous oxides, ammonia, carbon mono-oxide, volatile organic compounds like methane and particulate matter. They induce sever health effects on the people. The emission of harmful greenhouse gases is carbon, which was increased tremendously in the recent years. The major contributor in greenhouse gases is carbon di-oxide with a share of nearly 75 per cent (IPCC, 2007; p.35). The key reasons for this are combustion of fossil fuels, deforestation and industrial emissions. There is some literature review on the basis of pollution release in industrialization was sets up those review are given following.

Gull, N., et al., (2013, p.536) study on industrial air pollution and its effects on human's respiratory prove that those people who lived near industrial area were affected more due to industrial air pollution than those who lived far away from the industry. Also, majority of the respondents were aware about reasons of air pollution in their area. Many people faced respiratory health problems due to industrial smoke. Majority of respondents felt hurdles in their routine work and social life due to industrial smoke.

Kumar. N. and Andrew D. Foster (2007; pp.48-58) examined the CNG Regulation in Delhi. He has focused on air pollution distribution in Delhi and the neighbouring districts

of three other states that from the national capital region. His study based on both the primary and secondary data sources. He has collected 65 samples from each sites and he has used proximity analysis for data integration, spatial interpolation of air pollution surfaces and regression modelling. He has suggested that the reduction in air pollution by CNC regulations on buses, taxis, and auto rickshaw has been offset by a phenomenal increase in the numbers of private vehicles.

Aaronj. Chen and C. Arden Pope iii (1995; pp.219-224**)** investigated that the lung cancer and air pollution. He has studies the 30 to 50 per cent increase in lung cancer rates associated with exposure to respirable particles. He has focused on ambient air pollution of occupational groups, urban and rural population. His study is based on the both primary and secondary survey methods. He has taken as methods to compute the data analysis methods which are the time series and data from national aerometric.

David V. Bates (1995; pp.49-53) examined the effects of air pollution on children. He has observed air pollutant have been documented to be associated with a wide variety of adverse health impacts in children. His study based on the both primary and secondary survey data sources. He has analyse the data methodology in several statistical tools have been used which is taken econometric models. He has concluded that air pollution is likely to have a greater impact on asthmatic children due to non-access.

Rajindra Koshal and Manjulika Koshal, (1980; pp.65-79), discussed the externalities of air pollution. He has examined the quantitative relationship between air pollution and heart diseases. His study based on primary and secondary and he has taken 43 districts sample size. He also used method to estimating his work through the descriptive statistics and econometrics model and technique. He suggested that 50 per cent decreases in the air pollution would imply a decrease in the mortality rate about 24-34 per cent.

Zhaoyuzhu and et al. (2002; pp.226-230) has assessed the water pollution and degradation in Pearl River delta, in South China. He has identified the major problems in the region is the sustainable utilization of the water resources. He also analyzes the water environment status and pollution sources and domestic sewage is the primary cause of population. His study employs both natural and social science methods. His study is based on the primary and secondary data level and he has estimated the collection of data through the economic and statistical tools and technique have been used. His results of this study the volumes of degraded water resources will be up to 204,352 and 537 million m3 in 2002, 2010 and

2020. He also suggested that water for daily consumption and domestic sewage must be controlled more effectively and there should be cross-regional coordination in tackling problems of water environment.

Sundaray, (2009; pp.297-310**)** examined on the influences of anthropogenic and natural process on Brahmni-Koel River. He had collected samples from the nine locations in Rourkela Industrial Complex, Odisha. He also used certain parameters such as DO, BOD, COD, TSS, TDS etc. for estimating the contamination. He discovered both anthropogenic and natural process is responsible for the degradation for water quality in river. Mishra, V., et al., (2005; p.417) observed excessive growth in population, rapid urbanization and industrialization lead to over exploitation of land resources, groundwater and surface water resources. Industrial discharge of untreated waste in water bodies and air emissions also results in deterioration of air and water quality to environmental pollution. Another study found that air pollution has become an alarming problem with industrialization in Turkey. It also affects the human health and their well-being (Chaudhary, M.Tahir, and Atimtay, Aysel. T., 2013; pp. 1-6). Another study states that Iron and steel industry is not only promoting development but is also a major source of air pollution, which causes significant health impacts (WHO, 2000). (Hettige, Mani and Wheeler; 1997, p.105), observed that the Industrial water pollution, from twelve countries such as Brazil, China, Finland, India, Indonesia, Korea, Mexico, Netherlands, Philippines , Sri Lanka, Taiwan, Thailand and USA. They have using panel data and also investigate the effects of income per capita, regulatory strictness and relative input prices on factory level pollution intensity (pollution/output). His findings is the income elasticity of both pollution and labour intensity are approximately minus one and conclude that a sector's pollution/labour ratio is constant across countries at all income levels.

1.2.1.2 Health Hazards

Urbanization, industrialization and ignorance of people about vital importance of environment have created problems in their profession, occupations and in almost every field of work and employment. It produces occupational environment disorder and several diseases. Heitbrink, et al.,(1992; pp.617-624.) observed dust generation by free falling powders. The manner in which the powder is handled may be as important as the dust generating capacity of the bulk material, in terms of the resulting exposure. Falling height has an important influence on dust generation and release for more than one reason. The higher the impact, the more dissemination of dust there is. Moreover, the greater the

falling height, the greater flow of entrained air, which favours dust dissemination. This shows the importance of process design and adequate work practices

Olaniyi, Ibrahim et al. (2012; pp.406-413) explained that the effect of industrial effluent on the surrounding environment. They have focused on the industrial activities contribute a lot of toxic wastes to the environment. The study is based on both primary and secondary survey and is analyzed the data through the AAS. The PH meter, measuring cylinder, weighing balance, desiccators speratory funnel etc. and various statistical tools. They have suggested the concentration of some or all of the hazardous substance should be reduced before the effluent is discharged into the environment so as to circumvent their adverse effect on aquatic life and man.

C.S. Nanda and M.C. Dash (2010, pp.141-145) reported that the industrial impact on skin and respiratory system a case study of health hazards in Balasore, Orissa. They focused on the study a retrospective cross-sectional case of 12 villages with 14,346 populations around industrial estate. The data were collected from questionnaire survey, clinical study and operational health units of the area and dispensaries of industries. He also found that to establish a causal association of industrial factor for which a health management model is the need of the hour.

Govil et al. (2008, pp.313-323**)** conducted a study at an industrial zone which has 300 various types of industries nearby such as manufacturing chemicals, pharmaceutical, batteries, metal alloys, metal plating and plastic products, dyeing, edible oil production, battery manufacturing, metal plating, chemicals, etc. There are three sources of contamination exist within the industrial area such as dumpsites of solid waste, untreated industrial discharge, and emission from smokestacks. And most of these industries directly release their discharge into nearby ditches and streams and the solid waste is randomly dumped on open land, and along roads and lakes. The soil contamination is suggested to be the main causes from the random dumping of solid waste from the industry and it could be spread by rainwater and wind. The result showed that the land around the industrial area is heavily contaminated by as and then Pb, Zn. Furthermore, there is an analysis conducted at the pre- and post- monsoon over two hydrological cycles in 2002 and 2003 indicated that such as Cd and Pb contaminants are more mobile. Subsequently, these heavy metals can cause groundwater pollution through the infiltration by soil.

Susan G. Hadden (1987; pp.709-720) investigated that the statutes and standards for pollution control in India. He has discussed pollution control was thought to be incompatible with rapid industrial development. He has reviewed the industrial pollution policy in India focusing on the procedures through the policy in being implemented and the attendant problem. He has concluded pollution control conditions imposed on licenses are often perpetuated year after year without compliance. The central and state levels, industries to dicker with pollution control boards to win concessions on effluent standard.

Jain et al. (2005, pp.193-207) has assessed the water and sediment in the river Hindon. They have collected twelve sets of samples from thirteen locations on the river Hindon during April 1977 and February 1999. They have observed high concentration of metals in particulates as well as in dissolved form in the river. They concluded that the main reason behind the degradation of water quality and presence of metals in sediments in river Hindon are direct discharge of untreated and partially treated waste inputs of municipal and industrial effluents.

1.2.1.3 Livelihood

Livelihood in simplify being defined as securing a living (Chambers, R. Gordon R. Conway, 1991; p.6). The sustainable development or livelihood debate began in the early in the early 1990's. In the United Nations Conferences on Environment and development (1992), the need of sustainable livelihood as a goal for poverty eradication (Nayak, S. 2014; p.71) has introduced. Further; it was stated that everyone must have the 'opportunity to earn a sustainable livelihood' (Morse, S and Mc. Namara, N, 2013; p.22). Behera, B., Reddy, V., (2002, p.1250) A study on industrial belt shows the effect of industrial pollution on the agricultural productivity, irrigation capacity and livestock in the area. The industrial pollution results to decrease in agricultural productivity. It also leads to death of livestock and bovine. R.T. Tiwari (1983**)** investigated that the opportunity structure and industrialization of backward areas in Uttar Pradesh, evaluate its effectiveness in terms of achieved growth rates of industrial output and employment. His studies are based on the secondary survey and he has analysis the data estimating through the multiple regression models. He also suggested that the measures for a speedier process of industrialization in backward districts.

Karena. Miller (1984) investigated the effects of industrialization on men's attitudes towards the extended family and women's rights. His discussed about the impact of industrialization on men's attitudes. His study is based on primary survey for the analysis and he also collected data through interview methods and multiple regression models. His

findings are the education and living standard are the primary determinants of both across several cultures of the social groups.

P.K. Behera (2015) investigated the socio-economic impact industrialization and mining NALCO is located in the tribal areas of Koraput districts of Odisha. His study is based on primary survey of 100 samples for his study. He also used SIA (Social Impact Analysis) to assess the positive and negative impact of mining activity to suggest that they provide the better education, healthcare, market facility and control of environmental pollution.

Har Govind (1989; pp.429-433) has reported that the recent developments in Environmental protection. He has examined the major pollutants and critically affected areas have been identified in India. His study areas of Ganga purification plan. He also discussed the pollution and environmental degradation has reached alarming dimensions due to poverty deforestation, industrial development. He suggested the existing environmental protection, movement, greater emphasis is urgently needed for environmental education, people's participation population control, and cost effective population control measures.

Cheepi (2012, pp.40-51) studied the effect of pollution on the livelihood of the people in river Musi, Hyderabad. According to Cheepi, the direct impact of water pollution can be observed by fall in agricultural yield, increase in input cost for agriculture decline in milk production etc. He found that the fishermen and washer men lost their occupation due to polluted river water. Further, drinking the untreated or partially treated water increased the incidence of cholera, gastroenteritis, arthritis, malaria, typhoid, jaundice, eye diseases, paediatric problems, skin diseases etc.

Roger H. Bezdek and et at. (1989; pp.274-279**)** has examined the economic and employment effects of investment in pollution abatement and control technologies by industries. He has focused on the gross economic effects of business investments in the control of air, water and solid waste pollution for 80 industries and 475 occupations. His study is based on both primary and secondary data survey methods. He has taken methodology for data analysis through the (MISI) management information service and estimated the Econometric models through the abatement cost approaches. He observed that environmental problem generally hurt the economy by crippling industries and increasing unemployment.

1.2.1.4 Impact on Soil and Agricultural Production

Balasore city started industrialization after 1980 and the rapid industrialization is due to the easy availability of land, communication, man power and water. The Balasore town is divided into four industrial sectors such as Balgopalpur, Ganeswarpur, Chhanpur and Somnathpur. The Balgopalpur industrial estate has two major industries viz., Balasore Alloys Ltd. and Emami Paper Mills Pvt. Ltd. and also the area covered with 12 crushers with a daily crushing capacity of about 30 tones. The Balasore Alloys Ltd is a metal ferrous unit producing 95000 MT bulks of Ferro alloys per annum. The Emami Paper Mills Pvt. Ltd has two units. It has production capacity of 145000 MT of different quality of papers per year and also produces 20 MW power from the captive power plant. (Reddy, V.R, 2003; pp. 4700-4713) focused on the land degradation in India extent, costs and determinants. He also measures the extent of damage due to land degradation of various types in the form of water-induced soil erosion and wind erosion is main reason behind. His studies are based on both primary and secondary data level and analyze the time series on econometric model that are used in his study. Furthermore, he can explore the linkages between degradation and policy and institutional environment of agro-climatic regional planning. (Ikponmwosa. D. Et al. 2013; pp.140-147) examined the impact of soil erosion on agricultural potential and performance of sheshegu community farmers in the Eastern cape of South Africa. He has taken methods to compute through the structured interview scheduled and selected 50 respondents and using simple random sampling. His findings are that erosion occurred naturally through heavy rainfall and persistent drought, deforestation and indiscriminate bush burning. He also suggested that the bush burning should be enforced to check indiscriminate bush burning. (Shau, S.K. et al., 2004; pp-13-15) examined the soil pollution in Orissa. They also observed that the major sources of soil pollution in Orissa such as overburdens of mines, industrial effluents, sewage sludge and fertilizers and pesticides application into the cultivable land. He found that the most of crucial industries are discharges the large quantities of effluents industrial wastes as well as by-products to the environment. The negative effects of air pollution on productivity of piece-rate farm workers in California's central valley. They, however, cannot estimate the effect of pollution on total factor productivity that may occur, for instance, if land becomes less productive or if crop yields decline (Graff. Zivin and Neidell; 2011, pp. 1-53).

1.3 Justification of the Study

It has been observed that a large numbers of people are facing problems due to industrialization in Balasore Alloys Limited in Balasore district. The significance of the study is to focus on livelihood of people after due to environmental pollution in alloys industrial areas. This impact on industrialization occurs due to the various types of pollutions on health of people in these industrial areas. It also affected the agricultural productivity in this area. The result of outcome agricultural productivity is low and leads to malnourishment. There are the most vital effects on livelihood pattern due to industrial set up. The peoples are also facing environmental problems due to on-going crusher industries near this site. There is another industry in this area which is the IMMAMI Paper Mill. They create more obstacles to sustain the human beings. This industry also produces harmful Wastages into the soil and water pollution contamination to the environment.

1.4 Objectives of the Study

Keeping the above issues in mind, the following two broad objectives have been developed.

1. To assess the changes in agricultural productivity of the affected villages to those of non-affected villages by Alloys Industry.
2. To measure the impact of industrial pollution on health of people living in the surrounding areas.

1.5 Research Question

On the basis of above mentioned objectives, following hypotheses have been designed.

1. Due to establishment of Alloy Industry agricultural productivity has declined the affected villages.
2. The impact of Alloys industry on health of people became serious.

1.6 Methodology of the Study

1.6.1 Data Sources

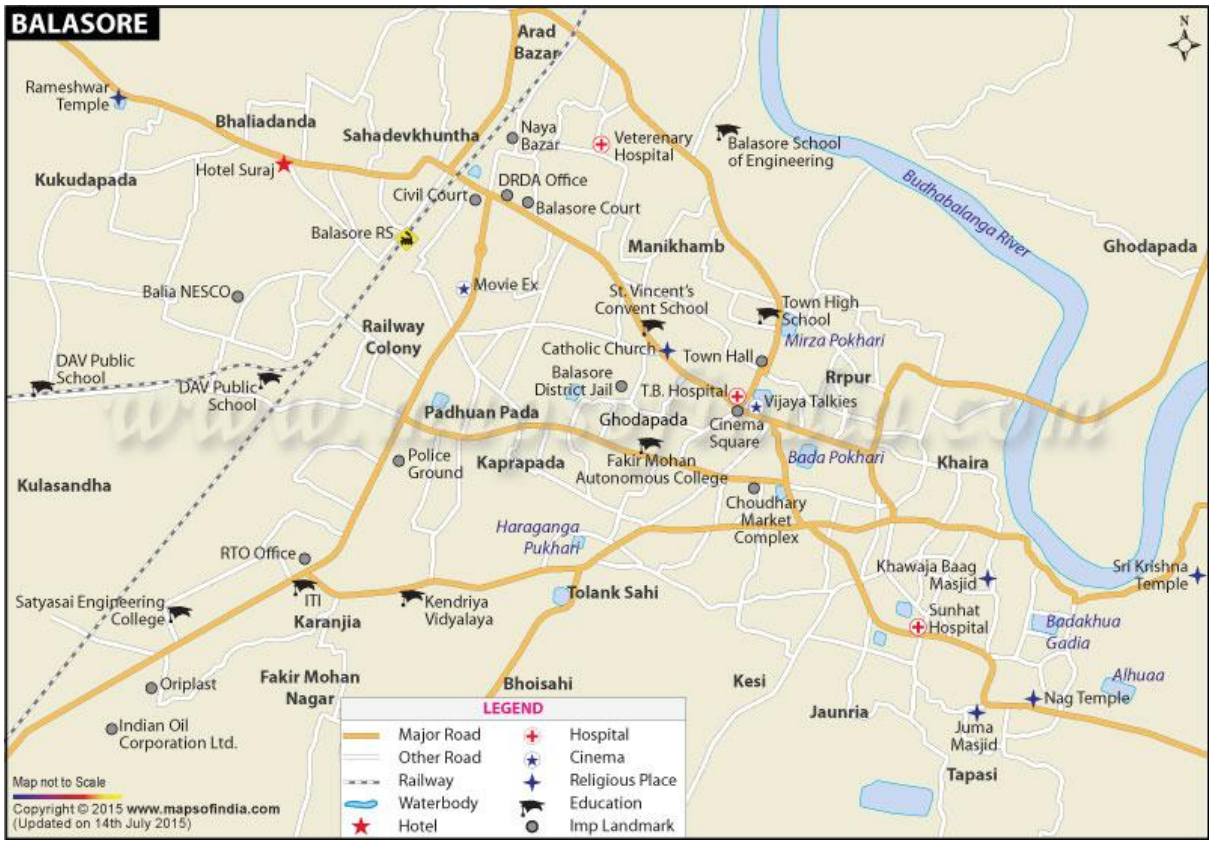
The study is based on both primary and secondary data. Secondary data are collected from Central Pollution Control Board, Statistical Handbook of Balasore, State Pollution Control Board, Odisha, Indian Ferro Alloy Producer Association, and World Banks Reports. Reports collected from various Ministries of Government India and State,

Government. Literature obtained from various books, journals, and online data sources. Primary Data are collected through a field survey in Balasore district in Odisha.

1.6.2 Study Area and Sample Design

Balsore is a smart city situated on the bank of the river Budha Balang and her distributary, the river Sona. It is situated between the parallels of longitude 20^0 $43^!$ to 20^0 $48^!$ N and latitude 86^0 $16^{'}$ to 86^0 $29^!$E. Geographical area of the district is 3634 square kms. The districts is surrounded by the Bay of Bengal about 25 km towards south and where Chandipur sea beach is situated. Balasore is one of the coastal district of Odisha lies on the northern part of the state. This is very famous for not only one industry but also major industries in this district. Balasore is one the major industrial zone of Odisha and also one of the major alloys industries in East region because of its diversified product range. The product range includes are semi-finished and finished metallic or Non-metallic allied goods. The area has well developed roads with a high traffic density, but the condition of other roads is very poor in this area. Balasore district is in the coastal area and it means "Town in the Sea". Balasore Alloys Limited is engaged in the manufacturing and mining of Ferro alloys. The Company is also engaged in the manufacturing and selling of Ferro Chrome of various grades. It has over five furnaces with a total capacity of approximately 60 megavolt ampere (MVA) to produce approximately 95,000 million tons (MT) of Ferro alloys per annum. Its products include High Carbon Ferro Chrome (FeCr60) and Low Silicon Ferro Chrome (FeCr65). It has a captive chrome ore mine in Sukinda Valley in Jajpur district in the state of Odisha. Its Manganese Ore Mine is located at Joda in the Keonjhar district in the state of Odisha, and Hathoda in Balaghat district in the state of Madhya Pradesh. Its metal recovery plants are used to recover the entrapped metal (ferrochrome) from the slag generated during the production of Ferro chrome and charge chrome. It focuses on the production of products, such as low and medium-silicon, low phosphorous, medium-carbon and high-chromium (Balasore Alloys Ltd. Report, 2014-15).The study is conducted on the household residing in Balasore Alloys industrial area of Balasore. Primary data has been collected from three villages of Balasore Alloys constituency, viz., Balgopalpur, Sireipur and Gourpur villages. Forty households have been selected from each village for the study and survey was conducted in August, 2016. Both Purposive and random sampling method is used for selection of households for primary survey.

Figure 1.1 Location Map of Balasore City



Source: www.mapsofindia.com

1.6.3 Methods of Estimation

Cost of Illness method is used to measure the economic burden of health hazards on the people. It is the procedure that 'costs' of the diseases are calculated under direct and indirect basis. The direct costs for an illness are represented by the value of tangible goods and services actually delivered to address consequences of that illness. Indirect costs are represented by the value of productive services that are not performed due to consequences of the illness (Gunatilak, H.M., 2003, p.99). Further**,** productivity change methods, also referred to as the production function approach or derived value method, is used to estimate the economic value of ecosystem products or services that contribute to the production of commercially marketed goods. It is applied in cases where the products or services of an ecosystem are used, along with other inputs, to produce marketed goods. The productivity changes attributed to environmental quality changes. The monetary values thus obtained are then incorporated into the economic analysis of the project (Gunatilak, H.M, 2003; p.99).

1.6.4 Analytical Tools

Various statistical tools such as descriptive statistics, dummy regression models and chi-square test, have been used for the study.

1.7 Outline of the Study

The first chapter deals with the Relevance of Industrialization for Economic Development, while describing the various states of industrialization. It also deals with economic development and environment. The second chapter entitled socio-economic profile of households in Alloys Industrial area of assesses the Balasore, while third chapter measure the change of agriculture productivity in the affected villages by Alloys Industry. The fourth chapter measures the impact of industrial pollution on health of people living in the surrounding areas, whereas fifth chapter deals with summary and conclusion of the study.

Chapter 2
Socio-Economic Profile of Households

2.0 Introduction

The socio-economic conditions of an area are the best parameter, which reflects the quality of its people. Socio-economic status is based on income, education and occupation. When analyzing a family's socioeconomic status, the household income earners, education, and occupation are examined. This chapter attempts to study the impact of Alloys industry on the socio-economic status of the people in this zone. It also analyzes the pattern of employment provided by the industry to the local populations. The study on socio-economic status of the people in this industrial area will helps in assessing the positive impact of Alloys industry on the living in this zone. It also important to understand the socio-economic conditions of an area in order to study its impact on agriculture and health quality of living standards of people (Dudala, S.R. et al.,2014, p.875). The crucial determinants are standard of living, accessibility and utilization of various health facilities. In which, level of education, occupation structure and per capita monthly income of the household have been taken into account.

2.1 Demographic Features of Balasore District and Odisha

The population of Odisha during census 2011 was 41,974,218 (4.2crores), out of which 21,212,136 are in rural and 20,762,082 (56.47 per cent) in urban areas respectively (Government of India, 2011). Nearly 56.76 per cent population is living in the rural Orissa. In 2001, total population was 36,804,660 in which males were 18,660,570 while females were 18,144,090. The decadal growth rate of population was registered 14.00 per cent. In respect of rural and urban decadal growth rate, it is recorded as 14.05 per cent and 15.94 respectively. The district has an area of 3806 square k.ms., and 23.21 lakhs of population as per 2011 census. The district accounts for 2.44 per cent of the states territory and shares 5.53 per cent of the state's population. The density of population of the districts is 610 per square. kms., and as against 270 persons per square k.ms., of the state. It has 2952 villages (including 365 un-inhabited villages) covering 12 blocks, 12 tahasils and 2 subdivisions. The scheduled caste population is about 21 per cent and scheduled tribe population is 11.90 per cent. The literacy rate of the district is 79.80 per cent against 72.90 per cent in 2011 at the state level. (Government of Odisha, Balasore, 2011., p. 1)

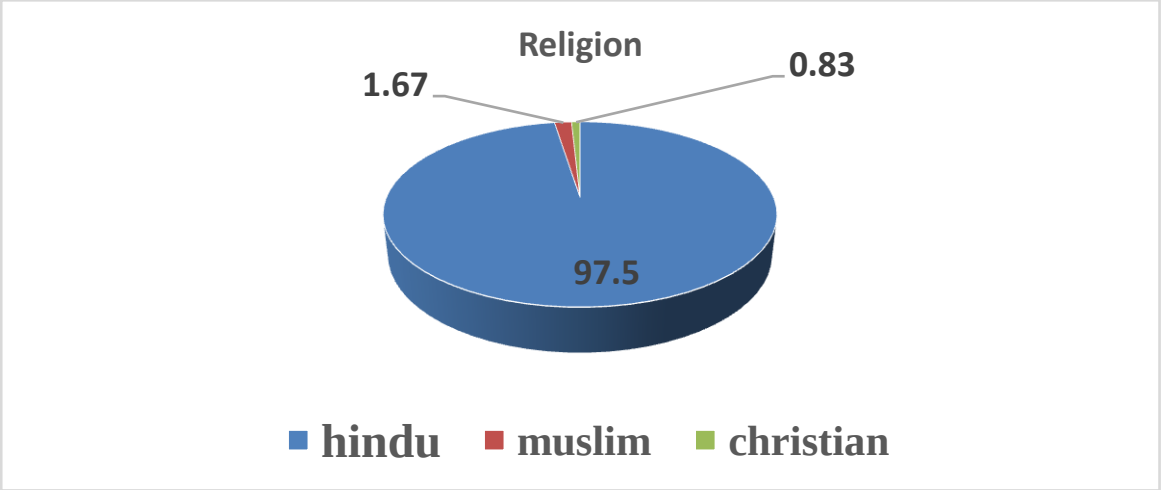
Furthermore, gender ratio is a valuable determinant to find the gender composition of the community. It defined as the number of females per thousand males. In Odisha, sex ratio has depicted an increasing trend. It was 1000 per thousand males in 2001 census, which increasing to 979 in Census 2011. But sex ratio in Balasore is very low as compared to the state average, for rural and urban population. Moreover, In case of child population, Odisha has recorded 3445 lakhs population in age group 0-6 years (12.44 per cent) with a negative decadal growth rate of 9 per cent (Government of India, 2011, p.2). This confirms that the child sex ratio is moving against the female child in recent times, one of the major causes behind the female feticide (Echavarri. R., Ezcurra. R, 2010, p. 249). Literacy is one of the fundamental social indicators to assess the development of the society. According to Census, a person of seven years or more, who can read and write in any language is termed as literate (Government of India, 2011, p.27). Odisha accounted 4, 76,464 literates in 2011, out of which 9,02,359 and 7,18,873 in 2011 in compare to male literacy rate is 7,22,244 and female literacy rate is 4,97,251 in 2001 census.

2.2 Socio-Economic Condition of the Households

2.2.1 Social Profile of Households

In this study, Most of the social scientists observed that religion caste plays a crucial role in determining various demographic factors and structures. Countries with traditional religious values have been found the house of high percentage of illiteracy rates leads to low income and high birth rate (World Bank, Data; 2014). The area is mostly Hindu dominated and principal spoken language is Oriya and Bengali. The primary survey was conducted on 120 households from Balasore industrial area. Out of 120 households, 97.5 per cent registered to be Hindu community, 1.67 per cent is coming under the Muslim community and rest 0.83 per cent belong to Christian community (Figure 2.1).

Figure 2.1 Religion Profiles of Households



Source: Estimated from Field Data.

Caste wise distribution reflects that nearly 33.33 per cent belong to Scheduled Caste followed by 29.17 per cent to Other Backward Caste. The percentages of households belong to General and Scheduled tribe category is 27.5 per cent and 10.00 per cent respectively (Table 2.1). Religion wise majority of the Hindu households belong to Scheduled Caste category. Whereas, 6.06 per cent of Muslim households is belong to general category, while Hindu category of households is 90.91 per cent. In case of Christian households, 3.03 per cent belong to general category. Thus it is clear shows that most of the total households belong to Hindu religion category working in Alloys industries.

Table 2.1 Religion wise Households Profile in the Study Area

Caste/Religion	**Category of Households**			
Variables	**Hindu**	**Muslim**	**Christian**	**Total**
General	30 (90.91)* (25.64)**	2 (6.06)* (100.00)**	1 (3.03)* (100.00)**	33 (100.00)* (27.5)**
OBC	35 (100.00)* (29.91)**	0 (0.00)* (0.00)**	0 (0.00)* (0.00)**	35 (100.00)* (29.17)**
SC	40 (100.00)* (34.19)**	0 (0.00)* (0.00)**	0 (0.00)* (0.00)**	40 (100.00)* (33.33)**
ST	12 (100.00)* (10.26)**	0 (0.00)* (0.00)**	0 (0.00)* (0.00)**	12 (100.00)* (10.00)**
Total	117	2	1	120

	(97.05)* (100.00)**	(1.67)* (100.00)**	(0.83)* (100.00)**	(100.00)* (100.00)**

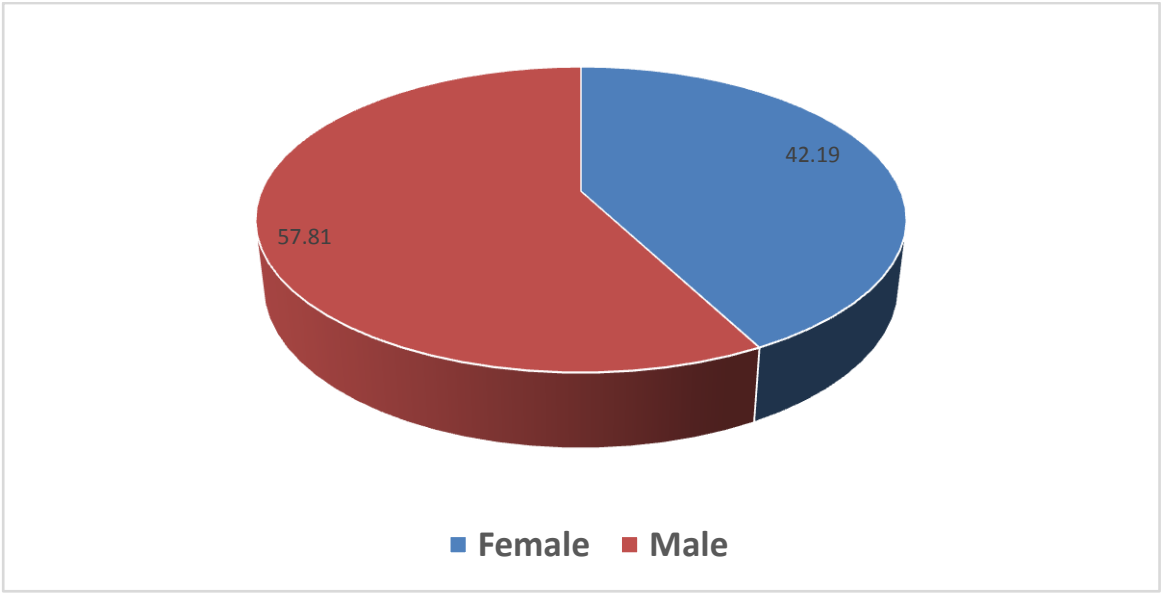
Source: Estimated From Field data.

Note: Figures in parentheses are per cent of total. *Row per cent ** Column Per cent

2.2.2 Demographic Profile of Households

The demographic features like age composition, gender and family size affect the income and expenditure patterns of the households. Gender composition is an important aspect, when economic and health status of the households is to be considered. It is essential to understand the linkage between gender, educational status, occupational status and income of the individuals in order to portray the real picture of the social and economic condition of the households in the area. Out of 521 individuals in 120 households, 42.19 per cent are females and rest 57.81 per cent are males.

Figure 2.2: Gender Profile of the Households



Source: Estimated from field data.

2.2.3 Housing Profile of the Surveyed Households

The housing conditions reflect the social and economic status of the community. Housing is also important parameter of health status of a household and affects the sanitation facilities. In above analysis, the houses in the study area have been categorized as (i) kachha houses, (ii) semi-pucca houses and (iii) Pucca houses. Kachha houses are made from mud, thatch, lime and other low quality materials. Semi-pucca houses are made by using both low quality material and high quality material, generally with tiled roofs and

asbestos roofs. Pucca houses are to be made with the high quality materials (IIPS, 2007, p.37).

Nearly 45.00 per cent live of total households in semi-pucca houses, followed by 38.33 and 16.67 per cent are lived pucca houses and kachha houses. Taking the social classes into account, it can be depicted that in case of general category, percentage of households living in pucca houses is highest 57.58 percent. The same conditions with the Other Backward Classes, the percentage of households increase with increase in quality of houses. There are only forty observations recorded in SC category and only twelve observations in ST category, hence the percentages are insignificant. Hence, more than half of the households surveyed live in their semi-pucca or kachha houses. This shows that the housing condition in the area is not good.

Table 2.2: Caste wise Housing Profile

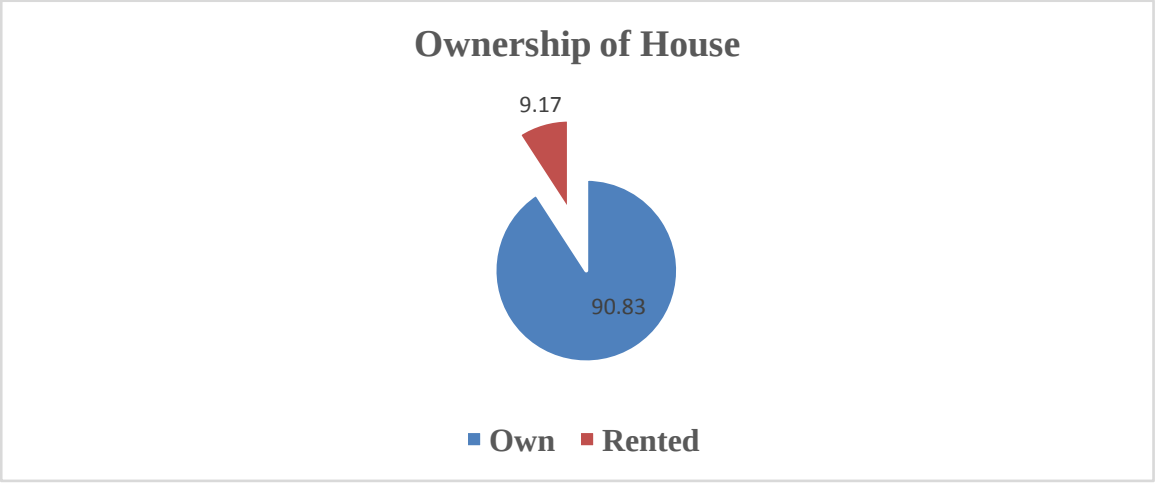
Caste/ Nature of House	Type of House			Total
	Kachha House	Semi-Pucca	Pucca House	
General	2 (6.06)* (10.00)**	12 (36.36)* (22.22)**	19 (57.58)* (41.30)**	33 (100.00)* (27.5)**
OBC	2 (5.71)* (10.00)**	22 (62.86)* (40.74)**	11 (31.43)* (23.91)**	35 (100.00)* (29.17)**
SC	5 (12.50)* (25.00)**	19 (47.50)* (35.19)**	16 (40.00)* (34.78)**	40 (100.00)* (33.33)**
ST	11 (91.67)* (55.00)**	1 (8.33)* (1.85)**	0 (0.00)* (0.00)**	12 (100.00)* (10.00)**
Total	20 (16.67)* (100.00)**	54 (45.00)* (100.00)**	46 (38.33)* (100.00)**	120 (100.00)* (100.00)**

Source: Estimated from Field Data.

Note: Figures in parentheses are percentage of total. *Row percentage **Column Percentage.

Figure 2.3 shows that the ownership of households in the study area. In case of ownership of houses also, two-third 90.83 percent of the total household possess own houses, while 9.17 percent reside in rented houses.

Figure 2.3: Ownership Scenario of Households



Source: Estimated from Field Data.

The Table 2.3 depicts that the caste wise toilet facility in study area. So far as toilet facility is concerned, only 87.88 percent of total household in general category have this facility and 12.12 percent do not have toilet facility in the house, where the 54.71 per cent of the household have facility and 45.71 per cent do not have the toilet facility for Other Backward Classes of people in this area. Moreover, 75.00 percent of Scheduled Caste category of the household has latrines facility in the villages. Nearly 75.00 per cent of the households do not have latrine facility in the Scheduled Tribe category in Balasore alloys industrial area. It also reflected by the social category wise that still one third of total household do not have toilet facility. Currently, the Government of India have provided the toilet schemes in the rural area in every households, but it needs further examination to assess it. Absence of an open defalcation toilet is the major causes of diseases, which affects health of the households in the alloys industrial area. It also creates environmental health hazards in this area.

Table: 2.3 Caste wise Toilet Facility

Caste of the Households	**Toilet facility of the Household**		**Total**
Indicators	Yes	No	
General	29 (87.88)* (35.8)**	4 (12.12)* (10.26)**	33 (100.00)* (27.5)**
Other Backward Castes	19 (54.29)*	16 (45.71)*	35 (100.00)*

	(23.46)**	(41.03)**	(29.17)**
Scheduled Castes	30 (75.00)* (37.04)**	10 (25.00)* (25.64)**	40 (100.00)* (33.33)**
Scheduled Tribes	3 (25.00)* (3.7)**	9 (75.00)* (23.08)**	12 (100.00)* (10.00)**
Total	81 (67.5)* (100.00)**	39 (32.5)* (100.00)**	120 (100.00)* (100.00)**

Source: Estimated from Field Data.

Note: Figures in parentheses are per cent of total. *Row percentage **Column Percentage

Table 2.4 depicts that the of operational land holdings in the study area. The ownership of land reflects with the caste wise social category in Balasore alloys industrial area. Nearly 85 per cent of the respondents in general category have own land and 15.15 per cent not land due to the alloys industry. Industry have purchased of land in the households of this two villages e.g., Balgopalpur and Sireipur. There is OBC category, 77.14 percent of having land and 22.86 per cent do not land. The Scheduled caste of the households are having own land is 77.50 percent and 22.5 percent have no land. This is clearly reflected that among the Scheduled Tribe category of people 33.33 per cent have land and 66.67 percent does not have any land. In the 120 households, having land is 75.00 per cent have land and 25.00 per cent are coming under the land less.

Table 2.4 Caste wise Ownership of the Land

Caste of the households	**Ownership of Land**		**Total**
	Yes	**No**	
General	24 (72.73)* (25.81)**	9 (27.27)* (33.33)**	33 (100.00)* (27.5)**
Other Backward Castes	31 (81.58)* (33.33)**	7 (18.42)* (25.93)**	38 (100.00)* (31.67)**
Scheduled Castes	36 (80.00)* (38.71)**	9 (20.00)* (33.33)**	45 (100.00)* (37.5)**
Scheduled Tribes	2 (50.00)* (2.15)**	2 (50.00)* (7.41)**	4 (100.00)* (3.33)**
Total	93 (77.5)* (100.00)**	27 (22.5)* (100.00)**	120 (100.00)* (100.00)**

Source: Estimated from Field Data.

Note: Figures in parentheses are per cent of total. *Row percentage **Column Percentage.

Table 2.5 shows that the landholding pattern of the households across social category in Balasore industrial area. The mean land is 2.99 acers for general category, followed by the minimum land is 0.2 acres, standard value of land is 1.35 acres and maximum total land value is 6 in acres. The another caste wise of total land holding of the households in Other Backward Classes of people having land in this area of mean total land is 3.46, minimum land value is 2.00 in acres, 1.22 acres is the standard deviation of total landholding size and maximum land holding of the 6 in acres of this area. The scheduled caste category of the household having landholding size of mean value is 2.95, minimum land holding is 0.2 in acres, their standard value of land holding size is 1.41, and maximum land holding size is 7 in acres of alloys industrial area. Last is the social category of the land holding size of the mean value of land 3.8 and minimum range holding size is 2 are in acres, standards deviation of land is 1.23 and maximum land holding size is 5.5 in acres of the household in the area.

Table 2.5: Caste wise Land holding size of the Households (in acre)

Caste/ Total Landholding size	Mean land size	Minimum land size	S.D land size	Maximum land size
General	2.99	0.2	1.32	6
Other Backward Caste	3.46	2	1.22	6
Scheduled Caste	2.95	0.2	1.44	7
Scheduled Tribe	2.00	2	0	2
Total	3.21	0.2	1.34	7

Source: Estimated from Field Data. Note: S.D * (Standard Deviation)

2.2.4 Educational Profile of the Households

Education is the best tool in for progressing the socio-economic status, since it generate better employment opportunities. Better education leads to better employment opportunities, and also helps in increasing the income levels of the people. It helps in improving the socio-economic status of the people. This play key role for better health conditions of the people. Education improves awareness regarding various health hazards. It also improves knowledge and life skills that allows are better educated persons to gain more ready access to information and resources to promote health conditions (Adler, N.E., et at., 2002, p.61).

In the above analysis, education level is classified into five categories such as (i) illiterate, (ii) educated up to primary, (iii) educated up to secondary, iv) up to graduation and v) post-graduation and above. The level of education of the households surveyed is very low (Table 2.8). Taking into consideration, the education profile based on caste wise, we observe that out of 148 persons belonging to General category 47.97 per cent are educated upto higher secondary level followed by 8.78 per cent attaining degrees. In the OBC category similar trend has been seen with 40.54 per cent at intermediate level. In case of Scheduled Caste, 20 persons are illiterate, 51 are educated up to primary level, 80 up to higher secondary, 16 are graduation and only 2 has reached post-graduation stage. ST category shows that majority of the individuals are educated up to primary level.

Table 2.8: Caste wise Educational level of the Households

Caste/ Education	Illiterate	Up to primary	Up to higher secondary	Up to graduation	Post-graduation	Total
General	20 (13.51)* (20.2)**	42 (28.38)* (26.25)**	71 (47.97)* (32.72)**	13 (8.78)* (33.33)**	2 (1.35)* (33.33)**	148 (100.00)* (28.41)**
OBC	27 (18.24)* (27.27)**	50 (33.78)* (31.25)**	60 (40.54)* (27.65)**	9 (6.08)* (23.08)**	2 (1.35)* (33.33)**	148 (100.00)* (28.41)**
SC	20 (11.83)* (20.2)**	51 (30.18)* (31.87)**	80 (47.34)* (36.87)**	16 (9.47)* (41.03)**	2 (1.18)* (33.33)**	169 (100.00)* (32.44)**
ST	32 (57.14)* (32.32)**	17 (30.36)* (10.63)**	6 (10.71)* (2.76)**	1 (1.79)* (2.56)**	0 (0.00)* (0.00)**	56 (100.00)* (10.75)**
Total	99 (19.00)* (100.00)**	160 (30.71)* (100.00)**	217 (41.65)* (100.00)**	39 (7.49)* (100.00)**	6 (1.15)* (100.00)**	521 (100.00)* (100.00)**

Source: Estimated from field data.

Note: Figures in parentheses are percentage of total. *Row percentage **Column percentage.

Table 2.9 depicts that the gender based education level of the households, which is nearly 39 per cent are illiterate and about 43.75 per cent are educated up to primary level of males in the households. The per cent of educated individuals decreases with further increase in the level of education. The 67.74 per cent are educated up to secondary and higher secondary level and only 82.05 per cent is educated up to graduate level. There is very low per cent of education level in post-graduation i.e., 83.33 per cent. Thus, low rate education is one of the key determinants in the level of education for females is far lower compared to males in alloys industrial areas and its peripherals. In compared to 39.39 per

cent illiterate males, the percentage of females with zero education is nearly 60.61 per cent (Table 2.9). Though, in case of primary education, percentage of females is comparatively higher. But in case of secondary education, again the percentage of males is higher than that of females. In case of education up to graduate and post graduate level also, percentage of males is higher compared to females.

Table 2.9: Gender wise Education level of the Households

Education/ Gender	Gender of the Households		
	Male	**Female**	**Total**
Illiterate	39 (39.39)* (13.31)**	60 (60.61)* (26.32)**	99 (100.00)* (19.00)**
Up to Primary	70 (43.75)* (23.89)**	90 (56.25)* (39.47)**	160 (100.00)* (30.71)**
Up to Higher secondary	147 (67.74)* (50.17)**	70 (32.26)* (30.7)**	217 (100.00)* (41.65)**
Up to Graduation	32 (82.05)* (10.92)**	7 (17.95)* (3.07)**	39 (100.00)* (7.49)**
Post-graduation and above	5 (83.33)* (1.71)**	1 (16.67)* (0.44)**	6 (100.00)* (1.15)**
Total	293 (56.24)* (100.00)**	228 (43.76)* (100.00)**	521 (100.00)* (100.00)**

Source: Estimated from field data.

Note: Figures in parentheses are percentage of total. *Row percentage **Column percentage.

2.2.5 Income Profile of Households

Income is key factor which plays as a crucial role in case of improving socio-economic conditions of a community. It also provide for purchasing health care. Higher income can provide better nutrition, housing, schooling and recreation facilities. There is a positive relationship between income and health, income and household environmental conditions and also between income and various diseases among household (Rahman, A., 2006, p.211).

Table 2.11 reflects that the caste wise mean income and total monthly expenditure in the households in the area. The mean monthly income and expenditure is Rs. 4148.34 and Rs. 2761.80 respectively. It also higher earning monthly income and highly spend on both durable and non-durable goods. In the same way, other backward caste also higher per capita income and also increases their consumption expenditure level i.e., Rs. 3125.78 and Rs. 2264.15. Further, the scheduled caste of people that have per capita monthly income and per capita expenditure is Rs. 2493.75 and Rs. 2422.08. It also lowers level of earning monthly income and low level of consumption of expenditure in this category. Furthermore, the per capita income and per capita expenditure is Rs. 2104.17 and Rs. 2092.78 in Scheduled caste in the area. It is lower income and consumption level in compare to other classes of people in the households. The scheduled caste peoples are illiterate and not awareness about their life styles in the area.

Table 2.11: Caste wise Mean Income, Total expenditure in the households (in Rs.)

Variables	Mean Per Capita Income	Mean Per Capita expenditure
General	4148.34	2761.80
Other Backward Caste	3125.78	2264.15
Scheduled Caste	2493.75	2422.08
Scheduled Tribes	2104.17	2092.78
Average	3120.15	2436.51

Source: Estimated from Field Data.

2.2.6 Occupational Profile of Households

Occupational structure is a significant determinant in many social and cultural aspects of the life. It is most important parameter of current and future economic opportunities in modern societies. Occupation defines, in large extent opportunities of current and future income, as well as is related to social honour, prestige and political authority (Rose, D., Pevalin,D.J.,2001, p.6).Occupational structure may also reflect the level of discrimination and segregation among social groups (Schimdt, P., Strauss, R., 1975, p.471). The changes in the occupational conditions are also related to changes in the demand for different occupational services, as a result of socio-economic improvements and technological up gradations. Since technological development affects the division of labour, it also impacts on every aspects of the social structure (Williams, G., 1979, p.75). This is against the general belief that industrialization brings better employment opportunities and it helps in improving their economic status of the people. Occupational structure of a country refers to the distribution or division of its population in different occupation (Banu Sayira, N., 2015; p. 1).

In this Table 2.11 reflects that the caste wise occupational structures of households in the industry and peripherals. Out of the total population of 521 in the households, 4.73 per cent of people engaged in self-employed and business, 1.35 per cent are in public services, the 24.32 per cent are alloys industry, 0.68 per cent is wage labour and rest is the unemployed in general category of the households. Similarly, the highest percentages of peoples works in Alloys industry i.e., 20.95 per cent among them 2.7 per cent in public service, 0.68 per cent are business, 6.08 per cent in wage labour and 69.59 per cent are unemployed respectively in OBC. Further, in case of scheduled caste of peoples are works at 2.96 per cent is self employed, 1.78 per cent are in public services and wage labour. The highest percentages of people are works in Alloys industries i.e., 21.3 per cent and 72.19 per cent are unemployed persons in the households. Furthermore, the scheduled tribes in the area are frequently engaged in their job, the 28.57 per cent are works in Alloys industry and 8.93 per cent are wage labour. Also, they are coming under seasonal labourers, due to availability of works.

Table 2.11: Caste wise Occupational Pattern of Households

Caste/ Occupation	Self Employed & Business	Public services	Alloys Industry	Wage Labour	Unemployed	Total
General	7 (4.73)* (50.00)**	2 (1.35)* (22.22)**	36 (24.32)* (30.25)**	1 (0.68)* (5.56)**	102 (68.92)* (28.25)**	148 (100.00)* (28.41)**
OBC	1 (0.68)* (7.14)**	4 (2.7)* (44.44)**	31 (20.95)* (26.05)**	9 (6.08)* (50.00)**	103 (69.59)* (28.53)**	148 (100.00)* (28.41)**
SC	5 (2.96)* (35.71)**	3 (1.78)* (33.33)**	36 (21.3)* (30.25)**	3 (1.78)* (16.67)**	122 (72.19)* (33.8)**	169 (100.00)* (32.44)**
ST	1 (1.79)* (7.14)**	0 (0.00)* (0.00)**	16 (28.57)* (13.45)**	5 (8.93)* (27.78)**	34 (60.71)* (9.42)**	56 (100.00)* (10.75)**
Total	14 (2.69)* (100.00)**	9 (1.73)* (100.00)**	119 (22.84)* (100.00)**	18 (3.45)* (100.00)	361 (69.29)* (100.00)**	521 (100.00)* (100.00)**

Sources: Estimated from field data.

Note: Figures in parentheses are per cent of total. *Row percentage ** Column percentage.

Table 2.12 depicts that the gender based disparities in education and income are also reflected in case of occupational pattern. Though the overall percentage of people in public and private service is less and quite low in case of women. Out of the total working

population, nearly 57.01 percent are males and 42.99 percent are females. Thus, the participation of females in economic activities in the area is relatively less; one of the major reasons behind this is the low level of education clubbed with social and religious constraints in Balasore Alloys industrial area. Minimum per cent of women employed as wage labour in this area, which is nearly 5.56 percent. Majority of them are housewife is 62.88 per cent in unemployed in the households. Though the nature of the employment is indirect, Alloys industry provides ample amount of employment opportunities to the males. The participation of males in economic activities in this area is very high and their contribution of work percentage is nearly 56.24 per cent.

Table 2.12: Gender based Occupational Pattern of Households

Variables	**Gender of the Households**		
Occupation	**Male**	**Female**	**Total**
Self employed & Business	14 (100.00)* (4.78)**	0 (0.00)* (0.00)**	14 (100.00)* (2.69)**
Public services	9 (100.00)* (3.07)**	0 (0.00)* (0.00)**	9 (100.00)* (1.73)**
Alloys industry	119 (100.00)* (40.61)**	0 (0.00)* (0.00)**	119 (100.00)* (22.84)**
Wage labour	17 (94.44)* (5.8)**	1 (5.56)* (0.44)**	18 (100.00)* (3.45)**
Unemployed	134 (37.12)* (45.73)*	227 (62.88)* (99.56)*	361 (100.00)* (69.29)**
Total	293 (56.24)* (100.00)**	228 (43.76)* (100.00)**	521 (100.00)* (100.00)**

Source: Estimated from field data.

Note: figures in parentheses are per cent of total. *Row per cent ** Column per cent.

Table 2.13 shows that the business, Alloys industry and wage labour, the per cent of individual's decreases with the increase in the level of education. People working in Alloys industry are 8.08 per cent illiterate, followed by 10.63 per cent with primary education and 34.1 per cent with secondary education, 43.59 per cent with graduate level and 50.00 per cent of individuals are in post-graduation level of education. Where as in case of public services and private service, the percentage of individuals at secondary education level is 2.03 per cent followed by 5.13 per cent and 33.33 at both graduation and post graduation level respectively. In case of unemployed individuals of the

household are illiterate is 80.81 per cent, 84.38 per cent are coming under the primary education level, 58.53 per cent of secondary level, 46.15 per cent of graduation level and 16.67 per cent of post-graduation, it also very less education levels in this area.

Table.2.13: Education Level based on Occupational Structure of Households

Education/ Occupation	Self employed & Business	Public services	Alloys industry	Wage labour	Unemployed	Total
Illiterate	1 (1.01)* (7.14)**	0 (0.00)* (0.00)**	8 (8.08)* (6.72)**	10 (10.1)* (55.56)**	80 (80.81)* (22.16)**	99 (100.00)* (19.00)**
Up to primary	3 (1.88)* (21.43)**	0 (0.00)* (0.00)**	17 (10.63)* (14.29)**	5 (3.13)* (27.78)**	135 (84.38)* (37.4)**	160 (100.00)* (30.71)**
Up to Higher secondary	8 (3.69)* (57.14)**	5 (2.3)* (55.56)**	74 (34.1)* (62.18)**	3 (1.38)* (16.67)**	127 (58.53)* (35.18)*	217 (100.00)* (41.65)**
Up to graduation	2 (5.13)* (14.29)**	2 (5.13)* (22.22)**	17 (43.59)* (14.29)**	0 (0.00)* (0.00)**	18 (46.15)* (4.99)**	39 (100.00)* (7.49)**
Post-graduation	0 (0.00)* (0.00)**	2 (33.33)* (22.22)**	3 (50.00)* (2.52)**	0 (0.00)* (0.00)**	1 (16.67)* (0.28)**	6 (100.00)* (1.15)**
Total	14 (2.69)* (100.00)**	9 (1.73)* (100.00)**	119 (22.84)* (100.00)**	18 (3.45)* (100.00)**	361 (69.29)* (100.00)**	521 (100.00)* (100.00)**

Source: Estimated from Field Data.

Note: Figures in parentheses are per cent of total. *Row percentage ** Column percentage.

2.3 Major Findings and Conclusions

It is general perception that industrialization leads to economic development of people and helps in raising their socio-economic conditions. However in case of Balasore Alloys industry, it is observed that the area is poor in terms of socio-economic status. Housing structures, educational level, income level and their occupational pattern provides a clear picture of the socio-economic status of an area. Nearly 62 per cent households surveyed lived in kachha and semi-pucca houses. Also, nearly 19 per cent of them are illiterates; out of total population size is 521 in the area. The level of education is working age group and old age group is very low. Nearly 100 per cent of working population is involved in Alloys industry, followed by 3.45 per cent in private jobs and 2.69 per cent self-employed. This shows the poor level of employment in the area. Also, most of the people

employed in Balasore Alloys sector work on very low wages and the quality of employment provided are also not good.

Thus it can be said that the level of housing conditions in the area is poor. The level of education is also very low for the households in the area. This is one of the major issues for poor economic conditions as better education leads to the development of skills and better employment opportunities. It also the educational constraints, peoples are compelled to work at lower wages in hazardous sectors like processing allied product. Another it also tells about the industrialization brings the ample amount of job opportunities, which helps in enhancing the socio-economic status of the people. The Alloys industry is also generating the huge employment but also the quantity of employment is good and quality of the employment remains takes a huge questions?

Chapter 3

Industrial Pollution and Change of Agricultural Productivity

3.0 Introduction

Rising population, industrialization and unsustainable development pattern have contributed towards environmental degradation. This can be seen in the form of transformation of lakes, rivers, and coastal waters into sewage depots, water crisis, air pollution and climate change. The industrial and agriculture sector consumes fossil fuel, water, and topsoil at unsustainable rates thereby causing air pollution, water pollution, soil pollution, soil depletion and decline in biodiversity. Numerous studies observed that industrial sector is one of the major sectors causing water pollution. Industries release effluents containing chemicals and biological matter into water which increases the oxygen demand in water. Apart from this, industrial wastes contain chemicals and heavy metals such as arsenic, lead, mercury, cadmium, zinc, dust and slag etc., which are harmful for the entire ecosystem, specifically to human health. The impact of such pollution is found in the food chains in many places (Reddy. V., 1998; pp. 26-36). Toxicity of water bodies through the discharge of industrial effluents are a global concern now (Khan Rao, A.A and Khan, M. A, 2009; pp. 121-128). Further, there are many empirical studies on agricultural related environmental problems, such as soil degradation, water erosion while there are few studies that deal with environmental problems in the agricultural sectors due to industrial pollution.

Existing biological evidences suggest that pollution leads to a reduction in health (Emberson et al., 2001; pp.107–118. Maggs et al., 1995; pp. 1311–1316 and Marshall et al., 1997; pp. 1-24). The effects are present not only among agricultural producers but extend to other residents in rural areas. The compositional change in the local population (i.e. migration) or a change in agricultural practices due to a weakening of property rights for example, by planting fewer cocoa trees as in (Besley, T, 1995, pp. 903–937). Another argument of a solid basis is that growth in agriculture is a key engine for growth, not least to start a growth process in pre-industrial economies. Beyond the more narrative approaches in the macro models of growth with an explicit agricultural sector provide similarly strong predictions of the role of agricultural productivity growth in overall growth (Eswaran and Kotwal, 1993; pp.243-269, Echevarria, 1997; pp. 431-452 and Gollin, Parente and Rogerson, 2007; pp. 160-164). Industrial agriculture depends on expensive inputs from off the farm (e.g. pesticides and fertilizer), many of which generate

wastes that harm the environment and uses large quantities of non-renewable fossil fuels and it also tends toward concentration of production, driving out small producers and undermining rural communities. The following environmental and public health concerns are associated with the prevailing production method (Horrigan. and et al., 2002, pp.445-456). Metals accumulate in sewage sludges from domestic and industrial sources. Where such sludges are used in agriculture, the metals may contaminate land to such an extent that the quality and yield of crops is affected (Coker, E.G and Mathews, P.J. 1983., pp. 209-225).

Another study is the effect of pollution on the livelihood of the people in river Musi, Hyderabad. The direct impact of water pollution can be observed by fall in agricultural yield, increase in input cost for agriculture decline in milk production etc. Further, drinking the untreated or partially treated water increased the incidence of cholera, gastroenteritis, arthritis, malaria, typhoid, jaundice, eye diseases, paediatric problems, skin diseases etc. (Cheepi, 2012, pp.40-51). The industrial belt shows the effect of industrial pollution on the agricultural productivity, irrigation capacity and livestock in the area. The industrial pollution results to decrease in agricultural productivity (Behera, B., Reddy, V., 2002, p.1250).

3.1 Environmental Valuation Approach

Economic valuation of environmental goods and services is an approach to make the value of the environment visible. The strategy for environmental valuation is the co-modification of the services that the natural environment provides. It also assesses individual and group priorities and trade-offs in the case of non-priced scarce commodities (Sundberg, S.P., 2011, p.11). Environmental amenities are beneficial only to the extent that human beings value them. Their value remains what people are willing to sacrifice for that amenity (Mendelson, R.S. Olmstead; 2009, p.326). The economic value of an environmental resource as an asset can be estimated or defined as the sum of the discounted present values of the flows of all goods and services from the resource over its productive life span (Singh, K. and Shishodia A, 2007; p.126). The techniques used for measuring the economic value of environmental amenities and disamenities in the absence of an explicit market can be classified into two categories such as revealed preference and stated preference methods (Garrod, G., K.G. Willis, 1999; p.35). There came in further classified into direct and indirect approach, which is based on the observation of behavior in a real market (through voting, parallel markets or consumer

surplus) or behavior in a hypothetical market (contingent valuation surveys reveal a person's willingness to pay for an improvement in environmental quality). The productivity change method, the replacement cost method, it comes under the RPM and the contingent valuation method holds the direct approach. The indirect techniques do not seek to directly measure individual preferences. They calculate a dose-response relationship between pollution and some effect, and only then some measure of preference for that effect is applied. The travel cost method, hedonic price method and contingent ranking method hold to the indirect approach (Pearch and Turner, 1990; p.142).

3.1.1 Revealed Preference Method

Revealed preference methods seek natural experiments to estimate the demand function for an environmental good. They use actual behavior of individuals as revealed in the market. The productivity change method, replacement cost method, travel cost method and hedonic pricing method can be classified as revealed preference methods.

3.1.2 Productivity Change Method: The productivity change method, also deals with the production function approach or derived value method is used to estimate the economic value of ecosystem products or services that contribute to the production of commercially marketed goods. It is applied in cases where the products or services of an ecosystem are used, along with other inputs, to produce a marketed good. The productivity change method first quantifies physical changes in production due to environmental quality changes. Then market prices are used to value the productivity changes attributed to environmental quality changes. The monetary values thus obtained are incorporated into the economic analysis of the project (Gunatilak, H.M., 2003; p. 99). Market prices can often be used to value the output from a productive process and environmental conditions often affect such processes. In these circumstances, values for a change in the environment can be derived from the associated change in productivity. An increase in output due to the change is a measure of an increase in benefit, and a decrease in output is a measure of an increase in cost (Australian Government Publishing Service; 1995).

The productivity change methods are classified into two techniques, which is direct and indirect technique. Direct approaches such as Contingent valuation methods (CVM) and indirect approaches such as effects on production (EoP), replacement costs (RC), and human capital approaches (HC). These approaches are analyzing below following.

(a) The effects on production approach: The effects on production approach are principle states that an activity may affect the output, costs and probability of producers through its effect on their environment. If there is a market for goods and services, the effects of environmental impact can be stated that the value of the change in output (Winpenny. J.J, 1991; pp. 170-171).

(b) Replacement costs: This method said that if the environment has already been damaged, in order to restore it to its original state the people have to spend money. For instances, the victims of environmental damages replace their environment by moving away from the affected area. This costs incurred by the victims in moving to clean an environment are known as replacement costs (Winpenny, J.J, 1991; p.48).

(c) Human capital: The human capital approaches are considered as the people as the economic capital and their earnings as return on investment. Environmental economics focuses on the impact on human health because of the bad environmental situations, and its effects on individuals and society's productive potential (Winpenny, J.J., 1991; pp. 170-171).

The empirical approaches of measurement of productivity change in agriculture sector. Solow (1957) suggested that measure of productivity change (which is labelled as residual or total factor productivity (TFP) change), in other way to defined as the rate of change of output per unit of an aggregate measure of input, is nothing but the index of technical change when constant (unitary) returns to scale (CRS) production technology is assumed. If the technology is non-CRS input markets are competitive, the TFP change is decomposed into technical change and economies of scale (Denny, Fuss, and Waverman ,1981; p. 179-218).

In our study of Balasore Alloys industry, an attempt has been made to understand the environmental issues in agriculture sector arising out of industrial pollution. In order to encapsulate the productivity and to measure the value of various changes that took place in this sector due to rising industry related pollution, productivity change method has been applied.

3.2 Analysis of Data

3.2.1: Pattern of Operational Land Holdings in study areas

Table 3.1 shows that the village wise operational land holding in the Balasore Alloys industrial area. There are two villages, viz., Balgopalpur and Sireipur, which are affected

by the Alloys industries and another village viz., Gourpur which is not- affected by the study. It is located at 5 kms away from the Alloys industry. Most of the villagers are mainly engaged in Alloys industry and few households are into agriculture. Due to Alloys industry establishment, there are people who have lost their cultivable land. In this study, we can describe the land size of the cultivable area and land size is also categorized into marginal small, semi-medium, medium and large in NSSO reports. The total 120 households are in the three villages; out of 93 households is operating agriculture. The rest 27 households are engaged in other sectors. In Balgopalpur village, there are 69.57 per cent farmers who are semi-medium landholders, 13.04 per cent are small size landholders, and 8.7 per cent are marginal size landholders. The total land holding cultivations are of 23 acres of land in Balgopalpur village. In case of Sireipur village, majority of the households, i.e., 60.00 per cent are semi-medium and 26.67 per cent have small land holding size and 8.7 per cent have landholdings of medium size. The land holding size of the Gourpur village can be categorized into the 25.00 per cent having small size land holding, whereas Semi-medium land holders are 45.00 per cent and 30.00 per cent come under the Medium size landholders.

Table 3.1: Village wise Operational Land Holdings

Village/land	Marginal	Small	Semi-medium	Medium	Large	Total
Balgopalpur	2 (8.7)* (66.67)**	3 (13.04)* (14.29)**	16 (69.57)* (30.77)**	2 (8.07)* (11.76)**	0 (0.00)* (0.00)**	23 (100.00)* (24.73)**
Sireipur	1 (3.33)* (33.33)**	8 (26.67)* (38.01)**	18 (60.00)* (34.62)**	3 (10.00)* (17.65)**	0 (0.00)* (0.00)**	30 (100.00)* (32.26)**
Gourpur	0 (0.00)* (0.00)**	10 (25.00)* (47.62)**	18 (45.00)* (34.62)**	12 (30.00)* (70.59)**	(0.00)* (0.00)**	40 (100.00)* (43.01)**
Total	3 (3.23)* (100.00)**	21 (22.58)* (100.00)**	52 (55.91)* (100.00)**	17 (18.28)* (100.00)**	0 (0.00)* (0.00)**	93 (100.00)* (100.00)**

Source: Estimated from field data.

Note: Values in parentheses are percentage of total. *Row percentage **Column Percentage. The operational land holding size are estimated from NSSO Reports. Ranges up to (0-1 hectare) "marginal".(1.0-2 ha) "small", (2.0-4 ha)"semi-medium", (4.0-10.0 ha) "medium and (10.0- above) "large").

3.2.2 Caste and Village wise average size of pattern of land holding of the Study area.

Table 3.2 reflects that the caste and village wise average size of operational land holding in the Balasore Alloys industry area. In this study, we can analyze the land holding pattern to cultivate the agricultural activities in three villages and their average size of land is 2.84 acers of land, 3.03 acres and 3.54 acers respectively. Similarly, in case of caste basis the average size of land holding is 3.10 acers of general caste, 3.58 acres are Other Backward Caste, 2.98 acres are in Scheduled Caste and 2.63 acres is Scheduled tribe respectively.

Table 3.2 Caste and Village wise average size of Land holding of the Study area

Caste/ land size	Mean of land (in acers)	Village/ land size	Mean of land (in acres)
General	3.10	Balgopalpur	2.84
OBC	3.58	Sireipur	3.03
SC	2.98	Gourpur	3.54
ST	2.00		
Average	3.20	Average	3.20

Source: Estimated from field data.

3.2.3 Caste wise Operational Land Holdings of the Study area.

Table 3.3 depicts the caste wise operational land holdings of the Balasore Alloys industrial area. Considering land holding size, households are categorized into marginal, small, semi-medium and medium. The maximum frequency in case of General category is seen in case of semi-medium land holding with a percentage of 57.69 per cent followed by small (23.09 per cent) and medium landholdings (15.38 per cent). In the OBC category, 51.61 per cent are Semi-medium sized landholding followed by 16.13 per cent small and 32.26 per cent of medium land holding size. Similarly, in the Scheduled Caste category 59.38 per cent farmers are semi-medium landholdings, 25.00 per cent possess small land holding size and 9.38 per cent have medium landholdings. It also reflects landholding pattern of the Scheduled Tribes. In this category, 18.28 per cent are total cultivations of landholdings, 50.00 per cent are small landholdings and 50.00 per cent are semi-medium landholdings under their possession. In other words, total 120 households, among the 93 households are operated in cultivation and rest of the households are depends on any other sectors in the area. Similarly, most of the scheduled caste and scheduled tribe caste are cultivated paddy crops in lease- in basis in the area.

Table 3.3: Caste wise Operational Land Holdings (in hectors)

Caste/ land size	Marginal	Small	Semi-medium	Medium	Large	Total
General	1 (3.85)* (33.33)**	6 (23.09)* (28.57)**	15 (57.69)* (28.85)**	4 (15.38)* (23.53)**	0 (0.00)* (0.00)**	26 (100.00)* (27.96)**
OBC	0 (0.00)* (0.00)**	5 (16.13)* (23.81)**	16 (51.61)* (30.77)**	10 (32.26)* (58.82)**	0 (0.00)* (0.00)**	31 (100.00)* (33.33)**
SC	2 (6.25)* (66.67)**	8 (25.00)* (38.01)**	19 (59.38)* (36.54)**	3 (9.38)* (11.76)**	(0.00)* (0.00)**	32 (100.00)* (34.41)**
ST	0 (0.00)* (0.00)**	2 (50.00)* (9.52)**	2 (50.00)* (3.85)**	0 (00.00)* (0.00)**	0 (0.00)* (0.00)**	4 (100.00)* (4.30)**
Total	3 (3.23)* (100.00)**	21 (22.58)* (100.00)**	52 (55.91)* (100.00)**	17 (18.28)* (100.00)**	0 (0.00)* (0.00)**	93 (100.00)* (100.00)**

Source: Estimated from field data.

Note: Figures shows parentheses are percentage of total. *Row percentage **Column Percentage. The operational land holding size is estimated in NSSO Reports. Range up to (0-1 ha) "Marginal". (1.0-2 ha) "Small",(2.0-4 ha) "Semi-medium", (4.0-10.0 ha) "Medium and (10.0- above) "Large").

3.4 Agriculture Production, Productivity and Value of Production

Table 3.4 depicts that the agriculture production & productivity and their total value per acre in the area of Balasore Alloys industry. Studies on productivity change into efficiency of change, technical change, and scale effects have alternative approaches using the parametric production, cost, and profit functions. Some studies on agricultural production and productivity in terms of value of the rice output (Ester et al., 1977, p.101). (Kumbhakar, S. C; M. Denny and M. Fuss, 2000; pp. 425-460). In this study area, we can analyze the village wise production of paddy crops. The total productions of paddy in two villages are 16.52 and 18.33 in quintals, in compare to Gourpur village i.e. 29.05 in quintal of total production of paddy. Similarly, agriculture productivity is also lowers in the two village viz., Balgopalpur and Sireipur i.e.5.57 in quintals and 6.32 in quintals per acre respectively. The total value of agricultural production and productivity are declining in per acre i.e. Rs.8108.7 and Rs.9362 respectively due to the impact of Balasore Alloys industry. On the other hand Gourpur village of their agricultural production, productivity and total value are 29.05 quintals and 8.10 quintals of Rs.12246.1 increasing in per acre, which is non-affected village is near about 5 k.ms distance from the Alloys industry.

Further, we also compare to the caste wise in agricultural production and their productivity in the area. The general category of this area is less amount of cultivated land in the agriculture because they have depended on other sectors. Few farmers are depend on agriculture production is 18.87 in quintals of paddy crops and their getting low productivity i.e. 6.08 quintals in per acres and Rs.9180.8 of the total value in per acre. In case of OBC and Scheduled caste of this area are getting agricultural production and productivity is 27.68 and 19.72 in quintals of paddy. It also increase their agricultural productivity is 7.61 and 6.53 quintals and also increases their total value cost is Rs.11491.1 and Rs.9860.3 respectively in per acres respectively. Most of the Scheduled Tribe caste also deepened on agricultural production of paddy is 20.5 in quintals and productivity is rising to 7.79 in quintals in per acres. The total value in per acre i.e. Rs. 11762.9 increases in compare to other category of the area. Furthermore, the operational land holdings on the basis of agricultural production and productivity in the area. The total agriculture production in marginal land holder is getting 0.53 in quintal and also their productivity is 2.67. In case of small land holder is getting production of paddy 14.24 in quintals and productivity is 7.82 in quintals per acres. The total value of agriculture production is Rs.4031.7. Also it is lowest rate of agricultural production in the area. The medium size of landholders is getting highest agricultural production and productivity. This is the 40.06 in quintal and 7.56 in quintals in per acre. The total value of agricultural production is getting higher amount i.e. Rs.11415.6 in per acre.

Table 3.4 Agriculture production and productivity & Total value

Indicators	Production (In quintals)	Productivity (quintals/acre)	Total Value (Per acre)
Village wise			
Balgopalpur	15.70	5.37	8108.7
Sireipur	17.95	6.20	9362
Gourpur	29.05	8.11	12246.1
Caste wise			
General	18.87	6.08	9180.8
Other backward caste	27.68	7.61	11491.1
Scheduled Caste	19.72	6.53	9860.3
Scheduled Tribe	20.5	7.79	11762.9
Land holding wise			
Marginal	0.53	2.67	4031.7
Small	14.24	7.82	11808.2
Semi-medium	20.77	6.41	9679.1
Medium	40.06	7.56	11415.6

Source: Estimated from field data.

Note: The total values are estimated from minimum support price Rs.1510, Agriculture Census of Government of Odisha 2016. Productivity =Production/total land size. TV= Productivity*1510 (in Rs.)

3.5 Agriculture Input Cost

Table 3.5 shows that the agriculture input cost of production on the village, caste and operational land holding wise. In this study, we can estimate the caste basis agricultural production and input cost of agricultural items. In case of Balgopalpur and Sireipur village, which is used the agriculture input cost in per acre. The fertilizer cost is Rs.723.51 and Rs.775.4, pesticides cost is Rs.86.79 and Rs.98.39, cost on seeds is Rs.84.78 and Rs.101.33, agricultural equipment cost is Rs.775.36 and 840.22, cost of machine is Rs.91.74 and Rs.96.83. Also they have used irrigation through the surface water and ground water, which cost in per acre is Rs.81.16 and Rs.78.33 respectively. The cost on male labour is Rs.274.35 and Rs.305.56 and female labour i.e. Rs.339.49 and Rs.375.The total cost cultivation of paddy i.e. Rs.2612.25 and Rs.2834.12 per acre in one of season. These two villages are affected by the Alloys industry and Gourpur is non-affected village that production and productivity also significantly higher. The general category of the area they are using the cost of fertilizer is Rs. 731.85, cost of pesticides is Rs. 95.19, seeds cost is Rs.103.08, agricultural equipments cost is Rs.837.18, use of surface water and ground water cost is Rs.76.92 and Rs.156.41, cost of repairing machine is Rs. 129.36 and labour cost is Rs.358.33 and female cost is Rs.419.55 respectively. Similarly the per acre input cost on agriculture production of Scheduled caste category are using more cost on agricultural production and their production, productivity and total input cost are highest. In this area, majority of scheduled caste of peoples are engaged in agricultural sector. Whereas they are cultivating own land or work as tenants or leased in land. Furthermore, the small size of landholder are using input cost is higher on agriculture production in per acre followed by the fertilizer cost is Rs.746.33, pesticides cost is Rs.87.9, cost on seeds is Rs.81.55, cost on agricultural equipments is Rs.735.24, repairing machine cost is Rs.201.19, surface water and ground water cost is Rs.100 and Rs.207.14 and cost of male labourer is Rs.485.71 and female cost price is Rs.555.48. The cost of male is getting per days wages Rs. 200 per days and female labour cost is Rs. 140, 160 and 170 per days of wages. We can found that the female labourers get discriminated wages in this area. In case of medium land holders are also use the input cost on agricultural production and the lowest rate of input cost are using in their paddy field in marginal land holder of the area, compared to Semi-medium landholders in the area.

Table 3.5 Caste, Village and Operational land holding wise Input Cost of Production (per acre)

Indicators	Fertilizer (in Rs.)	Pesticides (in Rs.)	Seeds (in Rs.)	Agriculture equipments (in Rs.)	Machine (in Rs.)	Surface Water (in Rs.)	Ground Water (In Rs.)	Cost of male labour (in Rs.)	Cost of female labour (in Rs.)	Total Cost (in Rs)
Village wise										
Balgopalpur	723.51 (27.70)	86.79 (3.32)	84.78 (3.25)	775.36 (29.68)	91.74 (3.51)	81.16 (3.11)	155.07 (5.94)	274.35 (10.50)	339.49 (13.00)	2612.25 (100.00)
Sireipur	775.4 (27.36)	98.39 (3.47)	101.33 (3.58)	840.22 (29.65)	96.83 (3.42)	78.33 (2.76)	163.06 (5.75)	305.56 (10.78)	375 (13.23)	2834.12 (100.00)
Gourpur	791.15 (24.67)	109.44 (3.41)	120.06 (3.74)	903.33 (28.17)	176.04 (5.49)	70 (2.18)	183.75 (5.73)	364.58 (11.37)	488.1 (15.22)	3206.45 (100.00)
Average	769.34	100.27	105.3	851.33	129.64	75.45	169.98	323.23	414.87	2939.41
Caste wise										
General	731.85 (25.17)	95.19 (3.27)	103.08 (3.54)	837.18 (28.79)	129.36 (4.45)	76.92 (2.65)	156.41 (5.38)	358.33 (12.32)	419.55 (14.43)	2907.87 (100.00)
OBC	777.72 (26.75)	104.11 (3.47)	114.27 (3.81)	886.02 (29.52)	139.25 (4.64)	66.67 (2.22)	174.73 (5.82)	314.52 (10.48)	423.95 (14.13)	3001.24 (100.00)
SC	796.71 (27.41)	99.42 (3.42)	99.69 (3.43)	831.46 (28.60)	116.46 (4.01)	81.77 (2.81)	165.89 (5.71)	312.29 (10.74)	403.28 (13.87)	2906.97 (100.00)
ST	729.17 (24.93)	110.42 (3.78)	95 (3.25)	833.33 (28.49)	162.5 (5.56)	83.33 (2.85)	254.17 (8.69)	250 (8.55)	406.67 (13.91)	2924.59 (100.00)
Average	769.34	100.27	105.3	851.33	129.64	75.45	169.98	323.23	414.87	2939.41
Land holding wise										
Marginal	216.67 (14.51)	137 (9.17)	36.67 (2.46)	300 (20.08)	30 (2.01)	200 (13.39)	50 (3.35)	203.33 (13.61)	320 (21.42)	1493.67 (100.00)
Small	746.33 (23.32)	87.9 (2.75)	81.55 (2.55)	735.24 (22.97)	201.19 (6.29)	100 (3.12)	207.14 (6.47)	485.71 (15.18)	555.48 (17.36)	3200.54 (100.00)
Semi-medium	757.61 (26.29)	96.89 (3.36)	104.23 (3.62)	858.33 (29.78)	119.55 (4.15)	66.67 (2.31)	170.83 (5.93)	307.69 (10.68)	400.38 (13.89)	2882.18 (100.00)
Medium	931.18 (30.56)	119.41 (3.92)	150 (4.92)	1070.59 (35.14)	89.71 (2.94)	50 (1.64)	142.65 (4.68)	191.18 (6.27)	302.21 (9.92)	3046.93 (100.00)
Average	769.34	100.27	105.3	851.33	129.64	75.45	169.98	323.23	414.87	2939.41

Source: Estimated from field data. Note: Agriculture input of cost is estimated in monetary terms. The parenthesis values are in per cent of total.

3.6: Village, Caste and Land holding wise Net Profit of Paddy.

Per acre net profit for paddy has been estimated in village, caste and land holding wise (Table 3.6). In case of Balgopalpur and Sireipur village per acre total value of paddy cultivation is Rs. 8108.7 and Rs. 9362.0. They have input cost on their agricultural activities is Rs.2612.12 and Rs. 2459.12 in per acres. On the other hand getting less amount of profit is Rs.5496.58 and Rs. 6527.88 respectively. This leads to the impact on alloys industry on their cultivated land. In compare to another village of Gourpur, which is the total value is higher of productivity is Rs. 12246.1 and the total input cost is Rs. 3206.45 and also higher in net profit i.e. Rs. 9039.65. Basically this village is non-affected by the Alloys industries. Furthermore, we can analyze the Caste wise of agricultural productivity and input cost of production. The general category of the area is receiving the total value of the agricultural productivity is Rs. 9180.8, the total input cost of production is Rs. 2907.87 and the getting net benefit is Rs.6272.93 per acre. Also, they are getting less profit in compare to other categories in this area. In case of OBC and ST category of the area are receiving higher benefit i.e., Rs.8489.86 and Rs. 8838.31, the total value is Rs. 11491.1 and Rs.11762.9 and total input cost is Rs. 3001.24 and Rs. 2924.59 in per acre in agricultural production and net benefits in the area. Furthermore, the operational land holding in the area. In case of marginal land holder are getting less total value of Rs. 4031.7, total cost in per acre is Rs. 1439.67 and net profit i.e., Rs. 2592.03. The semi-medium land holder is also less net profit i.e., Rs. 6796.92, total cost is Rs. 2882.18 and the total value of Rs. 9679.1 in the industry area. Similarly, the higher net benefit are getting the small and medium land holding size in the area, which the total value of Rs. 11808.2 and Rs. 11415.6, total cost of Rs. 3200.54 and Rs. 3046.93 and the net profits of agricultural production i.e., Rs. 8607.66 and Rs. 8368.67 respectively. The agricultural production and productivity in the affected villages are lower compared to those of non-affected villages due to impact on Balasore Alloys industry.

Table 3.6 : Village, Caste and Land holding wise Agriculture Net profit (in Rs.)

Indicators	Total Value (in Rs.)	Total Cost (in Rs.)	Net Profit (in Rs.)
Village wise			
Balgopalpur	8108.7	2612.12	5496.58
Sireipur	9362.0	2834.12	6527.88

Gourpur	12246.1	3206.45	9039.65
Average	10298.2	2939.41	7358.79
Caste wise			
General	9180.8	2907.87	6272.93
OBC	11491.1	3001.24	8489.86
SC	9860.3	2906.97	6953.33
ST	11762.9	2924.59	8838.31
Average	10298.2	2939.41	7358.79
Land holding size			
Marginal	4031.7	1439.67	2592.03
Small	11808.2	3200.54	8607.66
Semi-medium	9679.1	2882.18	6796.92
Medium	11415.6	3046.93	8368.67
Average	10298.2	2924.59	7373.61

Source: Estimated from field data.

3.7 Impact of Various factors on Agricultural Productivity on study area.

The productivity of paddy cultivation is affected by various factors, which is captured in regression model as below.

$$\mathbf{Y_i = \alpha_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \mu_i}$$

Here, Yi = productivity of rice per acre (in Rs.), α1=constant, β_1, β_2, β_3, β_4, β_5, β_6 are Coefficient value of their respective inputs. μi= error term, $X_{1=}$ the cost of fertilizer, $X_{2=}$ the cost of pesticides, $X_{3=}$ the cost of seeds, X_4= the cost of agricultural equipments, X_5 = the cost of repairing machine, $X_{6=}$ the cost of Irrigation (surface water and ground water), $X_{7=}$ the cost of agricultural labour.

Empirical Results

Most of the farmers are using the chemical fertilizer, pesticides, genetically modified seeds, agricultural equipment and other sources of cultivation related machines. The empirical results show that use of chemical fertilizers, pesticides, seeds, and repairing machineries are positively associated with paddy productivity. The irrigation systems of the cultivation of paddy crops in the area are negatively associated. In the same way to confine the agricultural equipments are also negatively determined in the agricultural activities in the area. Whereas, the use of agricultural equipments cost are difference in factor in case of cultivated in Paddy crops in the area. There is much difference in agriculture equipment such as tractors, power

tillers and etc. The different cost prices of agricultural machinaries are Rs.800, Rs. 950, and Rs. 1200.00 respectively.

Table 3.7: Impact of various factors on agricultural productivity

Variables	Coefficient	R^2	F statistics
Irrigation	0.000 $(-0.17)^{NS}$	0.4573	10.23
Fertilizer	0.002 (5.45)*		
Pesticides	0.001 $(0.46)^{NS}$		
Seeds	0.010 (3.98)*		
Agriculture equipments	-0.003 (-5.89)*		
Repairing of Machine	0.001 $(0.81)^{NS}$		
Agricultural Labour cost	0.001 (2.13)**		
Constant	4.995 (6.88)*		

Source: Estimated from field data.

Note: Values in Parenthesis are t values. Further,(* signifies 1 per cent significant and ** signifies 5 per cent significant and *** signifies 10 per cent significant, NS are the Non-significant.).

3.8 Major Findings and Conclusions

An agricultural production and productivity gets affected due to industry. Most of the people lost their cultivated land due to establishment of Alloys industry in the area. The mean land size of Balgopalpur and Sireipur villages is 2.84 acres and 3.03 acres respectively. These two villages are affected by Alloys industry and another village is Gourpur. Which is 5 kms far away from the industry and mean operational land size is 3.54 acres. Further, we can found that the village wise agricultural production, productivity and total value in the area of cultivated paddy crops in khariff seasons. The Balgopalpur and Sireipur village of agriculture production and productivity are lower compared to non-affected villages i.e., Gourpur. Now we can observe that the Gourpur village is "Better off" and Balgopalpur and Sireipur are

"worse off". Similarly, in the study there is caste wise disparities in agriculture production and productivity in the area. In case of OBC and Scheduled caste are also higher agricultural activities in compare to general category in the area. Furthermore, we can found that the operational land holding wise of agricultural production, productivity and total value. The small, semi-medium and medium landholdings of their agricultural production and productivity are higher in the area.

Here, we can also found that the village, caste and operational land holding wise input cost of production in per acre. The Balgopalpur and Sireipur villages are used agricultural inputs and their cost is relatively lower in case of non-affected villages in the area. In the same way, the OBC are used higher input cost in their cultivated land in per acre. Also, the small and medium land holding sizes are using higher input cost of agricultural production. Similarly, the caste, village and operational land holding size are getting net benefits are receiving less in two villages, which is affected by industry and higher benefits is getting in Non-affected villages in the area. The low levels of agricultural production and productivity in the area due to affected by Balasore Alloys Industry.

Chapter 4

Industrial Pollution and Health Cost Measurement

4.0 Introduction

Iron and steel industry is one of the most important industries in India. Alloys industry is one of the oldest and ranked amongst the ten topmost export-oriented industries of the country. The main centers of alloys industry are located in the state of Andhra Pradesh, Odisha, Maharashtra, West Bengal, Jharkhand, Karnataka, Chhattisgarh, and Tamil Nadu. During 2014-2015, India was the third largest producer of raw steel and the largest producer of sponge iron in the world. The industry produced 91.46 million tons of total finished steel and 9.7 million tons of pig iron. Most iron and steel in India is produced from iron ore. Balasore occupies a prominent place considering the diversified product range. The product range includes semi-finished and finished goods.

Most of the alloys industries in Balasore are located in the coastal areas. Which has the population of 2,317,419 (Census, 2011). It is a major industrial zone of Balasore district of Odisha. Various studies observed that the concentration of dust is beyond the permissible limit in the residential zone which is 100 m away from the crusher units (Amitshreeya. R, and Panda, R.B, 2011; pp.1-3**).** Another study revealed that groundwater quality around the Balasore alloys industrial area of Balgopalpur is not good for consumption (Das, K. K. et al., 2013, p.863). Due to open cast mining process, lots of over burden is being generated and leaching from this overburden adds the hexavalent chromium to ground water regime in Sukinda Valley (Mishra, H, and Shau, H.B., 2013, p.287-292). Another study found on the effects the human health of source and distribution of metals in bed sediments of Subarnarekha River, Balasore (Giri, S, and et al., 2013, pp.3381-3392). The Submerged Arc Furnace (SAF) process is most widely used in the industrial production of high-carbon ferromanganese. This process requires lump ore and reductants of 6–75 mm as feed material to ensure sufficient gas permeability through the material bed (Habashi, F, 1997; pp.420–437). Aluminum is the third most abundant element found in the earth's crust (Gupta *et al.*, 2013, pp.21-37). Aluminum occurs naturally in the air, water and soil. Mining and processing of aluminum elevate its level in the environment (Agency for Toxic Substances and Disease Registry, 2010, pp.1-357). Recently arguments on environmental toxicology

revealed that aluminum may present a major threat to humans, animals, and plants in causing many diseases (Barabasz *et al.*, 2002, pp.199-203).

According to World Health Organisation, these heavy metals have a lethal impact on public health and they enter the food/water chain. Cadmium is a potent kidney toxicant and mercury is a potent neurological toxicant. Other metals are potent sources of renal, neurological, skin diseases and blue baby syndrome affecting infants. The ground water in the land quality and surface water in the area due to the discharge of effluents from the slug in the industrial area of Sona river in Balasore. The waste water generated badly affected the groundwater and soil quality of the area. It also affected the productivity of agricultural inputs and declined land fertility of the soil. This creates harmful effects on the health of the people in the locality. Polluted ground water may cause the water-borne diseases, frequent fever, skin diseases and in eyes (Nasr, M.M. et al., 2011, p.390). Air pollution has lead to various respiratory diseases. It also leads to ulcers, joint pains, kidney and liver related problems.

Health effects can be studied under the mortality and morbidity effects. Mortality refers to death whereas morbidity can be known as deterioration of physical or mental health due to some illness or injury. 'Valuing health effect approach' can be defined as a technique to measure the economic costs of the health effect (Gunatilak, H.M., 2003, p.105). On the other hand, Freeman (1993) characterized morbidity as the parting from the state of physical or mental well-being due to as disease or injury of affected person is ignorant. Therefore, the present study is attempted to estimate the cost of morbidity of the affected and non-affected people of Balasore Alloy's industries on their health. Individual preference approaches are to be measured in terms of contingent valuation method and resource opportunities cost can be measured by the use of cost of illness method. The objective of this chapter is to measure the impact of industrial pollution on the health of the households, by measuring economic burden or cost of illness borne by the people living in this industrial zone. Further, it specifies the diseases caused due to contamination of water and industrial waste generated by Alloys industry. Some of the diseases considered are the water-borne diseases such as cholera, typhoid and fever. The skin diseases like dermatitis which is caused due to industrial waste, respiratory diseases such as tuberculosis, neurological diseases, kidney and liver related problems.

4.1 Cost of Illness Approach

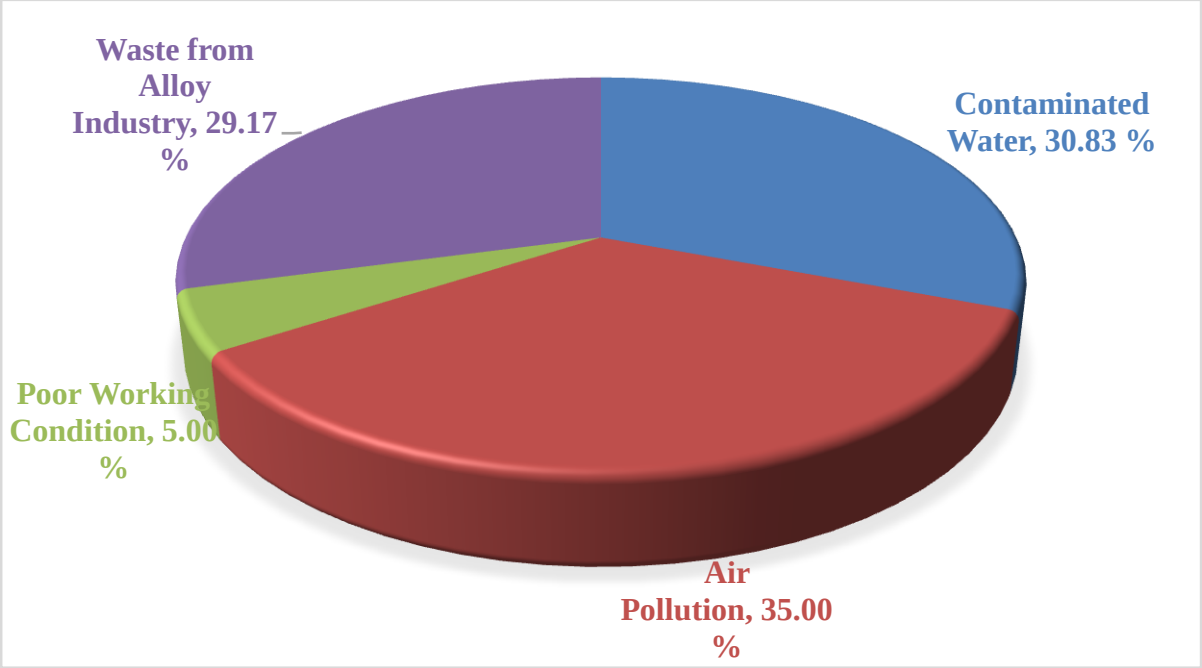
The cost of illness approach is one of the important methods which measures the health cost. It also is widely known as valuing reduced morbidity risk approach. These are specified for estimated through the diseases, or risk factors or a wider group of diseases or injuries. This approach to estimates the economic health cost expenditure incurred due to the adverse impact of environmental degradation. The cost also calculates direct costs and indirect costs. The total cost of illness is a summation of the direct cost of illness and indirect cost of illness. The direct cost constitutes the economic cost of medical care i.e. diagnosis, treatment, continuing care, rehabilitation, terminal care etc. (Hodgson, T.A., 1982). The indirect cost is a loss of earnings, fringe benefits and home production (Leigh, L.P., 2011, p.730). So, the loss of labour productivity is measured as the number of the days lost due to illness and the loss of wages on the following days comprised of indirect cost. The merits of cost of illness methods are that they have a valuable tool for promoting attention towards a particular illness or condition and stimulate the public policy debate (Finkelstein.E and Corso.P., 2003, p.367). The aim is to identify and measure all the costs of a particular disease, including the direct and indirect intangible dimensions. The output, also expressed in monetary terms, is an estimate of the total burden of particular diseases to society (Rice, D.P., 1994, p.1519). The cost of illness studies can be categorized as i) Prevalence studies and ii) Incidence studies. A prevalence study includes the cost in a given year of all cases arising in previous years as well as the current year. An incidence study also includes the cost in the current year and future years of cases arising in the current year.

4.2 Health Status of Households

The iron and steel industry is not only promoting development but is also a major source of air pollution, which causes significant health impacts (WHO, 2000). Nearly 35.00 per cent of respondents revels that the air pollution release form alloys industry as the major reasons for poor health conditions in the area (Figure 4.1). Another 30.83 per cent respondents are assumed to be consuming contaminated water, which is affecting their health conditions. Numerous diseases are occurred by the use of contaminated water. Water-borne diseases such as cholera, typhoid, and fever occur due to contaminated water. Other 5.00 per cent opined that poor working conditions in the factories are responsible for the health hazards. However, about the 29.17 per cent agreed that the waste generated from Alloys and Immami

Paper Mills is the reason for health problems in the area. Skin diseases like dermatitis are caused due to industrial waste. In addition, these wastes serve as important factors in affecting productivity levels in agriculture and degradation of soil in the area.

Figure 4.1: Awareness of Households regarding reasons of Diseases in the Area



Sources: Estimated from field data

Table 4.1 shows that the 66.03 per cent are suffer from water-borne a disease, which is caused by the use of contaminated water by the alloy industrial waste. Also, 47.22 per cent of people are suffered from other diseases such as joint pains, eye infection and kidney and liver-related problems, which are also caused by contaminated water by heavy metals (Zhang, M., and Zhang, M., 2006). This can be clearly shown that the extent up to the waste generated from Alloys industry is polluting the groundwater, air and soil of the area and is the highly affecting the health of the people. The other diseases are also affecting in this area which is most important determinants to cause degraded their poor health due to the Alloys industry. The iron and steel industry causes the significant effects on environment e.g., air, water, and soil. Other significant emissions from the basic oxygen process are mainly heavy metals and fluorides. During the electric steel, making is melting iron oxide, refining, calcium oxide from slag and charging iron and metallic oxides from the alloy in the scrap. However, the semi-finished product preparation the pollution is produced from the pouring of the molten steel are scarped effects into the atmosphere (Doushanov, D.L., 2000, pp.92-100).

The aluminum industry is hazardous to both the workers and the community. The pulmonary hazards are significantly higher in workers who are continuously exposed to gasses and pollutants for more than 8 h/day (L.H. Shaaban et al. 2016, pp.537-543). The 64.69 per cent of people are affected by respiratory diseases and also 65.69 per cent suffer from skin diseases, which are also caused by dust and slag release from the alloys industries, Emmami Paper Mills, and various stone crusher has been set up in Balgopalpur Industrial Zones, Balasore district. Numerous studies were conducted on health related problems due to the air pollution, water pollution, soil pollution and degradation in forest resources **(**Amitshreeya. R, and R.B, Panda; pp. 1-3**).** Most of the people are affected by the joint pain, kidney related and neurological problems and 47.22 per cent it is due to the effect of Balasore alloys industry and peripherals set up by some industries. These diseases are causing low productivity, loss of wages and high level of health cost expenditure.

Table 4.1: Respondents suffer from various Diseases in the Study Area.

Type of the Diseases	**Number Respondents Yes**	**Number Respondents No**	**Total Number of Respondents**
Water borne	344 (66.03)	177 (33.97)	521 (100.00)
Skin Diseases	343 (65.83)	178 (34.17)	521 (100.00)
Respiratory Diseases	336 (64.69)	185 (35.51)	521 (100.00)
Other & (Joint Pain, Eye infection, Kidney and Liver-related Problems	246 (47.22)	275 (52.78)	521 (100.00)
Total Number of Respondents	521 (100.00)	521 (100.00)	521 (100.00)

Sources: Estimated from field data.

Note: Values in parenthesis are per cent to total.

4.3 Cost of Illness of Households

The poor health condition of the individuals in the area poses a great economic burden to them. Not only this, they are forced to spend a huge portion of their income for the treatment of these diseases. People are unable to go to work due to their poor health or because of ill health of their family members. This leads to a loss of their productivity and wages. Most of the individuals in the area are employed in Alloys industry or some other private jobs. This loss in productivity creates an extra economic burden on the people of the area.

The mean direct cost of illness for the households is Rs. 777.24 and the mean indirect cost is Rs.1872.8 (Table 4.2). The mean annual total health cost of illness for households is Rs. 2650.04. The total health cost is the major contributor to the cost of illness for the households in the area. It can be stated that the major burden for the households is loss in wages due to ill health of themselves or any other family member. There can be various reasons for the low direct cost of illness as compared to the indirect cost of illness. The low levels of earning and poor education of the households are some of the crucial factors that affect poor treatment of the diseases. The economic burden of these health costs is visible when the annual cost of illness goes on increasing.

The mean direct health cost is Rs.816.7 in the case of general category of the households in alloys industrial area. The mean of total direct health cost of illness is Rs.2930.7 of general category of the household of affected industrial area. Also, it signifies that the total direct cost of illness is 27.87 per cent and 72.13 per cent is an indirect cost of illness of general category. It also has the highest per cent with reference to other categories. Another aspect of the total annual cost of illness of social categories in the case of Other Backward Classes of people, who spends due to affected diseases is Rs. 760.43.

Table 4.2 reveals the cost of illness of the households in three village's viz. Balgopalpur, Serious, and Gourpur. Balgopalpur average direct cost of illness is Rs.855.0 and the mean indirect cost is Rs.2517.4. The average total health cost for Balgopalpur turns out to be Rs.3372.40. Similarly, the Sireipur village of their direct cost of illness is Rs.866.75 and indirect cost is Rs.1597.45 respectively. The health cost of illness is Rs. 2464.20 in this village. In Gourpur, the mean of direct cost is pegged at Rs.745.07 while the average indirect cost has been Rs.1805.17. The data reflects that the mean of the total health cost is

Rs.2550.24 of Gourpur village. The data revels that cost of illness is relatively higher in the affected village viz., Balgopalpur and Sireipur than that of affected. So, it is conclude that pollution caused by this industry has an adverse impact on health status of people and it has increased their health expenditure substantially.

Table 4.2: Household wise Cost of Illness

Parameters	Direct cost of Illness (Rs)	Indirect cost of Illness (Rs)	Total Cost of Illness (Rs)
Cost of Illness	777.24 (29.33)	1872.8 (70.67)	2650.04 (100.00)
Caste wise Cost of Illness			
General	816.8 (27.87)	2113.9 (72.13)	2930.7 (100.00)
OBC	760.4 (30.85)	1704.8 (69.15)	2465.2 (100.00)
SC	761.3 (29.02)	1862.1 (70.98)	2623.4 (100.00)
ST	753.4 (30.89)	1685.5 (69.11)	2438.9 (100.00)
Average	777.24	1872.83	2727.97
Village wise Cost of Illness			
Balgopalpur	855.00 (25.35)	2517.4 (74.65)	3372.40 (100.00)
Sireipur	866.75 (35.17)	1597.45 (64.83)	2464.20 (100.00)
Gourpur	745.07 (29.22)	1805.17 (70.78)	2550.24 (100.00)
Average	777.24	1872.83	2727.97

Source: Estimated from field data. Note: Values in parentheses are per cent to total.

Majority of general and OBC category of this area is having more expenses on medical care such as medicine, clinical test and travel cost. The average cost on medicine is Rs. 612.50 and Rs.559.42, cost on clinical test is Rs. 142 and Rs.150, and travel cost is Rs.47 and Rs.53 respectively. Scheduled Tribe spend on medicine cost, clinical test and travel cost, which is less on medical cost, is Rs.556.90, clinical test cost is Rs.132 and Rs. 54 in travel cost. There is some reason behind the low cost on medical care for ST category in the area due to

unawareness about their health. Also they face economic burden. Similarly the in Balgopalpur cost on medical care revels that the cost on medical expenses is Rs.655, clinical test cost is Rs.58.52 and travel cost is Rs.44. Further in case of Sireipur village people are also spends on health cost such as cost on medicine is Rs.663.75, clinical test cost is Rs.55 and travel cost is Rs.50 respectively. Furthermore, the Gourpur village is non-affected by the Alloys industry and they spend less on health care. The average cost on medicine is Rs.547, clinical test is Rs. 70.29 and travel cost is Rs.52.

Table 4.3: Caste and Village wise Mean Expenditure of various Components of Direct Cost (in Rs.)

Variables	General	OBC	SC	ST	Balgopalpur	Sireipur	Gourpur
Medicine expenses	612.50	559.42	586.63	556.90	655	663.75	547.6
Clinical test	142.50	150.43	155.25	132.5	58.52	55.8	70.29
Travel cost	47.67	53.91	50.74	54.83	44.5	49.63	52.48
Total cost	783.64	737.71	924.63	761.25	758.02	769.18	670.37

Source: Estimated from field data.

The occupational structure also plays a key role in the determination of cost of illness. Here, also a loss in a number of work days and total cost of illness is highest for those employed in Alloys industry, followed by the self-employed group. It also, noted that the occupational pattern also reflects the quality of occupational history assessments in working age group obtained by health-care providers and to measure the prevalence of clinician-diagnosed (Shofer, S and Kuschner, G.W., 2006., pp.455-462).

Table 4.4 shows that the Caste and village wise mean loss of work days and wages in the industrial area. The Scheduled caste the loss of work days is 20 days and loss of wages Rs. 5419.36 in annually. Similarly, in case of OBC background have a mean monthly wages of Rs 5027.1 and loss of work days is 27.3 Also, it is higher loss of work days. The general category also bear the average loss of wages Rs.6536.93, which is higher loss of wages compare to other category in the Balasore alloys industry area. On the other hand, the Scheduled Tribe category are higher loss of wages i.e., Rs.4845.88 and also they have loss of day i.e. 28. Furthermore, in Balgopalpur villages of people are bear the loss of work days i.e., 25.5 and Rs. 7397.4 on loss of wages, which is highest lost of wages and work days in the area. Similarly, Sireipur and Gourpur villages are lower loss of work days and wages. Both

the villages are loss of work days is 25, 22 and loss of wages in Rs. 4924.36 and Rs.5360.00 respectively.

Table 4.4 Caste and Village wise mean Loss of Work Days and Loss of Wages

Variables	Loss of Days	Loss of wages (in Rs.)
Caste wise loss of work days & Wages		
General	22.23	6536.93
OBC	27.3	5027.1
SC	19.76	5419.36
ST	27.72	4845.88
Average	23.13	5576.42
Village wise loss of work days & Wages		
Balgopalpur	25.5	7397.4
Sireipur	25.8	4924.36
Gourpur	22.15	5360
Average	23.13	5576.42

Source: Estimated from field data.

Note: (wage of various category are Self Employed & Business is Rs. 496.77, Public services is Rs. 327.68, Alloys industry services of Rs. 498.4 and wage labour is Rs. 190.36).

The mean total cost of illness for males is nearly ten times higher than that for females in the area (Table 4.6). It can be visible in case of direct cost of illness. The annual loss in work days for males is about 30 days, which is nearly ten times higher than the of females. Generally, when women are ill, they tend to delay seeking treatment until their symptoms are too severe, perhaps they visit a traditional healer or local pharmacy.

On the other hand, while men are ill, others encourage them to seek medical help, and hence they are appropriately diagnosed and treated earlier than women. They also receive greater care and are not expected to perform other duties until they are completely cured. Women are often paid fewer amounts for the same work as men, which mean that they have fewer resources to fall back once they become ill, and their control over their own earnings is often limited. These are few reasons for that the gender disparities in cost of illness in the area (Vlassoff C, et al., 1994, p.39; Ostlin P., 2000, p.5).

Table 4.5 depicts that it is highest for the working group along with a loss in working days among all age groups. The annual loss in work days for the old age group is nearly 30 of days while that for working group is nearly 28.74 of days, which is slightly less than a change of the loss in working days (Table 4.6). Out of the total people employed in this age group, nearly 46.91 of days are employed in Alloys industry. Moreover, those employed in alloys industry are working in this industry from long time and most of them have reported respiratory, water-borne and neurological problems of various diseases. It also contributes to a loss in productivity and resulting high values of indirect cost of illness for this age group. Same reasons are applied to the high value of indirect cost for working age group. The majority of the working age group, i.e., nearly 69.54 per cent is directly or indirectly employed in Alloys industry. Thus, it can be concluded that the indirect cost of illness is higher for the working group.

Education plays an important role in reducing risks of various diseases. Higher education means awareness regarding health hazards and knowledge of preventive measures from such diseases (Khan, M.Z.H., et al., 2010, p.15). With the increase in the education level of individuals, the cost of illness along with a loss in productivity decreases. The annual loss in working days is highest for the group with least education and it gradually decreases with increase in educational level. Similarly, in the case of indirect and total cost of illness the highest values are for the group with no education and it goes on declining with the increase in education level. This shows that education is an important parameter in reducing the economic burden of health hazard due to industrial pollution.

Table 4.5: Cost of Illness based on Household Characteristics

Parameters	Annual loss in work days	Direct cost of illness (Rs)	Indirect cost of illness (Rs)	Total Health cost of illness (Rs)
Gender				
Male	29.59	804.31 (29.85)	1890.17 (70.15)	2694.48 (100.00)
Female	3.38	694.51 (49.82)	1394.00 (66.74)	2088.51 (100.00)
Age group				
Child	0.00	783.75	0.00	0.00

School going	0.00	707.15	0.00	903.39
Working group	28.74	804.55 (29.61)	1912.55 (70.39)	2717.1 (100.00)
Old age group	30.00	792.19 (34.12)	1529.83 (65.88)	2322.02 (100.00)
Educational Level				
Illiterate	18.18	749.89 (31.52)	1629.04 (68.47)	2378.93 (100.00)
Up to primary	18.08	766.92 (28.13)	1959.03 (71.87)	2725.95 (100.00)
Up to higher secondary	23.52	772.38 (32.98)	1569.52 (67.02)	2341.9 (100.00)
Up to graduation	31.10	822.89 (21.11)	3074.94 (78.89)	3897.83 (100.00)
Post-graduation and above	51.00	956.00 (26.40)	2664.00 (73.60)	3620.00 (100.00)
Occupational Category				
Self employed & Business	48.00	814.12 (26.96)	2205.59 (73.04)	3019.71 (100.00)
Public services	52.00	733.33 (34.29)	1405 (65.71)	2138.33 (100.00)
Alloys industry	46.91	872.68 (30.46)	1992.38 (69.54)	2865.06 (100.00)
Wage labour	37.71	775.00 (54.97)	634.93 (45.03)	1409.93 (100.00)
Unemployed	0.00	701.11	0.00	809.39

Sources: Estimated from field data. Note: Values in parentheses are per cent to total.

4.4 Dummy Variable Analysis

In order to understand, the impact of the variables such as gender, age group, and occupational pattern have a significant effect on the cost of illness of the households in the Balasore Alloys industrial area, the dummy regression is used.

4.4.1 Impact of Gender on Cost of Illness

Gender plays a significant role in the determination of cost of illness. The cost of illness is a function of the gender of the individuals. The cost of illness for females is significantly lower than that for males (Table 4.4).

Cost of Illness = f (Gender)

$Y_i = \alpha_1 + \beta_1 D_{1i} + \mu_i$

Where, Y_i= Cost of illness, α_1 = Constant, β_1 = Differential of Coefficient, D_{1i} is gender, where, 1= male, 0 = female and μ= error term.

The direct cost of illness for females is nearly two and a half times lower than that for males. There is significant difference in direct, indirect and total health cost of illness for males and females. In those cases, the indirect cost and total health cost is difference is even higher. In other way to identify the total cost of illness for females is Rs.2088.51 and that for males is Rs.2694.48. The total health cost of illness for males is nearly five times higher than that for females. Similar trends are depicted in case of indirect cost of illness. Difference in income levels and involvement in economic activities are some of other few factors for this disparitities among males and females. Many times, women's do not turn up for their treatment of diseases due to their illness is very critical conditions, whereas men tend to get treatment quickly as they are major breadwinner of the family (Vlassoff C, et al., 1994, p.40).

Table 4.6: Results of Dummy Regression for Cost of Illness with Gender

Dummy Variable	Coefficient	t value	R^2	F
Total direct cost of illness				
α_1	694.507	(18.39)*	0.0218	6.37
β_{1i}	109.8017	(2.52)*		
Indirect cost of illness				
α_1	1394	(1.74)*	0.0026	0.37
β_{1i}	496.1739	(0.61)*		
Total Health cost of illness				
α_1	2128	(2.23)*	0.0029	0.41
β_{1i}	621.7029	(0.64)*		

Source: Estimated from field data. Note: * signifies 1 per cent level of significance.

4.4.2 Impact of Occupation on Cost of Illness

Occupational pattern reflects the level of discrimination and segregation among social groups (Schimdt, P., Stratuss, R., 1975, p.471). This discrimination can be income, social structure or cost of illness. Its impact on the cost of illness is hereby assessed using dummy regression analysis. As already discussed, those who are employed in Alloys industry in the area have

suffered most. This also reflected in the economic burden they have to bear in form of high costs of illness. For this facilitation of the analysis, two categories for those working in Alloys industry and other working in other sectors have been made.

Cost of Illness = f (Occupational Category)

$$\mathbf{Y_i = \alpha_1 + \beta_1 D1i + \beta_2 D_{2i} + \beta_{3i} D_{3i} + \mu_i}$$

Where, Y_i = Cost of illness, α_1 = Constant, β_1, β_2, β_3 are differential coefficient of value, D_{1i} = 1 Self-employed & business,, 0 = otherwise (employed in any other sector), D_{2i}= 1 Public services 0= otherwise, D_{3i} , 1 = Alloys industry 0= otherwise, μi = error term.

Table, 4.5 depicts that the cost of illness with the occupational category in Balasore Alloy's industrial area. The occupational category is the major source of their livelihood pattern. There is significant difference in the cost of illness for those working in Alloys industry and other individuals. The direct cost of illness for those employed in Alloys industry is nearly Rs.872.68 and otherwise it is Rs.707.66. The indirect cost for those employed in Alloys industry is Rs.2024.14, which is almost three times the indirect cost for other individuals. Similar in kind of trends are shown for total health cost of illness as well. This further reflects the severely health hazards posed by Alloys industry and other factories in peripherals in this industrial area. Though, the Alloys industry provides ample opportunities to the people of the area but the cost and economic burden imposed on them is massive. Now it is the haphazard condition of their livelihood pattern in the Balasore Alloys industrial Zone. Most of the peoples are much more willingness to pay for spend on health care in the area and becomes declining their efficiency of working, not only loss in work days but also their loss wage and loss in purchasing power. This can be explained below the Table 4.7.

Table 4.8: Results of Dummy Regression for Cost of Illness with Occupational Category

Dummy Variable	Coefficient	t value	R^2 value	F statistics
Total direct cost of illness				
α_1 (Constant)	707.6582	(28.42)*	0.0606	6.11
β_{1i} Where, D_{1i}, 1 = Self-employed & business, 0= otherwise	106.4594	(1.33)*		
β_{2i} Where, D_{2i} , 1 = Public services 0= otherwise	25.67511	(0.14)		
β_{3i} Where, D_{3i} , 1 = Alloys industry 0= otherwise	165.0236	(4.25)		
Indirect cost of Illness				
α_1 (Constant)	634.9286	(1.35)*		
β_{1i} Where, D_{1i} 1 = Self-employed & business, 0= otherwise	1570.66	(2.48)*	0.563	2.76
β_{2i} Where, D_{1i} 1 = Public services 0= otherwise	770.0714	(0.69)		
β_{3i} Where, D_{1i} 1 = Alloys industry 0= otherwise	1357.87	(2.72)		
Total Health cost of Illness				
α_1 (Constant)	1409.929	(2.50)*		
β 1i Where, D_{1i} 1 = Self-employed & business, 0= otherwise	1609.777	(2.12)*		
β_{2i} Where, D_{2i} 1 = Public services 0= otherwise	728.4048	(0.54)*	0.0448	2.17
β_{3i} Where, D_{3i} 1 = Alloys industry 0= otherwise	1458.053	(2.44)**		

Source: Estimated from field data.

Note: *, ** and *** signifies 1, 5 and 10 per cent level of significance respectively**.**

4.6 Major Findings and Conclusions

Major reason for health hazards was contaminated water and air pollution. Nearly 30.83 per cent people do aware on the reason for their ill health was contaminated water, where the 35.00 per cent believe that it also affected by the air pollution in Alloys industry areas and other factories in the peripherals in the Balasore districts of Orissa. The externalities on health due to the industrial pollution were measured with the help of cost of illness method. The mean total cost of illness for the households accounted to be Rs.2650.04. The mean indirect cost of illness, which is the major contributors to the total cost of illness for the households in this area. There is also one major factor that the economic burden of these health costs is more visible in case of annual cost of illness on earning income level in the households.

There was significant difference found among the direct and indirect cost between males and females. The total cost of illness for males was at least ten times higher than that of females. The cost of illness for working and old age group is higher as compared to other age groups. Those employed in Alloys industry have spent in health cost nearly double cost of illness as compared to other individuals. These are the affected by the villages in this area and also, the indirect cost of illness for households is a way to higher than the direct costs. This shows that on one hand the households are not turning up for the treatment of diseases until it also reaches the critical situation due to economic constraints. On other hand the loss in productivity and wages due to adverse impact on their health conditions is very high.

Chapter 5
Major Findings and Conclusions

5.0 Introduction

Economic development is very essential for a country. It is based on quantitative as well as qualitative changes in the economy. Industrialization is a key factor for development. It not only provides better employment opportunities to the people but also leads to the expansion of better infrastructure facilities and stimulates the growth of other sectors. However, industrialization leads to rapid and unplanned urbanization in developing countries like India. Unplanned industrialization leads to over-exploitation of natural resources. This leads to the environmental externalities. Alloys industry is one of the important industries, which provides ample employment opportunities and is one of the top ten foreign exchange earners for India. It is one of the most hazardous industries in India. It generates waste water and solid waste along with the polluting the air. The Alloys industry produces huge amounts metallic and non-metallic composition of heavy metals, and it releases pollution into the environment. The effluents discharged from this industry are rich in chromium, ammonia, and sulfides. Since the infrastructure development for wastewater treatment has not kept pace with the wastewater generation, and it leads to many diseases affected by the wastewater. The major share of industrial wastes is discharged into rivers and soil, deteriorating the quality of surface quality and reduces the fertility of the soil. The solid wastes and slages generative from the industry affect the ground water and soil adversely. This uncontrolled discharge of industrial effluents leads to heavy environmental pollution and creates health hazards in Balasore Alloy's industrial Zone of Odisha.

5.1 Major Findings of the Study

The first chapter entitled **"Relevance of the Industrialization and Economic Development"** has discussed the Economic development is very essential for the country and industrialization is a key to it. But unplanned industrialization leads to various infrastructural as well as environmental problems. Such environmental problems can be classified into two categories viz., those arising as negative effects of the very process of development and those arising from condition of poverty and under development. Increase in economic activities requires larger inputs of natural resources and generates larger quantities of waste by products and residues. Alloys industry is one such industry which generates various

hazardous effluents. Balasore Alloys industrial area holds a prominent position in Indian Alloys industry. Various phytoremedial studies have been conducted in the area to know the effect of pollution due to Alloys industry on the change of agriculture productivity and health cost of illness of the area. Thus, an attempt has been made to assess the economic burden of the health hazards of the people in the area. Also, the environmental impact of pollution such as the change of agriculture productivity and health cost measurement of the area has been done by using productivity change method and cost of illness method in the study.

The second chapter entitled "**Socio-Economic Profile of Households in Balasore Alloys Industrial Area"** is an attempt to analyze how Alloys industry in Balasore affects the socio-economic status of the people in the area. It is generally believed that industrialization leads to economic development of people and helps in raising their socio-economic status. Housing patterns, educational level, income level and occupational structure provide a clear picture of the socio-economic status of an area. Thus, an analysis of the housing conditions, education level, family size and income level of the households has been discussed in this chapter. In order to understand the positive impact of alloys industry on the households, occupational pattern has also been studied.

First, the demographic features of the sample district are slightly different from the state level. The literacy rate in Balasore is better than the state average. But the child sex ratio in Balasore is very less as compared to the state average.

Second, majority of the population in the survey area is Hindu. Out of the 120 households, 97.05 per cent are from Hindu community and rest is 1.67 per cent and 0.83 per cent belong to Muslim and Christian community.

Third, the housing conditions in a community reflect the social and economic status of the community and it also an important determinant of health status of a household. Nearly 62 per cent households surveyed live in kachha or semipucca houses.

Fourth, education is one of the most basic parameters in determining socio-economic status. The level of education for females is far lower than that of males in the area. the gender based education level of the households, which is nearly 39 per cent are illiterate and about 43.75 per cent are educated up to primary level of males in the households. The per cent of educated individuals decreases with further increase in the level of education. The 67.74 per

cent are educated up to secondary and higher secondary level and only 82.05 per cent is educated up to graduate level. There is very low per cent of education level in post-graduation i.e., 83.33 per cent. Thus, low rate education is one of the key determinants in the level of education for females is far lower compared to males in alloys industrial areas and its peripherals. In compared to 39.39 per cent illiterate males, the percentage of females with zero education is nearly 60.61 per cent.

Fifth, income level of households also plays an important role in determination of socio-economic status of a community. The mean monthly income of the household is Rs.12993.33, the maximum income is Rs.120000.00 and minimum income level is Rs.3000. The mean per capita income and expenditure of the general category is highest. The mean per capita income of OBC is 3125.78 and per capita expenditure is Rs.2264.15. Scheduled Caste of the populations are coming under the low level earning is Rs.2493.75, per capita expenditure Rs.2422.08 and also low income earning monthly expenditure i.e., Rs.2104.17 and Rs. 2092.78 respectively.

Sixth, occupational structure is a significant and powerful instrument aspect of social life. Out of the total working population, nearly 14 per cent are male and 45 per cent are females. Majority of the total working population, i.e. 47.21 per cent is directly or indirectly employed in Alloys industry. Nearly 54 per cent works are self-employed and nearly 14 per cent are business. The mean wages per day for Alloys industry is Rs. 498.4, which are highest, followed by Rs. 190.36, are compared to lowest wages per days in working wages labour in the area.

Third chapter entitled **"Industrial Pollution and Change of Agricultural Productivity"** is an attempt to analyze the impact of industrial pollution on change of agricultural productivity of the households in the area.

We find the agricultural productivity is adversely affected due to the industry. Most of the people are lost their cultivated land due to establishment of Alloys industry in the area. The average land size of the area is 3.20 acres. The size of land in Balgopalpur and Sireipur village is 2.84 and 3.03 acres respectively. These two villages are affected by the Balasore Alloys industry. On the other hand Gourpur is non-affected village, whose mean operational land holdings size is 3.54. In Balgopalpur and Sireipur village, total production of paddy is

15.70 in quintals and 18.33 in quintals. There is highest total production of agriculture of Gourpur village i.e., 29.05 quintals in the area. However, their productivity is also lower in two villages which are 5.37 quintals and 6.20 quintals in per acre compare 8.11 quintals per acre in Gourpur. In the same way, their total value cost of agriculture production is low the Rs.8108.7 and Rs.9362.00 in per acre in the area. The Gourpur village of agricultural production is higher in Rs. 12246.1 the total value of cost in per acre in the area. The net profits are receiving in Balgopalpur and Sireipur is Rs. 5496.58 and Rs. 6527.88. The Gourpur village is highest net benefit from agricultural productivity in the area i.e., Rs.9039.65.

Fourth chapter entitled **"Industrial Pollution and Health Cost Measurement"** is an attempt to analyze the environmental impact of Industrial pollution on health of the households in the area. The economic burden of health hazards has been calculated by estimating cost of illness for the households. Major reason for health hazards was contaminated water and air pollution.

First, nearly 30.83 per cent of respondents believe that the reason for their ill health due to contaminated water, where the 35 per cent of due to air pollution are affected their health Alloys industry and other factories in peripherals in the Balasore. It shows that the quality of water in the area is very poor. Nearly, 66.03 per cent individuals suffer from waterborne diseases like cholera, dysentery and frequent fever in the area. Also 47.22 per cent from neurological disorders such as joint pain, eye infection and kidney related problems, 65.83 per cent suffer from skin diseases, 64.69 per cent suffer from respiratory diseases like asthma, tuberculosis etc., which are generated due to direct contact with health hazardous chemicals like manganese, iron ore, slag, nickel and chromium in Alloys products.

Second, the direct and indirect cost of illness is calculated to assess the economic burden of health hazards on people. The mean direct cost of illness for the households is Rs.777.24 and indirect cost is Rs.1872.28. The mean total health cost of illness for households is Rs.2650.04.

Third, differences in cost of illness on the basis of household characters like gender are also estimated. Mean cost of illness for male is nearly ten times higher than that for female in the

area. In case of working days, the annual loss in working days for men is about 29.59 days, whereas for females, it is nearly 3.38 days. Also another difference is based on age group, whereas the working and old age group, the loss of work days is 28.74 and 30.00 respectively. Furthermore, study the differences in cost of illness on the basis of occupational category is analyzed. Mean total health cost of illness is Rs. 2865.48 for those employed in Alloys industry and their total annual loss in work days is nearly 46.91 days. The mean direct cost of illness for those employed in Alloys industry is nearly Rs.872.68 and indirect cost of illness is Rs.1992.80.

Fourth, impact of gender and occupational pattern on cost of illness is also analyzed using dummy regression analysis. The cost of illness for male is significantly higher than that for females. The cost of illness for working and old-age group is significantly higher than the school going and children age group. The cost of illness for the people employed in Alloys industry is significantly higher than the cost of illness for other occupational category of the households in the area.

5.2 Conclusions of the Study

Economic development is very crucial for a country and industrialization is a key factor for development. It not only provides better employment opportunities to the people, but also leads to expansion of infrastructural facilities and stimulates growth of other sectors. However, unplanned industrialization leads to over exploitation of natural resources, which further leads to environmental externalities. When the scale of economic activities increases, it brings boost to the economy, but the over utilization of resources also takes place. As a result, industrial pollution increases. This results in creation of environmental externalities. Alloys industry is one of such industry, which provides ample amount of employment opportunities. But, it also one of the most hazardous industries in the area of Balasore district of Odisha. There are two villages near by the Alloys industry. The total agricultural production and productivity has declined by the industry. Further, another factor which is raising the health cost of illness in the area. Also, they are become struggles in economic burden in the area.

5.3 Policy Recommendations

Some of the recommendations which can be useful in improving the problems of low productivity in agriculture and health in such areas are as follows.

1. The installation of new sewage treatment plants is required in industrial zone like Balasore due to the exiting STPs are not able to treat all of the domestic and industrial waste generated. The working of the exiting STPs also needs to be monitored, as they hardly function to their full capacity. If untreated waste will not be discharged in the soil, canal, rivers, the quality of soil and water will improve. Ultimately, this step will be increased of agricultural productivity and better environment in this area. The Green Belt Development should develop and the Common Effluent Treatment Plants are proper functioning in the area.

2. The level of education in the area is not very high. The female literacy is also very low. This results to their less contribution in the economic activities and their low income level. Also, many school-going children have to work in Alloys industry and other factories nearby the area because of the poor economic conditions of their families. This leads to child labour problem in this area. The government should take step to more education facilities and proper implementation of educational policy and to stop the child labour in the area.

3. The cost of illness in the area is very high. Most of the people in this area do not get for better treatment facilities due to budgetary constraints. This is because no government medical facilities are available in the area. The nearest government hospital is about 10 kms from the area. There should be facilities of primary diagnosis and treatment of the frequent diseases like fever, cholera, skin and eye infections. The frequency of the vaccination camps should be increased.

4. The wage rates of the people employed in Alloys industry are much lower compare to those in organized sector. This is lack of labour union in the unorganized sectors. Thus, legislation is required to ensure better wages rates in the unorganized sector in the area.

5.4 Further Scope of the Study

This study has not attempted to answer all the questions that have emerged during the research process. However, some of them are worth mentioning which can be addressed by cotemporary studies. The use of heavy metals in the Alloys industry, there will be resulted in depletion of soil quality in the area. Most of the people have lost their land due to establishment of Alloys industry and also the willingness to pay for better water quality. Thus, there is a need of separate study to analyze the environmental impact on industrialization on ground water quality and displacement and rehabilitation effects in the area. Water samples can also be drawn for measuring the heavy metal content in the area.

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Appendix

Source: www.mapsofindia.com

Sl. No.	Areas	Types of Industries
1	Rourkela Rajgangpur	Iron and steel, sponge Iron, cement, secondary steel melting and Rolling mill, Refractory's, chemicals and Engineering
2	IB Valley and Jharsuguda areas	Thermal power, Sponge Iron, Refractory's and Coalmines(Aluminium, Coalwasheries)
	Hirakud	Aluminum, Rolling mill
4	Talcher-Angul	Thermal power, Aluminum coal Washeries, Ferro Alloys, coal mines
5	Choudwar	Ferro Alloys, Thermal Power, pulp and paper, coke oven
6	Balasore	Pulp and paper, Ferro Alloys, Rubber Industries

7	**Chandikhol**	**Stone crusher, coke oven**
8	**Duburi**	**Integrated steel, Ferro alloys, mineral processing**
9	**Pradeep**	**Fertilizer, seafood processing, petroleum coke**
10	**Khurda-Tapang**	**Stone Crusher**
11	**Joda-Barbil**	**Ferro Alloys, Iron ore crusher, mineral processing.**
12	**Rayagada**	**Pulp and paper, Ferro Alloys**

QUESTIONNIARE

On

ENVIRONMENTAL IMPACT OF INDUSTRIALIZATION: A STUDY ON BALASORE ALLOYS INDUSTRY, ODISHA

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Date-..... **SL.NO.----------**

Place – Balasore

Interview Schedules

A: General Profile

1. State: .....
2. District: .....
3. Block/Tahsil: .....
4. Ward/Village: .....
5. Name of Head of HH: .....
6. Name of Respondent: .....
7. Relation with Head of HH: .....
8. Religion:

(Hindu-1, Muslim-2, Christian-3, Other-4)s

9. Caste:

(General-1, OBC-2, SC-3, ST-4)

10. Family Status:

(Joint-1, Nuclear-2)

11 B: Household Profile

1.1 Household Details:

1	2	3	4	5	6	7
Sl.No.	**Name of the Family member**	**Age**	**Gender**	**Year of Education**	**Occupation**	**Monthly Income (Rs.)**
1						
2						

3						
4						
5						
6						
7						
8						
9						
10						

Code: For 4 (Gender)-Male-1, Female-2

For 5 (Education) – illiterate-1, Up to Primary-2, Up to Higher Secondary-3, Up to Graduation-4, Post-Graduation and Above-5

For 6 (Occupation) – Self Employed = 1 Business = 2 Public Service = 3 Private Service = 4 Alloy Industry = 5 Wage Labour = 6 Unemployed = 7 Other = 8 (Please Specify...)

C. Economic Profile of the household

12. **Ownership of house**

Ownership	**Type**	**Rent (Rs. Per month)**

Codes- (Ownership – (Own-1, Rented -2), Type – Kachha House -1, Semi – Pakka House -2, Pakka House-3)

13. Source of drinking water?

(1. Well, 2-Tube well, 3-Borewell, 4-Pond, 5- Stream)

14. Do you have toilet facilities? (Yes/No)

If yes then type of toilet 1. Kachha. 2. Pucca

15. Do you have electricity facility? (Yes/No)

If yes then 1. BPL rate 2. Normal rate

16. **Expenditure and Income of the family member –**

Sl. No	**Name of the family members**	**Name of the Primary Occupation**	**Income from primary occupation**	**Name of Secondary Occupation**	**Income of the secondary occupation**	**Total Income**
01						
02						
03						
04						
05						

Codes for occupation

(0- unemployment, 1- casual, 2-farming own land, 3-tenant, 4-casual agricultural labour, 5-Indusrty service, 6-private service, 7-govt.service, 8-own business, 9-domestic servant, 10-housewife, 11-others)

17. Expenditure Pattern (Annual expenditure of the HHs)

Sl. No	Exp. Types	Exp. (in Rs)
1	**Non-Durables** **(a) Food grains** **(b) Non-food grains** **(c) Total**	
2	**Durables (during the survey year)**	
3	**Education (of all the children)**	
4	**Health (both curative and preventive)**	
5	**Social Ceremony**	
6	**Others**	
7	**Total**	

18 D: Employment Profile

19. If employed in Alloy industry, which type of work, do you perform? (Non skilled -1, skilled -2)

20. In which sector are you employed?

i) Industry
ii) Agriculture
iii) Service
iv) Others

21. Work Profile

Type	Period of Work in last year		Payment	
	No.	Units	Amount	Rate

Codes-

Type- (Regular-1, Contract basis-2, Daily wages-3), Period of Work (Units)- (Months-1, Days-2), Payment (Rate)- (Per month-1, per day-2).

22. Other allowances-

Head	Amount per month

23. Since how many years are you working in this industry?

24. Before working here, were you employed anywhere else? (Yes-1, No-2) ☐

25. a) If yes, what was your occupation?
(Self employed -1, Agricultural labour-2, Non agricultural labour -3, others -4) ☐

b) What was your income? Per month (Rs)..... ☐

c) Why did you change the job?

i) Higher wages ☐

ii) Near to home ☐

iii) More facilities

iv) Other reason (please specify) .....

26 E: Impact on Agriculture

27. Do you own land? 1. Yes ☐ 2. No ☐

28. **Ownership types**

Own land	Leased in	Leased out	Total

29. **Irrigation**

Items	Nature of Input		Ownership		Cost/ Acre/hour (in Rs)		Total Cost
	Surface	Ground Water	Self	Private	Surface	Ground Water	
Irrigation							

30. Production

Name of the Crop	Area (Acre)	Production(in quintals)	Productivity

31. **Cost of Production**

Items	Amount/ Acre (K.G)	Cost/ Acre (in Rs)	Total Cost
Fertiliser			
Pesticides			
Seeds			
Agriculture			

equipment			
Repairing Machines			
Others			

32. **Agricultural Labour**

Name of the Crop	**Agriculture labour (in no.)**		**Cost/ Acre/ (in Rs)**		**Total Cost**
	Self	**hired**	**Male**	**Female**	

33 F: **Impact on health**

34. Is there anyone in your family who is suffering any health related problem? (Yes-1, No-2)

35. If yes, what according to you can be the reason for it?

i) Contamination of water
ii) Air pollution
iii) Poor working conditions
iv) Waste generated from the Alloy industry
iv) Other (specify)

36. According to you, to what extent are the environmental conditions here affecting your health?

a) Slightly
b) Moderately
c) Highly
d) Extremely

37. **Diseases**

Sl. No	**Family Number**	**Types of Diseases**			
		Water Borne diseases	**Skin diseases**	**Respiratory diseases**	**Others**

Codes: 1 for Water borne diseases(Cholera, Dysentery, Typhoid, Fever), 2 for Skin Diseases (Irritation, Burning Sensation, Dermatitis), 3 for respiratory Diseases, 4 for Others (Neurological, Ulcers, Joints Pain, Kidney and liver related, Lung cancer, Loss in appetite and Eye infections).

38. Have you gone for the treatment of this disease? (Yes-1, No-2)

39. If no, what was the reason?
    a) Shortage of money .....
    b) Far from the hospital.....
    c) Doctors are not available in the locality.....
    d) Unaware.....
    e) Other.....

40. **Health Profile:**

Name of the person	**Disease**	**Frequency**	**Annual Medical Expenses***	**Loss of Days and Wages**	
				Days	**Wages**

***Medical Expense = Doctors Fees+ Expenses on Medicines**

41. **Any Other Information**

.....
.....
.....
.....