Human and Environmental Dimensions of Brick Industries in District Murshidabad, West Bengal

A Thesis Submitted

To

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In Partial fulfillment of the Requirement for the

Degree of Doctor of Philosophy

By

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I, Rakibul Islam, hereby declare that the subject matter of this thesis entitled **"Human and Environmental Dimensions of Brick Industries in District Murshidabad, West Bengal"** is the record of work done by me, that the content of this did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and the thesis has not been submitted by me to any other University/Institute. This is being submitted in partial fulfillment of the requirements of the degree of **Doctor of Philosophy** in the Department of Geography, School of Human Sciences, Sikkim University.

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This is to certify that the thesis entitled **"Human and Environmental Dimensions of Brick Industries in District Murshidabad, West Bengal"** submitted to Sikkim University in partial fulfillment of the requirements for the degree of **Doctor of Philosophy** in Geography embodies the results of bonafide research work carried out by Rakibul Islam under my guidance and supervision.

No part of this thesis has been submitted for any other degree, diploma, associate-ship and fellowship.

All the assistance and help received during the course of the investigation have been duly acknowledge by him.

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"Human and Environmental Dimensions of Brick Industries in District Murshidabad, West Bengal"

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Human and Environmental Dimensions of Brick Industries in District Murshidabad, West Bengal

ABSTRACT

India is the second largest producer and consumer of fire clay bricks in the world after China, has more than 100,000 small and medium-size brick producing units produces about 140 billion bricks annually to meet the demand for urban expansion and infrastructure development. Majority of the brick manufacturing units is spreading across the states like Punjab, Haryana, Utter Pradesh, Bihar and West Bengal (Ghoshal 2008). West Bengal has more than 3500 brick manufacturing units produce 300 crores bricks annually (Bera 2010). According to the recent data, the district of Murshidabad has 670 brick manufacturing industries (Office of the SRO 2015). Almost all the brick industries located on agricultural land in *Bagri* region of the district.

The establishment of brick industries has brought many adverse consequences in the district like land degradation, resources depletion, environmental pollution, etc. Therefore, this study tries to critically examine the role of different agencies involved in the development of brick industries, its production process, labour market, social relation of different groups involved in the brick industry. On the other hand, the study attempts to examine the impact of brick industries on air, water and soil pollution, and land degradation, agriculture practices. This study is broadly divided into two main sections. The first section deals with introduction of study, objectives, research questions, database, methodology, literature review, brief description of district Murshidabad and study blocks namely; its physical characterstics, soils, population, workforce structure, trends and pattern of workforce structure. Further, this section incorporates the spatial and temporal distribution, types, production

mechanism, nature, pattern and status of brick industry and identify and critically examine the role of different agencies involves in the development of brick industries in the district of Murshidabad.

While second section deals with examine the impact of brick industries on local landless labourers, marginal farmers and society; environmental degradation, agriculture practices, and the challenges face by the farmers in agricultural land management. Further, this section also incorporates the summary of findings, suggestions and conclusion. To fulfil the requirement of objectives the data has been collected from both primary as well as secondary sources. The primary data have been collected through interviews, questionnaire survey and case studies. Secondary data have been collected from different Government departments, Agriculture Census of India (2001 and 2011) and Census of India (1991, 2001& 2011).

Further, soils and water samples have examined to generate first hand data to support the studies. In order to understand the nexus among the different agencies working for the development of brick industries in the area of study, qualitative narrative method has been utilised. Information has been gathered through discussions with the owners of brick industries, along with farmers, contractors of labour and land (soil suppliers), brick businessman, fuel suppliers, local force groups and heads of the local Govt institutions (gram Panchayat, Dept of Land and Land Reform, Dept of Forest & Environment and District Pollution Control Office). Case studies have been referred to collects information about the contribution of brick industries in the life of labourers and farmers and also to know how they have become a part of the industries. The collected information is described in a sequential manner to fulfil the first objective. Further, to understand the shifts in the social relations, this study examined the power relations between the brick kiln owners and the farmers in

terms of resource transfer in the form soil and land. In this regards caste, class, religious and economic background of both groups and its spatial dimension have been analyzed. Furthermore, the dynamics of labour market and the changing mode of production system have been taken into consideration to understand the shifts in the economic relation. The issues like nature and pattern of labour contract and the labour movement as well as the occupational shifts among the landless labourers, their daily wages and wage differences with respect to their previous works, the changing socio-economic condition of the people like labourers and farmers due to emergence of brick industry; following parameters such as housing, occupation, income, shift in economic activities expenditure, sanitation, water supply for labourers and religious background, caste, housing, water supply, sanitation, land holding pattern etc for the farmers have been taken into account.

Further it is to be noted that certain techniques descriptive statistics, crosstab, custom table of SPSS uses to calculate the share of different categories under the different set of parameters. Arc-GIS tools and techniques were used to map the study blocks and the location of the brick kiln industries. The study area is mapped with the help of base map collected from the Survey of India (Kolkata). After that location of sample industries were collected with the help of GPS. Later on, the collected points (location) were converted into shape file with the help of Arc Tool. Finally, locations of brick industries in the study have been mapped.

Study shows that the new economic policy (1991-1992) brought rapid growth of urbanization and infrastructure development with other economic activities. The rapid growth of urbanisation and infrastructure development accelerates the demand for building materials including bricks. Therefore, number of brick kiln industries

flourished to fulfil the demand of bricks. In addition, the demands of brick also increased among the villagers due to the improvement of social – economic condition.

Study shows that, majority brick industries in Murshidabad district spread across the vast area of *Bagri* region of the district and exploits the agricultural top soil. The brick industries grew steadily during 1980-1990s. The highest concentration of the brick industries is found in the blocks like Berhampore, Domkal, Hariharpara, Jalangi, Raninagar, Beldanga, Lalgola, Murshidabad- Jiagang, Nawda etc. Among the study blocks, the maximum number of brick kiln industry is found in Berhampore followed by Domkal and Murshidabad- Jiagang. The maximum number of unauthorized industry is also found in Berhampore followed by Domkal and Murshidabad-Jiagang.

The discussion and valid classified documents provided by the Government authorities (Office of the SRO and DL& DLRO; Berhampore, Murshidabad) as well as data collected from the field investigation, it is safely stated that each and every agency has played their critical role in the brick industries and its development. To establish a brick industry owners start his journey from Gram Panchayat to Land and Land Reforms. After getting clearance from the Land Reform Department owner reach to Pollution Control Board, after getting clearance from it then reach to Department of Environment and PWD and Trade Licensing Authority to getting permission to produce and sell brick under his own Brand name. Mean while others stakeholders like local politicians, Labour contractors, Land contractors, Trucks and Tractors Owners, Small Businessman, pressure group (*Mastan*) have play their crucial respective role in the development of brick industry in the study area. Each of them tries to find out their personal source of income either directly or indirectly by involving them in the brick industry.

The Government authorities have tried their best to extend their support to the brick industrial owners by ignoring the important facts related to agricultural land use, land conservation and environmental protection. So we can assume that either Government either simply ignore the interest of the larger section of the society or very much reluctant to protect the interest of brick industrial owners or unable to take any action against the violators. These politically influential brick industrial owners may influence the government authorities to make the rules flexible at ground in respect of brick industries.

Thus it is all about corrupt political culture of the state where financially influential people are able to manage the policy implementing authority at ground in favour of them. The owners of the brick industries wisely exploit the corrupt system to run their industries without obeying the rules and regulation. They are also able to manage a network to take advantage of the financially stressful small and marginal farmers to exploit their land with the help of land contractors. Further, the supply of cheap landless labour by the labour contractors added additional advantage to these owners to make the use of them in exploitative production process. The absence of any form of union with regard to these labourers further expands the scope of production and reproduction. In addition to these government agencies, a considerable number of private agencies or stakeholders like the small, petty businessman, soil (land) and labour contractors as well as trucks and tractors owners played their respective role in the development of the brick industry in the district of Murshidabad.

Furthermore, association of the owners with the ruling political party and active donor of ruling party allow the owners to ignore many functional issues regarding brick industry. In addition to it, making soft target by the industry to the people who are really concerned about people and environment prevent them to act

against the industry. The continuous surveillance on researcher and other people those are working on different aspects of brick industry prevent them (researcher) to get desire information. If anyhow they manage to get the desire information, the Brick Field Owners Association requests the scholar not to use harsh language or not to write harsh reality of brick industries. On the other hand, they are trying to convince the researcher to work on the positive side of the brick industry.

Therefore, the result of mutual support and co–operation helps in rapid development of brick industry in the district of Murshidabad. The development of brick industries have brought many changes in the study area in respect of landless labourers, small and marginal farmers, agricultural practices, society and environment. Study shows that the majority of the brick industrial labourers belong to the social- economically poor and marginalized section of the rural society. The rapid development of the brick industry has changed the structure of economic activity and production system in the villages in relation to the landless labourers. The division of labour is very much sharp in the brick industry. The major chunk of these brick industrial labourers belongs to the young and youth age group. Youth and energetic people employs to perform the hard manual works like soil quarrying, moulding, shaping and transporting whereas aged and skilled people are appointed as mistry and firemen. The brick industry has provided 150 -180 days employment to the landless poor agricultural labourers.

The income of these brick industrial labourers ranges from between Rs. 5000-9000 per month. The majority of brick firemen and makers have monthly income is about Rs 7001- 9000. Similarly, the monthly income of Mistry and Rubbishmen ranges from Rs. 5000- 7000. In addition to it the income of brick transporters varies from individual to individual because the payment is based on number of bricks

transported/carried by each individual and ranges between Rs 4500- 7000. The income from the brick industry constitutes major part of annual income of these labourers. Study also reveals that major portion of the yearly income spent to buy food and allied items. A small part of their income is remained available for spending other sectors like children education and improving sanitation.

Study further demonstrates that though number of brick industrial labourers has shifted their house from the Kachha to Semi Pucca and semi Pucca to Pucca house but still a significant percent of labourers are living in Kachha houses. The share of semi Pucca and Pucca houses are higher among the brick makers and brick firemen due to relatively good monthly income from industry. But, still a considerable percent of brick industrial workers' don't have the access to the improved sanitation facility.

Study also shows that majority of these workers were depending on agricultural daily wage labour, daily casual wage labour, daily wage from other sectors, and daily wage labour from construction sector before join in brick industries as labourers. The brick industry has changed the production system in the study area in relation to the landless labourers. Earlier these labourers were mainly engaged in agricultural and allied based production system but now major part of their yearly labour devoted to industrial based production process.

Likewise local landless labourers, considerable number of small and marginal farmers of study area are getting an opportunity to lease out part of their land and generate good amount money which for time being may helps to meet many essential needs like celebration marriage ceremony, paid dowry (mainly for daughter), repay the existing debts, treat illness, meet expense of children education fee, build new house, etc. Study also reveals that brick industry also employed few migrant labourers

coming from the states like Jharkhand, Bihar and (a small percentage) Eastern Uttar Pradesh. Study further reveals that the majority of these migrant workers recruited by the labour contractors and very few of them come with their fellow workers who are already worked in different brick industries. The study also unfolds that though they are coming different states like Jharkhand, Bihar or Uttar Pradesh but so many things are very common among them. First, all of them belong to socio-economically deprived section of society. Second, either they are working as firemen or brick makers. In addition to it commonality also found in terms of expenditure. Majority of them are net buyer of food items throughout the year hence significant part of their income spend on buying food items. Moreover, majority of these migrant labourers are still living in Kachha or semi Pucca houses.

Almost all of them are deprived of basic facilities like good sanitation, safe drinking water supply, health facility in both the places; inside brick industries as well as at their native villages. The concept of decent work is totally absent in relation to brick industrial workers (local as well as migrant). They are deprived from all type of socio-economic benefits like pay leave, parental leave, bonus, gratuity, medical facility for family and children, old age pension etc. They are left behind from the all social dialogue like negotiation on daily wage, time of work duration of work etc. Lack of awareness about the rights, lack of organizational capacity absence of support from other agencies like trade unions and NGOs prevent them to gets their due benefits.

Above all, informal nature of operation, exclusion of brick kiln from the domain of industry and factory laws, organizational and political influence of owners on the institutions and absence of labour union and organize voice in favour of these workers causes of deprivation from their due benefits. As a result of lack of basic

work place safety measure, deprived from available equipments and lack of awareness exposes the industrial labourers numerous occupational health hazard. The health problems among the labourers are very much related to their task performed inside the brick industry. Majority of brick makers, rubbishmen, and brick transporter suffers from joints related problem whereas mistry and firemen exposes from health problems like suffocation, eye irritation skin burnt, etc. The Works of Singh and Asger (2002), Joshi and Durani (2008) Manga, Singh, Bhardwaj and Singh (2012) also reported similar results on occupational health problems of brick industrial labourers. But function of brick industries also brings number of challenges in the study area in relation to environmental degradation and agricultural practices.

Study further demonstrates that the function of brick industry is an important contributor for the increasing concentration of the Co_2 and the SPM in the local air and atmosphere. The discharge of the huge amounts Suspended Particulate Matter (SPM) and the Co_2 into the local atmosphere significantly increase the concentration of the Co_2 and SPM and reduced the quality of the air and the environment (Pandey 1997; Asger 2004; Joshi and Durani 2008, Baum 2010, Avitia, Antonio & Mora 2012).

The discharge of the Carbon dioxide and the SPM into the local air is responsible for hazy condition at local atmosphere during the winter season. Such hazy and smoky weather prevent sunlight to reach the ground as well as reflect it back to the space (Asger 2004). The rising level of SPM due to brick kiln activities not only affect the local atmosphere, but also these SPM travels with the wind and affects the distant places, vegetation, standing crops and water bodies (Avitia, Antonio & Mora 2012). The presence of physical parameters like water pH, EC and TDS as well as chemical elements like Na, P, K, Ca, Mg, and Cl have subsequently increased in

the surface water bodies located close to the working brick industry due to mixing of pollutant materials with water. The increasing level of these elements in the water bodies directly affects the local aquatic ecosystem (USAID 2003). In addition, the pumping of ground water by the brick industry is responsible for depletion for ground water (Santosh, Padmalal, Baijulal and Maya 2012). Therefore, the brick kiln burning is responsible for the changing neutral soil into the toxic, raising concentrations of the Co_2 and the SPM in the air and chemical and physical changes in the surface water bodies in the study areas.

In addition to it the brick kiln burning is responsible for the increasing toxic level in the soil adjacent to the industries as well as degraded considerable areas of agricultural land and depleted the availability of soil Nitrogen, Phosphorus and Potassium. The degradation of agricultural land and depletion soil fertility due to reckless quarrying, a considerable area of agricultural land turned into degraded land year after year in the respective study area. The removal of the top layer of soil by the brick industries has not only reduced the availability of agricultural land in the study area, but also responsible for changes of an essential plant supporting elements in the soil like Nitrogen, Phosphorus, Potassium etc (Grewal &Kuhad 2002 & Khan, Rahaman, Rouf, Sattar, Oki and Adachi 2007). The study reveals that the soil of the study area is neutral to basic in nature. The pH value of all agricultural soil in the study area lies in between 7.43 – 7.71 which is neutral to the basic soil. But quarrying activities significantly raised the pH value and turned the neutral soil into basic to the strong basic soil. It is also observed that the deep quarrying activities changed the soil pH level beyond 9 and above.

In case of other nutrients, the topsoil quarrying activity significantly reduced the available amount of Nitrogen, Phosphorus and Potassium. The losses of

agricultural land fertility adversely affected the soil quality and agricultural practices in the study areas (Grewal & Kuhad 2002). The removal of top soil by brick industrial quarrying causes of steep change of slope within the small area. The changes in slope altered the lands orientation in the study area. The farmers (the respondents) reported that the changes in relative slope and slope direction have an adverse impact on their land management practices. After top soil quarrying their land became relatively deeper than the land of immediate farmers. The new orientation of their land forces them either change the source of irrigation or relocate their irrigation sources and systems. In addition, land boundary management becomes a new emerging challenge for the farmers. During the rainy monsoon season these steep slopes accelerated the flow of rainwater to downwards and remove huge amounts of in compact soil and responsible for loss of fertile layer.

In addition to it the changing slope and land orientation ultimately forced the farmers to change the agricultural land use practice in the study areas. The land which is normally used to grow vegetables, potato, brinjal, lady fingers, onions, chilly, pulses jute, etc. during rainy season now all these crops are replaced by the paddy due to water stagnation in the agricultural field. The water stagnation is harmful for the standing crops and it damages the natural growth of those standing crops. If there is an early monsoon then the entire crops spoiled or immature crops harvested and it is a matter of economic losses. To avoid such risk and economic losses farmers are trying to adjust themselves by replacing crops like paddy in summer and wheat in winter.

In the case of cultivation of food crops, the amount of investment goes too high and reduced the yields and affects the profit margin due to loss of crop supporting soil nutrition. The losses of crops, supporting top fertile layer not only affects the yields of the crops but also significantly changes the agricultural land value

in the study area. Further, water logging is a newly emerging phenomenon in the study area because of appearance of degraded, fragile landscape in the study area. Water logging means the flooding of the lower area during the rainy season. The changes in the slope and altitudes of existing high land into low land after top soil quarrying, rain water gets accumulated in the quarrying land.

The accumulation of rainwater on quarry lands, cultivation of such land became a risky task for farmers. This temporal water logging on their agricultural land frequently delayed the crop sowing time. Sometimes water logging situation remain for few month causes of loss of one or more crop. It is also found that standing crops are getting damaged due to sudden rain. In addition to this, farmers having their land immediate to top soil quarrying land also faces the problem like top soil erosion, boundary damage, loss of irrigation water mostly due to land boundary failure. Sometimes these top soil quarrying lands left in an abandoned condition which have put numerous challenges to the farmers to reclaim such land for further agriculture.

Thus, the development of the brick industries in the study area are accompanied by the contribution and cooperation of the numerous agencies and groups from the Governments, private and individuals as well as continuous rising demand for building materials among the people within and outside the district.

The function of brick industries provides an opportunity for the thousands of landless labourers to get an employment for a period of 5- 6 months at their doorstep which prevent them from the out-migration for time being. In this way by employing in brick industry, gradually replaced the production relation of these rural landless labourers from agriculture based production to industry based production system. Though, brick industries provides few thousand employments to the landless and casual daily labourers from the local villages as well as few hundred migrant

labourers coming from the nearby district and the states but, industry does not bring any radical change in the life of these labourers due to its exploitative nature.

As a result, these labourers are still living with lack of basic facilities and struggling for fulfilling their daily basic needs. The exploitative, captivate and controlling nature of the production process as well as an advance payment system in brick industries are the main hurdle for the labourers to get out of the vicious cycle of poverty. Brick industries also offered an opportunity to many farmers to generates a quite good amount of money by lease out a portion of their land which helps them to get escape from economic stress and poverty for time being or build a small house or repay the existing debts or celebrate social functions or paid the offspring tuitions fees; but it permanently degraded important source of livelihood which put them under further marginalization by making their agricultural land infertile, fragile, degraded, marginal and unsuitable for many crops but as well as by puts a numerous hurdle in front of them to reclaim their already degraded land.

In addition to it the ignorance of the functional guideline regarding soil utilization and exploitation of top agricultural soil by the brick industries further intensifies the adverse impact of brick kiln quarrying on agricultural practices. Thus, brick industry gradually putting these small and marginal farmers in vulnerable situation with regard to their future livelihood.

On the other hand, the function of brick industry helps in capital formation for the owners of the industries. The under wages and profits are the two important sources of surplus capital generation for the owners. Further, brick industry also helps in transfer of ownership of land resources by exploiting the land of poor farmers in the study area. Furthermore, function of brick industries help in emergence of new classes in the village in the form of capitalist owners and voiceless, poor, unskilled

labour class. As a result, social relations of these people are largely getting changed. Now these owners are the main actors of decision making in the villages.

The unchecked growth and the use of traditional technology in the brick kiln burning are responsible for the generation of huge amount smoke, carbon dioxide, SPM and other gases. The discharge of these pollutant materials into the local environment is responsible for changing the quality of the soil, water and the atmosphere. The changing quality of the soil, water and air has an adverse impact on the human health.

Moreover, the uncertain nature of brick industries with regards to function and will create the situation for free labour by adding additional few hundred small and marginal farmers as landless labourers in near future. Therefore, to keep away from the above such possible future adverse outcomes from brick industries in the study area; Government should ensure that the brick industries should avoid the use of agricultural land for top soil quarrying as well as adopt available alternative raw materials based bricks production.

In this regard, fly ash based brick manufacturer is an important alternative. It was found that the fly ash brick is relatively cheaper than the fire clay bricks, yet people prefer to use the fire clay bricks due to prevailing popular notion about the highest longevity of the fire clay bricks as compare to the other available alternative form of bricks including fly ash bricks. It is due to colonial influence in the mind of the people. The common belief among the people is that the brick with '*Red bright Ring Tune'* is a best building material with high longevity. This perception and notion should be changed.

In this regards, media can play the positive role to change the people's perception by popularizing the utility and benefits of the Fly Ash bricks as well as

other alternatives from of building materials which can reduce the pressure on agriculture land for raw materials. On the other hand, switches from the traditional brick kiln burning techniques to the improved Vertical Shaft Brick Kiln (VSBK) technology may reduce the fuel consumption by 40 - 60 percent energy as well as the same amount of pollution load in the form of carbon dioxide which is ultimately reduced the severe environmental implication.

The ill and irregular implementation of Government rural employment programmes, political biases towards the village poor by the ruling parties, irregular and long waited payment or payment procedure discourage these landless labourers to join the Government run rural employment scheme. On the other side, regular payment system in the brick industry encourages these landless labourers to work in such hazardous and exploitative Industry.

Therefore, proper implementation of Government employment scheme could help these landless labourers to get out the labourers from this exploitative Industry. In this regard, taking brick industry and its labourers under industrial laws could minimize the level of exploitation as well as help these labourers to get their due benefits. Government should encourage the owners to establish agro based industries by providing the tax holiday and subsidy to accommodate the rural surplus labour forces. Every one of us needs development; but it is not in the cost of others. Development should be inclusive and sustainable.

Chapter I

Human and Environmental Dimensions of Brick Industries in District Murshidabad, West Bengal

I.1 INTRODUCTION

Urbanisation and infrastructure development requires huge quantity of physical materials in the form of bricks, sand, stone etc. Brick is still considered as important building material in India. India is the second largest producer and consumer of fire clay bricks in the world after China. India has more than 100,000 small and medium-size brick producing units (Punjab State Council for Science & Technology. 2010, Baum 2010) that produce about 140 billion bricks annually to meet the demand for urban expansion and infrastructure development. Majority of the brick manufacturing units exits across the states like Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal (Ghoshal 2008).

West Bengal has more than 3500 brick manufacturing units with 300 crores annual production capacity (Bera 2010). At present the state requires more than 600 crores bricks annually to meet the demand for urban expansion and infrastructure development (Bera 2010). Therefore, there is a huge gap between demand and supply. In addition, improvement in socio- economic condition of the rural masses; further increases the demand for bricks. To meet this particular 'demand', a large number of brick industries have been established in the state. Majority of these brick industries are spread over districts like 24 Paraganas, Medinipur, Hooghly, Howrah, Nadia and Murshidabad (Bera 2010).

According to recent data, the district of Murshidabad has 670 brick manufacturing industries (Office of the State Reforms Officer, District Murshidabad; West Bengal 2015). Almost all the brick industries are located on agricultural land in *Bagri* region

of the district. The establishment of brick industries had brought many adverse consequences like land degradation, resources depletion, environmental pollution, etc. The existing works on brick industries mainly focuses on the negative outcomes. But any industrial unit do bring some kind of positive element in its process. These positive outcomes are related to the whole discourse of industrial establishment itself. The brick industry carries with it the developmental paradigm like infrastructural development role of different agencies, labour process, labour market and functional mechanisms.

Therefore, this particular study tries to understand human and environmental dimensions of brick industries in Murshidabad. This study tries to critically examine the role of different agencies involved in the development of brick industries, its production process, labour market, social relation of different groups involved in the brick industry. Mere outcomes of negative impacts cannot erode the fact; as to why this particular industry still flourishes in West Bengal.

On the other hand, the study attempts to examine the impact of brick industries on air, water and soil. This study is broadly divided into two main sections. The first section deals with introduction of study, objectives, research questions, database, methodology, literature review, brief description of Murshidabad district and study blocks (Berhampore, Murshidabad- Jiagang and Domkal) - its physical characterstics, soils, population, workforce structure and its trends and pattern. Further, this section incorporates the spatial and temporal distribution of brick industries, types, production mechanism, nature, pattern and status.

Furthermore, this section will also comprehend and critically examine the role of different agencies, involved in the development of brick industries in Murshidabad. This particular section deals with the impact of brick industries on local landless

labourers, farmers' et.al and how it affects their daily lives. As human and nature cannot be separated; the impact of brick industries on environment vis- a- vis humans adheres an attention. Further, this section also incorporates the summary of findings, policy recommendation and conclusion.

I.2 STATEMENT OF PROBLEM

The demand of bricks is increasing day by day to meet the requirement of urban expansion and infrastructure development. In addition to this to accommodate the increasing population India needs 5 million dwelling units every year (Lal 1995). Likewise, the conversion of existing kachha house to pucca house or construction of new pucca or semi pucca house owing to socio-economic improvement of millions of rural masses put additional demand for bricks in the state. Majority of state's brick industries are privately owned and located across the districts like 24 Paraganas, Medinipur, Hooghly, Howrah, Nadia and Murshidabad.

At present Murshidabad district has 670 brick manufacturing units spreading over vast area of *Bagri* region. The establishment of brick industries has brought many intriguing issues in the district like;

- Brick industry uses top soil of the agricultural land as raw material; which poses threat to sustainable agricultural development. Therefore, it is important to understand the role of brick industries and its relations as well as its impact on land resources.
- Brick industries acquire land from the small and marginal farmers, meaning that the loss of agricultural land put these small and marginal farmers under the risk of becoming landless. Therefore this study tries to find out the causes and process of leasing out land by such farmers to brick kiln owner.

- The functioning of brick industry adversely affects the soil, water, air and local environment. Therefore, this study tries to estimate the intensity of adverse effects of brick industries on soil, water bodies and air.
- A number of studies along with the personal observation of the researcher suggest that the labourer working in the brick industries get exploited by the labour contractors and industries. Therefore, this study tries to explore the causes of getting trapped by the labour contractors and existing market forces.

1.3 CONCEPTUAL FRAMEWORK OF THE STUDY

To understand the process and growing problems emerging from the functioning of the brick industries in Murshidabad, the study has been designed from the perspective of political economy framework. "Political economy approach is a whole range of perspectives which encompasses the ideas may differ from one another but share common concerns and similar viewpoints in terms of resource depletion and its outcome (Peet and Thrift. 2002)".

The Political Economy framework enables one to understand the economy in a broader sense wherein the geographical dimension is seen through the lens of economy. The supporters of this framework views the social economy, way of life and the mode of production as a political act; carried out by the member of classes other than social groupings. Thus a political economist tries to incorporate the wider socio-economic and political issue to address the problem of resources depletion in the developing as well as in the developed countries.

It is a holistic approach which takes ideas from the Marxist ideology of the historical development of society and its social process, the form of government, state power, politics and its role in transforming the society. Political economist have tried to study

the phenomena in relation to caste, class, area, the level of technological advancement, the role of the institutions in order to address the issues related to the natural environment as well as society (Peet & Thrift. 2000).

The scholars of political economy had taken wider issues to address the rising environmental problems especially; land degradation, soil erosion, and environmental degradation, etc. Among these numerous issues, socio-economic inequality is considered as a major factor for environmental degradation (Blaikie1987).

Besides this, political economists believe that the introduction of 'new economic policy', replacement of traditional way of production system and related social life and value systems along with prevailing socio-economic inequality are the important causes of environmental degradation and hazards (Watt 1983). In addition, the nature of government along with policies of concerned government and functioning of the elites and bureaucrats - too influence the causes leading to land degradation and environmental changes (Herschel 1998).

Therefore, different issues and commonality among the issues provide a common platform for the study of the diverse social power relations and their multiple links helps to understand the rising problem of natural resource depletion, degradation, and environmental changes (Blaikie 1985, Blaikie and Brookfield 1987). Blaikie and Brookfield argues that land degradation cannot be understood without understanding the nature of society and its historical background. Their study reveals that the combination of different factors leads to the land degradation which may further vary from area to area.

According to them, increasing population is not only a factor for land degradation; there are other social factors which accelerate the process of land degradation. For instance, in the case of hilly terrace paddy cultivation wherein huge amount of labour

force is engaging, if some labourers withdraw from it and engage somewhere else or if population declines due to any reason, then the system may break down and may cause terrace damage, slope failure and the comprehensive sedimentation in down streams. Further, the mismatch of social system and the land use pattern may also lead to land degradation. Such a mismatch occurs either when poor farmer makes intensive use of their marginal lands or when rich farmers try to maximize their profit from their land within a short span of time without giving adequate attention to its sustainable use. Also, these rich farmers may not reinvest their gains on the same lands. Similar outcomes are very much prevalent in the study area where owners of the brick kiln industries uses the agricultural land for top soil and generate huge amount of profit but not pay any attention to improve the condition of land.

As a result, considerable area of agricultural land is degrading every year due to top soil quarrying. On the other, the poor farmers those who are leasing out their land to brick industries for top soil quarrying also not able to reclaim their land due to lack of available means.

In both cases, improper use of land by these poor and rich farmers is causing land degradation and environmental changes. Moreover, even the unequal relations of production between the rich and poor may also amount to land degradation. Poor farmers may lack of basic amenities unlike the rich (Blaikie 1985). In addition, economic inequality between poor and rich, modes of production and power relations are closely related. The over emphasis on cash crop cultivation by the rich farmers and simultaneous ignorance of traditional land use pattern under the colonial economy has led to the famine and environmental hazards (Michel Watt 1983).

Besides this, the government policies, government elites played a vital role in marginalizing the poor by adopting policies against them (Hoeschele 1998).

Therefore, the supporters of political economy try to co-relate the systematic process of marginalization of the poor and underprivileged and natural resource depletion and environmental degradation (Blaikie 1985, Blaikie & Brookfield 1987, Watt 1983 and Hoeschele 1998).

The above mentioned scholars mainly talks about three type of marginality. Among these economic marginality is closely linked to this study. It helps to understand the process of the development of brick kiln industries and related changes in Murshidabad. Here economic marginality denotes that a certain sections of the society, especially the weaker and the underprivileged people are being systematically deprived of the basic resources for their survival by the politically and economically powerful people.

The politically powerful people are able to influence as well as manage the government authority to allot the potentially rich land in favour of them. It is also evident that the best quality resources like potentially rich land, forest or other natural resource are mainly controlled by the socio-economically and politically powerful people. In India too, it has been observed that since the colonial times the best quality land is occupied by the people who have good political influence. While the influential people or social group holds fertile agricultural lands, the economically weaker section are usually left with infertile, degraded land for cultivation. Such infertile land can hardly fulfil the requirement of the poor.

Therefore, poor people are forced to depend upon insufficient land resource they have and over utilize in order meet their basic needs (Hoeschele 1998). It is not true that they are not aware of the consequence of their present action on land, but they have no other option rather than meeting their present need for survival. They are not in position to think about the future.

Thus, the question of class, social categorization and the presumption about cultural superiority and inferiority and notion of socio- cultural privilege among the people plays an important role within the political economy framework. In addition to this, the role of state is another important issue because the state is an important player or facilitator who grants legal right to the people to enjoy the privilege over the use of natural resources.

Further, this may result in exclusion of certain marginalised groups due to the monopoly of resources by the rich and powerful. It has been observed even in a democracy; the state may be unwilling to go against interest of the economically powerful groups. Therefore, the state is an important agent which plays a vital role in formulation of a particular type of land use pattern within its administrative area (Hoeschele 1998).

Social interaction and its outcome is a multidimensional issue and it varies from area to area. Thus, it is crucial to focus on the interconnected dimension instead of looking for a specific factors causing environmental degradation. But certain factors within these (multiple factors) are very important and understanding of such factors would help to find out the ground reality. For instance, in order to address the problems related to the functioning of brick industry in the present study, it is essential to understand the roles played by various agencies related to brick industry. Thus this study classifies the social agencies and their relation into following different heads with regard to social relation, economic relation and political relation and also emphasis how these relations change over time and space.

With regard to social relation, the present study focuses on commonality and differences among the different cultural group associated with brick industry and also looking how the industry influence their life. It is to be noted that the changing power

relation based on inter connected factors related to their caste, class, social and religion background are to be considered important aspect in order to comprehend the social relation.

Similarly, with regard to economic relation, emphasises put on the understanding the economic status of those people who are associated with brick industries such as owners, labourers, contractors, transport facilitators, etc. and also on those who have leased out their lands for quarrying such as farmers. In addition, this study also focuses on the shift in their economic relation.

In this regard, this study attempts to understand dynamics of brick industries in relation to labour related issues such as demand and supply of labourers, nature of the contract, mode of payment, condition of works (duration and time etc.). In addition to this study also focuses on the changes in village production system. Earlier the village economy was entirely based on the agrarian based production systems, but now villages within the study areas witnessed significant change in production system with the emergence of brick industry.

The study further focuses on the issue of natural resource transfer from a particular group of people to the other groups based on class, religion background and related socio-economic condition. Study also tries to understand its spatial-temporal dimensions, how resources transfer from one area to other area through the functions of brick industry. Furthermore, this study tries to focuses on the outcome of brick industrial functional activities on agricultural land and agricultural crops practices, air and water pollution and related environmental changes.

Concerning above issues, this study intends to understand that what is the motive of establishing the brick industry in the district of Murshidabad? Further, how the role of different agencies of the state government helps in the development of brick industries

in the District. Similarly, study also attempts to answer the following questions like what is the nature of brick industry. Whether it falls under organised or unorganised sector of an industry?

I.4 Objectives of the Study

1. To identify and critically examine the interactions between agents, and processes involved in the development of the brick industry
2. To examine the outcomes of such interactions in the agriculture production system, economy, livelihood, social relations and the environment.

I.5 Research Questions

i. What are the social, economic and political factors that help in the establishment and sustenance of Brick industries?

ii. How brick kiln industry affects the farmers?

iii. How the environmental changes affected by the brick kilns interact with the social process?

I.6 Data Base

The data has been collected from both primary as well as secondary sources. The primary data have been collected through interviews, questionnaire survey, case study and secondary data have been collected from different Government sources like State Statistical Abstracts, Stare Economic Reviews, District Statistical Handbook, District Gazetteer, Census of India (1991, 2001 (PCA 2001) and 2011(PCA 2011) and Agriculture Census of India (2001 and 2011).

1.6.1 Primary Sources

Structured Interview: Structured interview has been conducted among the owners, government officers involve in the development of brick industries to know their view about the brick industry**.**

Semi-Structured Interview: Semi-structured interviews have been conducted among the local politicians, intellectuals (teachers) and common people those who are not directly involved in the brick industry.

Population Survey: Schedule questionnaire based survey has been conducted among labourers, farmers and owners **(**directly involved**)** to gather information about them.

Census of India: Census record also considered as a source of information regarding population distribution in terms demography, rural and urban population distribution (A1series), occupational structure, work force participation (2011-PCA) and household amenities (HH series 2011) for the study.

Government Office Survey: Following offices; the Department of Land and land Reforms, (Govt. West Bengal) Murshidabad (to collect the information about the brick industry in the district), "Department of Forestry and Environment", District pollution control Board (to collect the information about the rules and regulation to establish brick industry) and "The Department of Agriculture and Irrigation" have been visited to gather the information.

Field Sample Collection: Soil and water sample have been collected from the fields for analyzing the changes in soil fertility and water quality in the study areas.

I.6.2 Secondary Sources

District Gazetteer: Information regarding historical background, geography, Physiography and soils of the district has been collected from the "District Gazetteer" published by **District magistrate** (Murshidabad) office to consolidate the study.

District Statistical Abstracts: District statistical Abstracts have been referred to understand the present status of economy of the district and the role of small scale industry (Organize and Unorganized) in terms of economic development which operates in the District.

Agricultural Abstracts: District Agricultural Abstracts have been referred to understand the present agricultural activities in the study blocks in particular and the district as a whole in general.

I.7 Methodology

Qualitative as well as quantitative methods were utilized for this study. The qualitative part of the study is descriptive and explanatory. It includes the diverse type of issues like the growth of brick industries in terms of the time and space, agencies and their role, labour process, labour market system, socio economic dimension of the brick industry. In addition, extensive field work with the help of a structured questionnaire, lab test, use of statistical tools and techniques have applied to generate first hand information. The selection of the study area and issue of brick industry has been done by applying various sampling methods.

I.7.1 Selection of Study Blocks:

In Murshidabad district, most of the brick industries are found in the *Bagri* region. Therefore, three blocks (Berhampore, Murshidabad Jiagang, and Domkal) from the *Bagri* region were selected by applying purposive sampling adopting the criteria of the number of working Brick Kiln Industries.

I.7.2 Selection of Brick Industries:

Stratified proportionate sampling method has been used to select the brick industries. Three types (Fixed chimney kiln/ Vertical shaft chimney, Howa Kiln, and Moveable chimney kiln) of brick kiln industry operate in the study areas. Two criteria namely (i) type of the brick industry (ii) production capacity of the industry has been taken into consideration to select the number of brick industries.

Total number of twenty seven (27) brick industries spreading over three Community Development blocks of district Murshidabad [Ten brick kiln industries from

Berhampore (one Moveable Chimney, two Hawa/Zigzag kiln Chimney and seven Fixed kiln Chimney), nine (9) from Murshidabad- Jiagang (one Moveable Chimney, two Hawa/Zigzag kiln Chimney and six Fixed kiln Chimney) and eight (8) from Domkal (one Moveable Chimney, two Hawa/Zigzag Chimney and five Fixed kiln Chimney)] has been selected for the present study.

I.7.3 Selection of Sample Size:

Since, various types of the people are involved in the brick industry like owners, managers, labourers, contractors (labour, land) farmers and businessman etc, diverse types of sampling techniques applied to collect the information regarding them. The simple proportionate sampling techniques were applied to collect the information about the owners of the brick industry. Twenty-seven owners as respondents (one owner from each brick industry) have been selected for the study. In the case of multiple owners, single owner has been randomly selected from each of the particular industries. Stratified proportionate sampling techniques were applied to collect the information about the labourers.

The labourers were stratified based on their task such as Pakmill worker, brick maker, transporters, rubbishmen, mistry and fireman. After stratifying, proportionate share from each stratum were taken into account. In total two hundred ninety seventy (297) respondents (eleven respondents from each industry) from the twenty seven (27) brick kiln industries, from the three Community Development blocks has been selected for the study.

Out of these eleven respondents; three brick makers, three brick transporters, two brick *Firemen*, one '*Mistry'*, one *Rubbishmen* and one *Pakmillers* were taken for the study. Multistage sampling technique was applied to collect the information concerning farmers. The farmers are stratified based on the amount of their

landholdings. After that, proportionate sampling techniques were applied to collect information from each section. In total sixty (60) respondents (twenty from each block) from three Community Development blocks were taken into consideration for this study.

I.7.4 Collection of Data on Cropping status and the Crops Yields:

To collect data regarding the area's cropping status and cropping pattern in-depth interviews and discussions were conducted with the farmers. In addition, the data related to change in the crop yield with regard to the common crops such as paddy, wheat and jute, cultivated by the farmers was collected by the questionnaire survey.

I.7.5 Collection of Data about the agricultural land areas used by the Industries:

Field survey was conducted to gather data about the amounts of land used by each industry, for establishing the industry and for top soil quarrying.

I.7.6 Collection of Data about the depth of the Top Soil Quarrying Land:

Depths of the topsoil quarrying agricultural land of the individual respondents (farmers) were measured with the help of a measuring tape.

I.7.7 Collection of Soil Samples:

Thirty soil samples (fifteen from top soil quarrying land and fifteen from immediate un-quarried land) from three blocks were collected for the analysis and for the comparison the results. The soil samples were collected during the winter season following the standard norm mentioned by Hesse (1994) and Dhayan et al (2010).

I.7.8 Collection of Water Samples:

To evaluate the functional impact of the brick kiln industries on the surface water bodies (ponds); ten (10) water samples were collected and analyzed. Five water samples were collected from the surface water bodies located 50 -100 meters away from the boundary of the brick industry and the remaining five water samples were

collected from 150-200 meters away from the boundary of the brick kiln industry following the standard norm given by Singh, D., et al. (2005) and C. C. M. E (2011).

I.7.9 Collection of data related to Fuel Consumption and Brick Production:

The field investigation shows that in order to bake one lakh green bricks requires or consumes 16 – 24 tons coal. A typical movable chimney kiln consumes 20 to 24 tons coal to bake 1 lakh bricks. Similarly, a vertical shaft/ fixed chimney kiln needs 16 to 20 ton coal to bake 1 lakh bricks. In addition to, a typical Hawa/zigzag chimney kiln consumes 15 tons or below 15 tons coal to bake 1 lakh bricks.

A movable chimney kiln is capable of completing the 3- 4 rounds production in a season/year with about 3- 4 lakh bricks per round. Therefore, the average production per moveable brick kiln in a season is 12- 16 lakh bricks. Likewise, a typical fixed chimney kiln produces 4.5 to 5.0 lakh bricks per round hence the average production capacity of a fixed chimney kiln industry ranges from 16 to 20 lakh bricks per season. Further, a Hawa/zigzag kiln industry produces about 5 lakh bricks per round and average seasonal production is 20 lakh bricks per production season/year.

I.8 Methods of Analysis:

In order to understand, the nexus among the different agencies working for the development of brick industries in Murshidabad, narrative method has been utilised. Information has been gathered through discussions with the owners of brick industries, along with farmers, contractors of labour and land (soil suppliers), brick businessman, fuel suppliers, local force groups and heads of the Govt institutions (Gram Panchayat, Dept of Land and Land Reform, Dept of Forest & Environment and Pollution Control Office). Case studies have been referred to collect information about the contribution of brick industries in the life of labourers and farmers and also to know- how they became the part of it.

The collected information is described in a sequential manner to fulfil the first objective. Following issues have been taken into account to understand the role of brick industries with regard to landless labourers.

I.8.1 Shifts in Social Relations:

To understand the shifts in the social relations, this study examined the power relations between the brick kiln owners and the farmers in terms of resource transfer in the form soil and land. In this regards caste, class, religious and economic background of both groups and its spatial dimension have been analyzed.

I.8.2 Shifts in Economic Relations:

To understand the shifts in the economic relation of the brick industries- the dynamics of labour market and the changing mode of production system have been taken into consideration. In labour relations, issues related to labour process like the nature and pattern of labour contract and the labour movement has been examined. Besides this, the occupational shifts among the landless labourers, their daily wages and wage differences with respect to their previous works have been taken into consideration.

To evaluate the impact of the brick industries on the changing socio-economic condition of the labourers following parameters such as housing, occupation, income, shift in economic activities, expenditure, sanitation and water supply have been taken into account.

Further, in order to understand the impact of industries on the farmers and owners certain socio-economic variable related to them such as issue of religious background, caste, housing, water supply, sanitation, land holding pattern etc has been considered. Furthermore, it is to be noted that certain techniques descriptive statistics, crosstab, custom table of SPSS uses to calculate the share of different categories under the different set of parameters.

Arc-GIS tools and techniques were used to map the study blocks and the location of the brick kiln industries. The study area is mapped with the help of base map collected from the Survey of India (Kolkata). After that location of sample industries were collected with the help of GPS. Later on, the collected points (location) were converted into shape file with the help of Arc Tool. Finally, locations of brick industries in the study have been mapped.

I.8.3 Estimation of Areas used by the Individual Brick Industry:

The total areas cover by each brick kiln industry in Murshidabad district is estimated with the help of the Google Earth Satellite Imagery. The approximate agricultural land uses by each brick kiln industry for top soil per season is estimated by applying the following formula:

$$= \left[\frac{\{(X.Y.Z \times N)cm3\}}{Dfcm}\right]$$

Where *X= Length of the Brick in centimeters*

Y= Width of the Brick in centimeters

Z= Depth/height of the Brick in Centimeters

N= Number of bricks produced by each industry per season

D f = Average Depth of the top soil quarrying agricultural land

[1 square centimeter = 1e-8 hectare]

I.8.4 Estimation of depths of the Topsoil quarrying Agricultural Land:

Depth of the individual top soil quarrying land varies from one another. It has been measured with the help of a measuring tape. After collecting individual quarrying field data; statistical mean is used to calculate the average depth of the topsoil quarrying agricultural land. 'Standard deviation' method is used to understand the closeness of the individual value with respect to average.

I.8.5 Measurement of Loss of Soil Fertility:

The impact of the brick kiln top soil quarrying on the changing fertility status of the agricultural land was estimated by collecting and analyzing the soil samples. The changing level of pH values was estimated with the help of electrode pH meter (Jackson 1973). Similarly, the changing level of soil Nitrogen (N) was estimated with the help of micro- Kjeldhal distillation method (Subbiah and Asija 1956).

In addition, the changing level of Phosphorus (P) in soil was extracted by following blue colour method with the help of flame photometer (Oslen & et al 1954) and available amounts of Potassium (K) in the soil was measured with the help of the flame photometer (Schollenberger& Simon 1945).

I.8.5.1 Measurement procedure of Available soil pH

Materials and Methods

The important materials and instruments were used to measure the soil pH is electrode pH meter, Standard pH solution, Beaker (100 ml), Spatula, Measuring cylinder and Rubber tipped glass rod, etc. First of all the soil samples were sieved by the 2 mm diameter sieve to separate the small stone, the tiny plant roots, weeds and small broken leaf etc. After sieving the soil; 20 gram soil from each soil samples were taken into series 100 ml dry beaker. Later on, the soil was dry by hot air oven to remove the soil moisture. After completely removing the soil moisture; 40 ml distilled water was added to the soil. The distilled water mixed soil was stirred by the magnetic stir rod for 30 minutes. After completing the stir soil mixture was kept at rest for 1 hour to saturate.

Procedure of Measurement:

To measure the soil pH first of all switches on the pH meter. Later on, the temperature of the pH meter was set by using the temperature correcting knob and warm up it

about 15 - 20 minutes. Later on, reading of pH meter turn at zero with the help of zero setting knobs. Two pH standards (pH 4.00 to 7.00 and pH 7.00 to 10.00) were used to calibrate the pH meter before taking the reading. It has been done in accord with the pH range expected in the soil samples. After that electrode was dipped into the soil suspension and taken the reading value once the reading was constant.

I.8.5.2 Determination of available Soil Nitrogen:

The amount of soil nitrogen is treated with the excess of alkaline and $KMnO_4$ distilled. The $KMnO_4$ mild oxidizing agent was used as an alkaline medium. The organic matter present in oxidized form in the soil which is liberates nitrogen by $KMnO_4$ in the presence of NaOH. The ammonium released was distilled and absorbed in a known as volume of a standard acid. The excess amount ammonium was titrated with a standard alkali, using methyl red as the indicator. This method of nitrogen estimation is considered to be hydrolysable N or potentially available Nitrogen.

Material, Equipment and Essential Chemical:

For estimating the available nitrogen in the soil a Kjeldahl distillation set, measuring cylinder, pipette, and burette, and conical flash, electric heater was used. Besides above instruments following chemicals are also used at different stages of testing; i) Potassium Permanganate 3.2 gram, ii) Sodium Hydroxide 25gram iii) Liquid paraffin, iv) Sulphuric Acid 0.02 N and v) Methyl red indicator 0.15gram.

Preparation of reagent:

At first 3.2 gram reagent grade $KMnO_4$ is dissolved in a considerable amount of distilled water. After properly mixing, we added additional distilled water and make it 1 litre in a volumetric flash and store it in a brown bottle. After that, we dissolved 25gm NaOH in a separate glass with distilled water. Later on, added additional distilled water to make it 1littre and store in a plastic container. Required amount of

liquid paraffin and sulphuric acid were kept in the two separate glasses. At last, 0.15 gram methyl red power dissolved in 100 ml alcohol and kept it in a separate place.

The steps followed to make the testable samples:

At the 1st step 20 grams of dry soil pours into 800 ml dry Kjeldhal flash. After that 20 ml water was added to the soil and spins the mixture few minutes. After the spin, added 1 ml of liquid paraffin and a few glass beads with soil to prevent frothing and bumping during distillation.

Later on 25 ml H_2SO_4 is taken into a fresh conical flash and added 2-3 drops of Methyl red indicators in it and dipped into the end to deliver it into the tube. After that added another 0.32 gram $KMnO_4$ and 2.5ml NaOH solution into the Kjeldhal flash and cork it immediately. After distil the solution in a Kjeldhal assemble at a steady state rate and collects the liberated ammonium in H_2SO_4 solution.

The process of dipping is keep continuing until the evolution of Ammonium ceases completely. Lastly, titrate the excess acid against NaOH and note down the volume of NaOH used at the end point is reached and colour changes from pink to yellow.

Calculation of available Nitrogen (N) in soil

$$\text{Percentage of available N} = (25 - x) \times 0.00028 \times \frac{100}{20} = \text{A}$$

$$\text{Availability of Nitrogen in ppm} = \text{A} \times 10{,}000$$

A represents the available Nitrogen (N) in per gram dry soil

Classification of soil based on availability of Nitrogen

Amount of N (kg ha-1)	Soil category
< 272	Low Quality Soil
272 – 544	Medium Quality Soil
>544	High Quality Soil

I.8.5.3 Measurement of soil Phosphorus:

Materials and equipment used for Measurement of phosphorus:

For measurement of phosphorus in soil, following materials and equipments were used at different stages. Among these equipments, different types of beaker, 150 ml conical flash, p free charcoal, distilled water, whatman filter paper (number 42), colour photometer, shaker, magnetic stir rod, measurement flashes of 250 ml, 100 ml, 50 ml, tissue paper, spatula, Volumetric flash etc were used.

Chemicals:

The chemical like Sodium bi-carbonates, ammonium molybdate, antimony potassium tartrate, ascorbic acid,H_2SO_4, KH_2PO_4, 2-4 digitize phenol, NH_4OH and 2 Normal HCl acid were used to test soil phosphorus.

Making solution/ reagent for Phosphorus test:

Preparation of $NaHNO_3$ solution: Dissolved 42 gram $NaHNO_3$ in water and mixed thoroughly and made up-to 1 litre. To adjust the pH of solution again mixed with 1 m_ NaOH. After adjusting the pH of the solution, were stored in volumetric glass in dry and cool place.

Preparation of reagent A: To prepare the reagent A, at first, about 6 gm ammonium molybdate is dissolved in 250 ml distilled water in a volumetric flask. Another 0.1854 gm antimony potassium tartrate dissolved in 100 ml distilled water in a separate glass. After properly mixing of these two chemicals in the two separate glasses, pour down both the mixtures in new large glass to make it 500 ml by added the additional distilled water. After that added 2.5 m_ H_2SO_4 acids with the reagent A and made it 1000 ml by adding additional distilled water. Finally, whole solution keeps in a large glass bottle in a dark and cool place for future use.

Preparation of reagent B: About 1.056 grams of ascorbic acid mixed with 200 ml reagent 'A' which is already made to prepared reagent B.

Standard Phosphorus (P) stock solution: To make the standard phosphorus solution about 2.5 M_ or 140 ml concentrated H_2SO_4 were mixed with distilled water and made 1 litter in a volumetric flask. Later on**,** exactly 0.439 g KH_2PO_4 (AR grade) was dissolved in distilled water and made it 100 ml. This KH_2PO_4 solution was giving up 100 mg or 100 ppm P standard stock solution. From this KH_2PO_4 stock solution, diluted 5 ml in distilled water and was made 10 mg/kg-1 solution.

Preparation of standard curve:

- 0, 0.5, 1.0, 1.5, 2.0, 2.5 ml of 10 ppm P solution taken in a series of volumetric flashes.
- Added 5 ml extracting sodium bicarbonate into the solution.
- 1-2 drops of p- Nitro phenol indicator added to adjust PH 5.0. To made it colour yellow. After that added a few drops of dilute NH_4OH with solution.
- Later on, 2 N_ HCl acids were added drop by drop with the solution to remove the yellow colour.
- Finally, 20 ml distilled water and 4 ml reagent B were added with P solution.
- After mixing the distilled water and reagent B, the solution taken to the spectrophotometer and check the intensity of the blue colour of the standard solution. The transmittance vs. concentrated on semi log graph paper was used to understand the standard value with a sample value.

Measure of Phosphorous concentration in soil samples:

i. 2.5 gram air dry soil samples taken into series of 150 ml conical flash.
ii. A pinch of P free charcoal added with the soil.
iii. 50 ml sodium bicarbonate solution added to the soil samples.

iv. The mixture shaken for 30 minutes for properly dilute.

v. The diluted solution filter through Whatman paper no. 42 into clean and dry beakers.

vi. 5 ml filter aliquot collected into 25 ml volumetric flask and adjusted its pH at 5.0 by added 2 N_ HCl.

vii. After adjusting the pH, 20 ml distilled water and 4 ml reagent B added with the aliquot.

viii. After added the reagents, the reagent mix aliquot kept for 10 minutes in rest and finally placed into the spectrophotometer to read the intensity of blue colour.

Calculation of phosphorus (P) in soil

$$\text{Availability of Phosphorus in (ppm) in soil } R \times 25 \times \frac{25}{2.5} \times 5$$

$$= R \times 50$$

R represents the availability of Phosphorus (P) per gram dry soil.

Classification of soil based on availability of Phosphorus

Amount of P (kg ha- 1)	Soil categories
< 10.0	Low Quality Soil
10.0 – 24.6	Medium Quality Soil
>24.6	High Quality Soil

I.8.5.4 Measurement method of soil Potassium:

The most widely used method of determining the available soil potassium is based on the principle of equilibrium of soil, with an exchanging cation made of the solution of neutral normal ammonium acetate (Schollenberger & Simon 1945). The availability of Potassium in the soil samples was estimated with the help of the flame photometer.

Materials, Instruments and chemicals:

The important materials and instruments like the conical flask, shaker, funnels, beaker, Whatman filter paper no. 1, pipette, pH meter, tissue paper and flame photometer and distilled water were used. Following important chemicals like Ammonium acetateCH_3COONH_4, potassium chloride (KCl), NH_4OH (sodium hydrate) were used to test the soil potassium

Chemical solution Preparation:

- At first 77 gram ammonium acetate has been dissolved in distilled water and made up the volume of 800 ml. After that, pH of mixture (at 7.0 levels) adjusted by adding required amount of NH_4OH solution and makes it volume.
- In another beaker 1.908 gram AR grade potassium chloride dissolved in 1000 ml distilled water. This is considered as 1000 ppm potassium (K) chloride solution.
- Finally 100 ml of 1000 ppm Potassium solution taken out and made it one Litter with extracting solution.

Preparation of standard curve:

0, 5, 10, 15, 20 ml of 100 ppm K solution were taken into a series of 100 ml volumetric flask and make up their volume. This solution considered as a standard solution to compare with the samples reading with the standard.

Measure of Potassium concentration in soil samples:

i) 5 grams of air dry soil samples taken in a series of 150 ml conical flask.

ii) 25 ml of ammonium acetate solution was added with soil samples.

iii) The mixture was shaken by reciprocating shaker for 5 minutes for proper mixing soils with the solution.

iv) After shaken the mixture, immediately filter through Whatman no. 1 and collected in a dry clean beakers.

v) The filter aliquots were taken to the flame photometer to read the intensity.

Calculation of available K in soil samples

$$\text{Availability of Potassium (K) per ppm } R \times \frac{25}{5}$$

$$= R \times 5$$

R represents availability of Potassium (K) per gram dry soil.

Classification of soil based on availability of Potassium

Amount of K (kg ha - 1)	Soil category
< 112	Low Quality Soil
112 – 280	Medium Quality Soil
>280	High Quality Soil

I.8.6 Estimation of changes in Crops Suitability:

The top soil quarrying activities have an adverse impact on changing crop suitability of the land. The level of changes in crop suitability on the top soil quarrying land in the study areas have been calculated by applying the following steps:

At first, total number of crops used to cultivate by the farmers prior to lease out their land to brick industry, mean value of that is calculated. In second step, the mean value of number of crops cultivated after top soil quarrying is calculated. In third step, second mean value is subtracted from the first mean value to get the difference of estimate the changes in crop suitability[1].

I.8.6.1 Estimation of Changes of yield of Common Crops:

The changes in the Relative Yield (RY) of the common crops have been estimated by applying following two steps.

[1] The information about the number of crops cultivated by the farmers, before lease out their land to brick industry has been collected by conducting discussion with them. In this regard, general cropping scenario of the villages was also taken into account. Collected information has been cross checked by discussing with the farmers those are yet not leased out their land to brick industry.

At first step, mean yields of individual crop before and after the top soil quarrying is calculated by applying following formula.

$$Y=\frac{P}{A}\ (Kg/Bigha)$$

Y= Yield

P= Production

A= Area

[Note: 1 Bigha = 0.1338 hectare in West Bengal]

At second step, the changes in yields of same individual crop after top soil quarrying is calculated by applying following formula:

$$CY=\frac{PRY-pay}{PRY}\times 100$$

CY= Change in Yields

PRY= previous Value (yields)

pay = Present Value (Yields)

I.8.6.2 Estimation of Changes in Agricultural Land Value:

The change in land values due to top soil quarrying is estimated by utilising the following formula:

$$\frac{PER\ UNIT\ MEAN\ MARKET\ VALUE\ OF\ AGRICULTURAL\ LAND-Per\ unit\ mean\ market\ value\ quarrying\ land}{PER\ UNIT\ MARKET\ VALUE\ OF\ AGRICULTURAL\ LAND\ IN\ STUDY\ AREA}\times 100$$

[NOTE: Agricultural land value is calculated by conducting the field survey among the respondents (farmers). At first, individual farmers land value is collected. After that mean of all land value is calculated. Similarly, the land value after top soil quarrying is also calculated. To confirm the agricultural land value in the study area survey also conducted among farmers those who are not leased out their land to brick industry for top soil quarrying].

I.8.7 Analysis the Changes in soil Toxic (pH) Level due to brick Kiln Burning:

The changing toxic level of soil due to continuous burning was estimated by

analyzing the pH value of the soil samples collected from the kiln floor and the kiln side in order to compare the result.

I.8.8 Estimation of Carbon Dioxide (Co_2) Generation:

The burning of coal in the open air or in the presence of the oxygen produces the heat energy and carbon dioxide. The amount of carbon dioxide produced due to the burning of coal has been calculated by adopting the method used by the scholars like Leila Croitoru and Maria Sarraf (2012) and the agencies like US Energy Information Administration (2013) and IPCC (2006). The above agencies have shown that the burning of one ton coal generates 3.6 tons of carbon dioxide. It is because of the chemical combustion. During complete combustion of coal, each carbon atom of coal combined with two oxygen atoms in the air to make one unit of carbon dioxide.

The present study shows that in order to bake the one lakh green bricks require 16 – 24 tons of coal. The nature, type, and size of the kiln determine the level of the fuel consumption. It has been observed that most of the brick industries in study area are fixed chimney kiln based. Very few of these industries Howa/zigzag chimney kiln based. There is one or two movable chimney kiln based industry operating in the area of study. Therefore, the Co_2 generated by each industry per season has been calculated by considering the following steps:

Step 1: The amount of coal consumes by each industry per season is calculated.

Step 2: Coal is converted into Co_2 by "*Coal to the Co_2 conversion factor"*.

After calculating the amount of Co_2 produced by each industry per season; statistical mean is applied to measure the variation levels in Carbon dioxide production according to types of the brick kiln industries.

I.8.9 Estimation of SPM Generation:

Brick kiln industry is one of the major producers of the Suspended Particulate Matter.

The amount of the Suspended Particulate Matter (SPM) produced by the brick kilns also varies from the industry to industry. A traditional moveable chimney kiln produces maximum amount of particulate matter corresponding to per thousand bricks production. A fixed chimney kiln produces relatively less amount particulate matter corresponding to per thousand bricks production. Similarly, a hawk/zigzag chimney kiln produces a relatively lesser amounts SPM corresponding to per thousand bricks. A movable kiln produces on an average 8.06 kg SPM/1000 bricks. Similarly a fixed chimney kiln produces on an average 1.71 kg SPM/ 1000 bricks whereas a typical Hawa/zigzag chimney kiln produces 0.57 kg SPM/ 1000 bricks (Tuladhur, Acharya and Raut 2006).

Therefore a moveable Chimney kiln generates about 806 kg SPM/1 lakh bricks whereas a fixed chimney kiln generates about 171 kg SPM/1 lakh bricks production. In addition, a typical hawa/zigzag chimney kiln generates about 57 kg SPM/ lakh bricks production. After calculating the amount of the SPM produced by an individual industry per season; statistical mean is applied to measure the variation in SPM production according to types of the industry.

I.8.10 Estimation of Changes in Water Quality:

The relative changes in water quality of the water bodies located close to the brick industries in the study areas following certain parameters has been analyzed. The water pH level has been estimated with the help of electrode pH meter. The relative changes in Electric Conductivity (EC) and amount Total Dissolved Solid (TDS) has been estimated with the help of Horava TDS meter. The changing level of water elements like Sodium (S), Potassium (K), Magnesium (Mg), Calcium (Ca) and Chloride has been estimated with the help of ICPMS. Finally, statistical mean is applied to measure the variation in the above-mentioned water parameters.

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Chapter II

II.1 Review of Literature

Bricks are considered to be as integral part of construction activities. In modern society also brick industry is gaining importance day by day specially in developing world (Alaa and Muhammad 2013). As a result, the number of the brick industry is increasing day by day to meet the demand of bricks for the urban expansion and infrastructure development. The rapid growth of the brick industry in the developing world has brought number of opportunity for the landless labourer, small and marginal farmers as well as challenges in relation to agricultural land degradation, air, soil and water pollution.

To understand and address these issues, emerged from the functioning of the brick industry; a considerable number of scholars and agencies have done their study taking into account different issues ranging from land degradation, water and air pollution, environmental changes and the socio-economic aspects of the brick industry. Therefore, this chapter discusses notable works that have been done on the brick industry to understand major debates emerging out of scholarship over the time and space. The whole work of different scholars is broadly divided into two categories:

- Works done by the scholars outside India.
- Works done by the Indian scholars within India.

The works done at outside India again sub divided into two sub categories:

1. Works on environmental consequences of brick industries.
2. Socio-economic consequence of brick industries.

Similarly, the works of Indian scholars are sub divided into two categories;

1. Studies on environmental consequences
2. Socio - economic consequences of brick industries.

II.2 Works conducted on brick industries outside India

II.2.1 Works on physical and environmental aspects of brick industry

Pandey (1997) conducted a study on brick industries and mentioned that the inefficient combustion of coal in kilns is responsible for generation of huge amount of Sulphur dioxide. His study further demonstrated that the addition of such huge amount of sulphur dioxide with air reduces the quality of air; especially in winter season.

Gutschow and kreutzman (2002) carried out a study on the brick industry from the socio- environmental perspective. Their study narrates how significantly large tract of agricultural land around the valley is getting severely affected, due to top soil quarrying to meet the rising demand of bricks for urban expansion of Kathmandu valley. In fact, the implementation of new brick making techniques to improve the production efficiency further exerted the pressure on existing agricultural land. As a result, more and more agricultural land turns into quarrying field. The use of agricultural land for brick making has reduced the net agricultural land which has directly affected the food production and food security in the valley.

Their study found a clear societal/class division between the owners and labourers. Almost all the owners are from the upper class of the society but all the labourers belong to socially lower caste people, especially from untouchable groups. Among the owners, few of them from the valley and the rest are from India. This study also noted that the benefits generated from the brick industries are at the expanse of poor farmers' lands; consumed by the socially influential upper caste/class people.

USAID (2003) published a report on the brick industry to highlight the environmental as well as a health hazards emerging from the function of brick kiln industry. This report mentions that, the toxic dust is the main by-product of brick and tile industry.

When this toxic dust mixed with water, it contaminates the water and pollutes it. Later on, this contaminated water makes its way into the local drinking water supplies and affect the health of the people. Another important issue has highlighted by this report is that the people working in brick kiln inhale the toxic dust. This dust enters into their human body through inhaling and remains the cause of silicosis among the workers; a disease that affects the lungs and breathing, and ultimately lead to death.

Khan, Rahaman, Rouf, Sattar, Oki and Adachi (2007)'s study on the brick industry in Bangladesh tries to assess the role of brick industrial top soil quarrying and burning in changing the soil quality and agricultural land degradation. Their study has noted that brick industrial top soil quarrying activity is responsible for removal of top soil up to two meters deep as well as changing chemical composition. They pointed out that quarrying activity is responsible for the destruction of large track of agricultural land. Their study further mentions that burning of top soil at kiln is responsible for significant changes of available chemical compound not only in the soil of kiln area but also a few meters away from the kiln. Their works further noticed that the extreme heat of the kiln has destroyed the soil's microbial organism at large.

Joshi and Dudani (2008) carried out their study on brick kiln industry to understand the negative environmental impacts that emerged from brick kiln industry and its subsequent impact on human health. Their study noted that the use of low grade coal and rubber tyre scraps as fuel for brick burning is responsible for generating huge amount of carbon dioxide, carbon monoxide, sulfur dioxide and other gases. Apart from these harmful gases, brick kiln burning is also responsible for the production of large amount of dust, suspended particulate matters. The addition of such amount of gases and dust particulate materials into the environment is responsible for air and water pollution in the valley. The people living in such polluted environment are

suffering from bronchitis, asthma, cough, fibrosis, silicosis due to inhaling of micro dust particles. Their study further noted that the children of the area are suffering from tonsil, inflamed pharynx, pharyngitis, emphysema, allergic rhinitis etc. due to inhaling of such micro dust particles.

The study of Heilrili and Maithel (2008) on the brick industry highlighted the present status of the brick kiln industry in Asia. Their study has shown that Asian traditional brick kiln industry produced about 1000 billion bricks annually to meet the demands of 4 billion Asian. Their study further noted that the traditional way of burning is responsible for producing 180 million tons of carbon dioxide by consuming 110 million tons coal. The main objective of their study was to analyze the feasibility of the introduction of new technology to reduce the pollution keeping production level static. Their study has also suggested that only switching in Vertical Shaft Brick Kiln (VSBK) technology could reduce the fuel consumption by 30 percent to 60 percent as well as pollution level.

The study of Ishaq, Khan, Jan and Ahmed (2010) on the brick industry in Peshawar, Pakistan tries to understand the impact of brick kiln industry on soil and plants of surrounding areas. Their study has pointed out that the continuous burning of soil at kiln adversely affected the availability of soil elements like copper, organic carbon, zinc, cobalt, manganese, lead, nitrogen, chromium and others.

Their study found that availability of copper, chromium and nickel increase significantly in the soil with increasing depth of the soil/land as well as increasing distance from the brick industry. The reduction of Cobalt and Zinc in the soil is responsible for poor plant growth. Beside poor plant growth, they also argued that the people working in the brick industry or living close to the brick kiln industry suffered from many health hazards.

Avitia, Antonio & Mora (2012) in their works on brick industry have discussed about role of brick kiln in environmental changes from the perspective of landscape ecology. Their study revealed that, the traditional way of burning, open casting and use of low grade coal as fuel are responsible for producing huge amount of smoke, carbon dioxide, total suspended particulates, heavy metals, nitrogen oxides, carbon monoxide, sulfur dioxide, hydrocarbons and ozone etc. and it is largely due to the incomplete combustion process and the different types of fuel used in the kiln. Their study further mentioned that there are few heavy metals which remains in its original form after burning or may react to create new compounds such as metal oxides, chlorides or fluorides.

Their study also has shown that the incineration of these metals and bioavailability of toxic metals is greatly increased in comparison with the original waste. The most common form of transport of the pollutants is air. Sometimes, these pollutants travel thousands of miles and deposits on the soil in a distant area and ultimately affect the health of the people in distant places.

Ismail, Muhammad, Khan, Munsif, Ahmad, Ali, Khalid, Haq and Ahmad (2012) have done their study on the brick industry and found that brick kiln burning is responsible for the generation of huge dust and smoke. These dusts and smoke are the main sources of heavy metals in the surrounding soil and plants. Their study has also noted that wind is an important player in spreading these dust and heavy metal in wider distance from the brick kilns.

The soil and plants located in the wind ward side of brick kiln received more heavy metals as compare to soil and plants located in the leeward side of the kilns. Their study further noted that these heavy pollutants find their way to plant bodies through the roots of plants and subsequently enter into ecosystem and adversely affect it.

II.2.2 Works on Socio- Economic aspects of Brick Industry

Sebesvari, Sehiller and Ortelepp (2015) conducted an important study on brick industry to understand its impact on food security in south Asian countries. Their study have noted that brick industry and its top soil extraction is responsible for the shrinking of fertile agricultural land, in densest part of South Asia as well as in other developing countries of the world. Their study noted that the rapid population growth and faster growth of urbanization are responsible for large scale use of fertile agricultural top soil extraction and non agricultural activity to meet the physical demand of urban or city centre.

The use of top soil has reduced the fertile agricultural land and put serious question about food production and food security in front of the poor rural people of South Asian nations. The study further suggested that an effort should be made to identify and use of substitute suitable building materials according to local climatic condition which could reduce the pressure on available fertile agricultural land.

The study of Plant (2004) has highlighted the problems of migrant labourers of the brick industry in Pakistan. He mentioned that the workers of brick industry mainly constitute of poor and marginal people who migrate from their native villages every year to work in brick industry with their family. He further argued that these labourers are the buyers of food and depending on daily wage for the major share of their yearly income. He has also found that the workers are recruited through labour contractors with advance payment to the workers for a specified period of employment. This way of advance payment is responsible for bonding the entire family of labourers comprising husband, wife and children. They move to the brick industry and works until operating season is over. The industry treated them with all forms of slavery and bonded labour in history; this is a systematic worked out phenomenon.

II.3 Works Conducted on Brick Industries within India

India with its second largest population in world also provides the well established narratives of brick industries and its ethos. The brick industry in India has also drawn attention from the researchers and other agencies over the time and space. The renowned Indian scholars also conducted their study on the brick industry to understand its impact on the society, land and the environment. These Indian scholars' works mainly discussed about the functional impact of the brick kiln industry on the agricultural land, agricultural practices, land degradation as well as changing soil fertility, natural vegetation covers, river bank erosions, air and water pollution etc.

There are also notable eminent Indian scholars whose works mainly focuses on socio- economic aspect of the workers of the brick industry. In the social section, their studies tried to understand the religion and caste background of the workers. In the economy section, their studies tried to explore the economic background, occupation structure, labour relation, labour markets, etc. in addition, their studies also tried to incorporate the issues of the migrant labourers. The notable works of Indian scholars and agencies could be grouped into two broad domains, such as work on:

II.3.1 Works on Environmental aspects of Brick Industry

Grewal & Khud (2002) tried to understand the role of the brick industry in soil desurfacing of Haryana state. Their works highlighted that the top soil removal activity is responsible for the changing bulk density, loss of soil organic carbon, losing hydraulic conductivity, water holding capacity, loss of soil nitrogen, soil nutrients, agricultural productivity and yields.

Yadav (2003) conducted a remote sensing database study on the brick industry located around the JNU campus, Delhi. His study found out that the brick industrial activity is responsible for degradation of large track of fertile land in an around Delhi.

His study has also mentioned that a considerable amount of agricultural land steadily used by the brick industry for the top soil quarrying purposes. His study further noted that the injudicious quarrying of top soil not only responsible for changing physical landscape of the area; but also has an impact on the fertility status of the soil. His study also noted that, quarrying of top soil has changed the chemical composition of soil and turns the acidic soil into 'alkaline'. His study also noted that apart from quarrying, brick kiln burning activities severely reduce available amount soil moisture as well as change the water table. The lack of soil moisture and changing water level is responsible for the limited growth of herbs and shrubs in the study area.

Asger (2004) explored the impact of brick industry on environmental degradation in Aligarh city. His study shows that the brick industry is an important source of carbon dioxide, carbon monoxide, dusts, smoke etc and air pollution. His study further demonstrated that the people living in and around brick industry suffers from number of health problems due to pollution emerge from the function of brick industry. And the range of studies proves that medical problem remains perennial.

Ghoshal (2008) unfolded the spatial distribution of brick industries in India. His study demonstrated that the majority brick industries of India are spread over northern plain region. His study further noted that the states like Panjub, Haryana, Uttar Pradesh, Bihar and West Bengal are the major producer of clay bricks and these states produced about 65 percent country's bricks by using agriculture top soil. His study also shows that the top soil quarrying activity of brick industry is responsible for degradation and destruction of considerable area of agricultural soil in the country.

Bera (2010) conducted a study on brick industries to understand the problems and future prospects of brick industry in West Bengal. His study shows that the brick industries of West Bengal facing acute problems of shortage raw materials, fuel and

capital. His study also revealed that the demand for bricks as building material is increasing day by day but shortage of raw materials forced number of brick industry to exploit the fertile agricultural land. His study further shows that the shortage of raw materials forced to close down many brick industries. His study further indicated that the financial crisis is another important challenge faced by the brick industry as none of financial institution agrees to give support by offering loan to owner of brick industries.

Gupta & Narayan (2010) in their work on brick industry talks about the rapid urban expansion, rising brick industry and its impact on ecosystem. Their study mainly concerned about the anthropocentric transformation of the natural environment. They had mentioned that, material demand of the city in the form of brick has been fulfilled by the brick industry. Their study has mentioned that a huge chunk of fertile agricultural land has been transformed into wasteland due to top soil quarrying.

Their study further noted that, brick industry not only responsible for increasing amounts of wasteland, but also plays a vital role in changing the physical and chemical property of soil and water of the quarrying area. Their study further noted that the new type of species of weeds is evolved on quarrying land and alter the natural ecological setting of the area.

On the other hand, brick burning is responsible for dust accumulation on plant leaves and heat stress for the plants located nearby kiln. Dust accumulation on plants and heat stress is responsible for invasion of native species by the new species. The appearance of new species has disturbed the area's natural ecosystem.

Sapkale (2011) works on brick kiln discusses about the consequence of topsoil extraction conducted by the brick industry in the lower reaches of Tarali river of Umbraj. His study found that rapid excavation of top soil not only change the slope of

the area, but also responsible for top soil erosion of unexcavated land. His study further mentioned that, unplanned quarrying of agricultural land located nearby the river has raised the risk of diversion of river channel during monsoon and poses the number of threats to the nearby agricultural land. Beyond this, evacuation of soil as a raw material has changed the slope of existing land surface and modifies the direction of streams every year and sometimes cause of severe flooding.

Das (2014) tries to evaluate the role of the brick industry on changing characteristics of the River Nadia in Nadia district of West Bengal. He found that the soil cutting on river bed is the main cause of river bank erosion, channel diversion, river meandering, bar formation and gradual shifting of the river channel in the downstream of river. His study also revealed that the gradual shifting of the river channel lead to the river meandering and sometimes eroded the fertile agricultural land as well the houses of the people residing near the bank of the river. Hence, challenging both nature and human beings.

Islam (2014) conducted a study to examine the impact of brick industrial top soil quarrying and affecting it also with brick burning process. His study revealed that quarrying activity largely contributes to rising soil pH value of top soil quarrying agricultural field and turns it from neutral to basic soil. On the other hand, burning of soil at kiln reduces the soil pH and turns it into acidic soil. His study further reported that the large scale quarrying of top soil is responsible for the significant reduction of available soil nutrients like organic carbon, nitrogen, phosphorus and potassium etc.

Purkait (2015) conducted a study to examine the impact of brick industries on environment in Hugli, Haora and Nadia of West Bengal. His study revealed that physical environment like air, water and land is adversely affected due to function of brick industries.

His study also suggested few remedial measures to reduce the harmful impact of brick industries on the surrounding environment.

Das (2015) carried out a study on brick industry to examine the role of brick industry to pollute the air at micro level in at *Khejuri* Community Development Block of costal Medinipur, West Bengal. His study found that brick industry is responsible for air pollution in coastal region of the block. His study also revealed that the brick industry is responsible for large scale land degradation in the *Khejuri* block of Medinipur district of West Bengal.

II.3.2 Works on socio- economic aspects of brick industry

Gulati (1979) has conducted her study on female labourers of brick kiln in Kerala. In her case study, she has noted about the daily working routine of a female brick kiln workers and her struggle in life. She further argued that how a poor old aging woman performs her inhuman work to carry out her family expenditure and livelihood. She found that the division of work based on gender in the brick kiln industry wherein female workers are exclusively involved in carrying head loads. Women are restricted from doing work like brick making, moulding of clay and firing of brick etc. Thus, women are only employed for carrying weight on their head; as a result, their earning is very less as compared to a man.

Rao (1981) has conducted a study on labourers of brick industry in Punjab from the perspective of the political establishment. He has unfolded the nexus between the political party and the brick kiln industrial owners. He argues that the government and the political establishment are very much bias in the context of protecting the right and interest of the labourers. His study clearly states how State Government frequently ignores the order of Central Government regarding bonded labourers of the brick industry in Haryana. Further, his study disclosed that the owners of brick

industry use police to arrest the people those are fighting against merciless exploitation and protecting their right of the migrant brick kiln labourers. In addition, he argues that how owners of the brick kiln manage to keep the exploitative system by giving bribe to the local authority and police. His study also revealed that labourers who are trying to escape from the brick industry, false charge are putting on them by using the local police.

Another study on brick industrial labourers carried out by the Dharmalingam (1995) has tried to understand the social dimensions of brick industrial labourers in south India (Tamil Nadu). His work has mentioned about the condition of work, the level of wages, as well as societal position of the workers. His study has stated that the people working in the brick industries have important caste relation. Almost all the brick industrial workers are belonging to a lower caste. On the other hand, the entire owners are from the economically sound middle and upper class people.

His study further noted that brick industrial labourers are always underpaid. His study also found that the exploitative nature of these affluent brick industrial owners towards the lower caste labourers putting these people more vulnerable situation. His study further demonstrated that the brick industry is responsible for creating of small affluent groups within the village.

Singh & Asger (2002) have tried to understand the impact of the brick industry on the surrounding environment and the health of the workers. Their study revealed that the high temperature of kiln surface is the cause of pulmonary disorder, burn, heat cramp, heat stress, heat exhaustion, heat stroke, headache, irritation of eyes and skin among the workers. Their study also reveals that, the people living in the surrounding villages also suffered from a number of health related problems due to dust laden atmosphere.

Gupta (2003) has unfolded the issue of migrated labourers of brick kiln industry. Her study reveals that the brick kiln workers belong to marginal to landless labourers; most of them are net buyers of food items and substitute their income by the daily wage labourer. Her study also mentioned that the workers are recruited by the agents. After requiting, they are brought by these agents with their family to the brick kiln during the agricultural lean period at their home. The agents maintain their influence on the workers by putting the burden of advance payment.

Her study further mentions that, only male member is registered at the work place and whole family work as a team. This study pointed out that the demand factor plays an important role in determining the amount of advance payment by the agent. Her works further mentioned that the low daily wage, limited employment period in agriculture in their village and lack of basic skills forced these people to work on such hazardous environment.

A report published by Prayas (2004) to estimated the employment capacity of the brick industry as an informal sector of the economy in India. It has mentioned that each brick kiln industry has the capacity to employ on an average about 100 workers. It also reported that the brick kiln industry exploiting the migrant labourers by only counting the male workers and ignoring the contribution of women and others in social production.

Another important study on brick industrial workers has been carried out by Kumar & Sindu (2005) in Punjab. Their study tries to unearth the causes of migratory labourer in brick kilns in Punjab. Their study has pointed that the pull factors are more pronounced and worked as a driving force in respect to migrant labourers in Punjab. Their study has revealed that, better job opportunity and comparatively higher wages as compared to the native place attract the migrant labourers to migrate in brick kilns

in Punjab. In addition to this, their study further noted that, besides high wages and better opportunity; freedom from family, desire to get free from debts, improving standard of living and attraction towards urban amenities, higher agricultural development in Punjab and diverse nature of work in Punjab attract large number of families to migrate in brick kilns in the state.

Isabelle, Bhukuth, Augerndra, Parthsaasrathy & Subramanian (2007) work on brick kiln labourers have tried to understand the nature of bondage of brick industrial labourers. Their study revealed that, bondage is influenced by demand as well as supply factors. Their study noted that during the off season, the owners of brick kiln have given some amount of money in advance to the workers through labour contractors. Further, they raised the question of surviving, poverty; lack of alternative source of livelihood as factors which forces the lower class labourers to take advance during off season.

In addition, their study observed that the working condition in brick industry is cyclic in nature. Therefore, nature of work, works as a mechanism behind getting into debts trap and soft bondage of labourers. Their study further noted that lack of credit market, inaccessibility to the bank and high rate of interest prevent the workers from getting free from the cycle of bondage, because a large number of labourers spend their income to repay the loan. To repay the loan and gets free from the debts these labourers reach to contractors for advance money. Once they are taken in advance from labour contractor they get tied to the cycle of bondage.

Tomorrow Foundation (2009) prepared a report to estimate the seasonally migrated child labourers in the brick kiln industry spreading over *Shyampur* block of West Bengal. This study tries to understand the social and the spatial dimension of the migrant child labourers in the brick kiln industry. This report reveals that the migrant

child labourers working in brick kilns in West Bengal are mostly coming from two states like Bihar and Jharkhand (especially from lower castes and adivasis origin). The report further mentioned that these migrant children are coming from particular parts of this state as well as particular section of the society. The report mentioned that these children mostly belong to tribal families of Bihar and Jharkhand state.

It also reported that these children are recruited mainly for transporting of raw bricks from drying field to the kiln and firebrick from kilns to selling point. These children are working in the brick kiln industry to support their family to cope the poverty. Like every industries in India, child labour holds its importance; in spite of legal prohibitions.

Manga, Singh, Bhardwaj and Singh (2012) have conducted a study to understand the nature of brick kiln dust related respiratory health hazard among labourers. Their study has shown that the brick dust comprises of SiO2, Al2O3 and Fe2O3 and other suspended particulate matters which is produced during unloading and shipping process. These dust particles enter into the human body through inhaling as well as high temperature in the kiln causes of serious disease and cancer among the workers.

Das (2015) conducted a study on the female workers of brick industries in *Khejuri* block of Medinipur district of West Bengal. His study unfolded that majority of these female workers belong to schedule caste and schedule tribe community and are migrant workers. They are coming from nearby districts during agricultural lean period for search of employment.

His study further noted that the poor socio-economic condition, lack of working opportunity at their respective localities and higher daily wages at brick kiln are the main driving force for these poor women to joins in brick industries. Poverty undermines the health issues that emanates from industrial zones.

The work of Majumder (2015) study pointed out the fundamental problems faced by the rural labourers working with the un-organized sectors. His study has revealed that low wage and limited period of employment in the rural agricultural sector forced the unskilled landless labourers to migrate in under privileged sectors for surviving and brick kiln industry is the prime destination of a major section of these rural unskilled migrant laborers in India.

His study has also revealed that the prior arrangement of work for the rural migrant labourers have controlled by the labour contractors and manages their influence over migrant labourers by giving an advance payment. Once the labourers trapped by the labour contractors, the cycle of bonded captivity continue year after year and are getting circulated from one kiln to others and possibly coming back to their previous kiln. Issues regarding functional impact of brick industries highlighted on the above studies by different scholars are as follows:

Themes	
Physical and Environmental Issues	**Socio- Economic Issues**
The existing works mainly highlights the functional outcomes in the form of air and water pollution, agricultural land degradation, loss of top fertile soil and crop yields. Study demonstrated how kiln burning is an important source of sulphur dioxide, carbon dioxide, carbon mono oxide, SPM and other gases and responsible for air and water pollution, acid rain etc.	Among the socio- Economic issues, studies mainly highlighted the issue of migrant labourers, small and marginal farmers and the people living around the brick industry. Studies unfolded that how (Local and Migrant) labourers are trapped by the labour contractors and brick industry and reason behind get trapped by the brick industries and its vicious cycle of exploitation.

Studies further revealed that how top soil quarrying is responsible for loss of soil fertility and degradation of large tract of fertile land which is severely affected the soil quality, crops practices and yields. In addition, study also unfolded that brick industry also responsible for emergence of new herbs and weeds on quarrying which is responsible for changing natural ecosystem.	Studies unearthed the mechanism of labour recruitment mechanism in brick industries. It further tries to highlight the social class dimensions workers. Further studies to unearth causes of migration of labourers from agriculture sector to brick industry as well as its spatial dimensions. In addition, studies also unfolded the role state Government in relation to the brick industry.
Horizontal relation across the studies: Studies on brick industries outside India demonstrated that the function of brick industries causes of environmental pollution and human health hazard among the people not only involved in it but also people residing around it. A study further highlights that, the loss of agricultural land due to top soil quarrying causes raising food security among poor of South Asia.	**Horizontal relation across the studies:** Studies on brick industries with India also demonstrated similar story related to function of brick industries. Studies within India further highlighted socio-economic, Class, Caste, gender and political dimensions of brick industrial workers. Studies trying to unfolded how poor farmer's agricultural land turns into degraded and waste land and destroyed their source of livelihood.
Linkages across the studies	
Therefore, studies demonstrated that the function of brick industries have important outcome in relation to different aspects of environment and society. The function of	

brick industries have significant stake in pollution of air, water, soil, etc. The degradation of these physical resources not only affects physical environment, but also largely affects the society. The different sections of society affected in different ways; small and marginal farmers' loss their agricultural land due to top soil quarrying which subsequently reduced availability of agricultural land in the study area. The landless labourers and their production behaviour are changed and turned them as informal industrial labourers from agricultural labourers. So, studies on function of brick industry have tried to demonstrate the very complex outcome in relation to physical environment and society as whole.

Thus, studies on brick industries across the globe mainly emphasises on the adverse aspects of the brick industries on society and environment. Their studies have given additional focus on the issues related to the land degradation and environmental pollution. Particularly, studies conducted by scholars outside India given little attention on class and caste dimensions of the brick industries. Their studies simply ignore the class and caste dimension of the labourers of the brick industry. The studies confined within the socio-economic issue of the labourers. In addition to it their studies also ignored the changing production behaviour of landless labourers in relation to the brick industry in larger context. They can be considered as the legal heir of orientalistic discourse.

On the other hand, studies by Indian scholars tries to highlight the issues of class, caste, gender and little bit political dimension of the brick industry. However, these studies paid attentive to causes of development and changes in social and production relation of the labourers with regard to brick industry. Therefore, existing research on the brick industry either outside India or in India, mainly focuses on the issue like

impact/outcomes of the brick industry on the physical aspect of environment like on land, air and water. The existing works also highlighted the health issues of the workers, those who directly involved in the industry and people residing there. Further, studies also highlighted the condition of female, child labour and migrant labourers.

So far, the fundamental questions regarding brick industry have not been addressed by any scholars. Their study doesn't pay attention to the factors behind the emergence of brick industries or their works that as follows; how the brick industry came into existence? Who are the owners of the industry and why they are interested in brick industry? Which agencies are involved in the emergence of brick industry? How they are interlinked? What are the consequences for the brick industry of the agrarian relation? How brick industries target new areas for conducting soil quarrying and industrial expansion?

Why most of the land givers belong to small and marginal farmers? How industry changes the social fabric of the village society, especially the socio economic condition of the landless labourers? How and to what extend the brick industry influence the livelihood of the people involving in the industry?

Further, how agricultural practices and cropping pattern of the area are affected due to industrial expansion? What is the government policy towards brick industry? This study addresses these questions in effort to understand the agencies, processes and outcome of brick kiln industry in the Murshidabad district of West Bengal.

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Murshidabad District, West Bengal

III.1 Introduction

The district Murshidabad is located in the lower Gangetic plain of Indian Sub - Continent (Bairagya 2014). The physical and geographical ambit of Murshidabad district holds geographical, historical and political importance. It lies in between 23° 43' 30" North to 24° 50' 20" North latitude and 87° 49' 17" E longitude to 88° 46' 00" E longitude (District Gazetter 2003). It plays an important role in connecting both the ends of the West Bengal. The district also provides linkage with the rest of India through the corridor of Bihar. The Bengal province of British India faced division through partition; when Colonial masters left India.[2]

The partition of India was a historical phenomenon and it rewrote the geographical boundaries of Indian subcontinent; which was based on the famous Radcliffe Line.[3] Initially, Murshidabad became the part of East Pakistan (Contemporary Bangladesh). But Indian government claimed it and solved the issue of this particular district by taking into an account of Radcliffe line with Pakistan. Hence, Murshidabad was also incorporated within the dominion of West Bengal (Halder 2013). Historically, the district Murshidabad was among the most developed district of Bengal. It carries with it the legacy of industrial development and economical soundness under the rule of Nawab[4]. Industries like silk (*muslin)*, ivory carving, textile, metal and clay modelling

[2] The British Raj in India was started by the British East Indian Company after defeating the Nawab Sirajdullah at the battle of plassey. But, direct British raj was started in the year 1858 and it lasted upto 1947.

[3] The Radcliffe line was drowning to demarcate the international boundary between the India and Pakistan. As a result of partition, the Radcliffe line divided the unified Bengal into West and East Bengal. Subsequently the East Bengal was become East Pakistan in 1947. The line was divided about 450,000 sq km territory and 80 million people.

[4] Nawab- The independence king of unified Bengal, Bihar and Orrisa.

as well as bidi rolling were the important industries during Nawab era. In contemporary times Silk and Bidi[5] still holds its importance and rest have decayed as Indian state progressed.

The Murshidabad district is like an isosceles[6] triangle in shape with the apex in the north -west at Farakka. It is surrounded by the Bangladesh in the east, the Santhal Paraganas of Jharkhand and Birbhum district of West Bengal in the west, the Malda district of West Bengal in the north and the district Nadia and Burdwan in the south. The District Murshidabad has played a vital role in connecting the both North and South Bengal.

The river Ganga and Padma flow along the north and northeast and formed the natural boundary in the east of the district. The river Jalangi runs along the southern boundary for a considerable length that draws out the southern boundary and separates it from the Nadia district. This district connects India with the Bangladesh through its international boundary towards east, covering distances of 125.35 km (83 km distance is covered by the water boundary and remaining 42 km is covered by the land boundary (District Gazetteer 2003 & 2014).

The District Murshidabad is an interfluve[7] of the river Ganga and Padma River and a part of the lower Gangetic plain of West Bengal which is part of the great Indo - Gangetic plain. The large tract of alluvial deposit of Bengal basin has remained a subject of research for historical and geographical academia. The whole Bengal basin is divided into five divisions on the basis of the chronological and physical characteristics of the area, namely the moribund delta, mature delta, tidal delta, sub aquatic delta and active delta (Elizabeth 2012). The district Murshidabad lies in the

[5] Bidi – A type of locally made cigaratte made of tobacco leaves.
[6] Isoscele – The figure/ triangle which have two sides have equal length and remaining side has different length.
[7] Interfluve – A region/area lies between the valleys of an adjacent river/watercourse.

moribund delta of Bengal basin. It is layered with the beds of extinct rivers, with an unenergetic vitality during the rain and dry weather a chain of dangerous swamps. The subsoil/ground water rises during rainy monsoon and inundates the traditionally rich rice growing area of the delta closest to the main streams (Halder 2012). One can take into the account of rice cultivation with the topography of Bengal as a whole.

III.2 Administrative Division of the District

The total administrative area of the district is 5325 sq km which is 6.13 percent of the total geographical area of the state of West Bengal. The total population of the district is 7, 103, 807 people (Census of India 2011). The district Murshidabad is one of the most densely populated districts of West Bengal. The population density of the districts is 1334 person per square kilometer (Census of India 2011).

The district Murshidabad is divided into 26 Community Development Blocks[8] (CDB's). These 26 blocks fall under the five subdivisions[9] namely Berhampore, Jangipur, Kandi, Lalbagh, and Domkal. The Domkal is the newly created subdivision which consists of four community development blocks. Maximum number blocks fall under the Jangipur Sub - Division that is seven blocks. The remaining three subdivisions comprise of sixth Community Development Block each.

District Murshidabad has seven municipalities namely Berhampore, Beldanga under the Berhampore subdivision, Dhulian and Jangipur under the Jangipur subdivision, Murshidabad Jiagang-Azimjang under the Lalbag subdivision and Kandi under the Kandi subdivision. The Berhampore is the district's headquarter. More than 70 percent population of the districts still depends on agriculture directly or indirectly.

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[8] **Community Development Block-** In India Community Development Block consist of Several Gram Panchayat (A local Administrative Unit at the Village), administrated by the Block Development Officer

[9] **Subdivision**- In West Bengal the district is divided into several Community blocks and combination of several blocks consist Subdivision. It is also known as Sub District.

III.3 Regional division of the District Murshidabad

The river Padma – Bhagirathi interfluve is a major geographical feature of the Murshidabad. The river Padma roughly forms the eastern boundary of the district. The Bhagirathi, the main distributary of Ganga river flows southward, emerge from the Ganga at Dhulian (Jiaganj) and divide the district approximately into two equal halves.

The eastern part of the division is known as *Bagri*[10] while the western part of the division is known *Rarh*[11]. Both the region have distinct characteristics not only in respect of soil characteristics but also in soil fertility, soil colour, soil texture and related cropping pattern and in terms agricultural practices. The surface of the soil in the *Rarh* region is hard and undulating, basically, it is the part or extension of the Chotanagpur plateau of Bihar and Jharkhand. *Boro* Dhan[12] is the main crops grown in the *Rarh*.

On the other hand, the *Bagri* region is characterized by low lying fertile surface with humid climate with agriculturally rich. The river like Banshloi, Pagla, Dwaraka, Mayurakhshi and Babla brilliantly mould the district soil characteristics. Thus, these rivers and their tributaries deposited the alluvium which makes soils of the district so rich and productive. The rich alluvial soil support resist people from migration despite of problems of seasonal flood and damage. This fertile alluvial plain is the major factor for agricultural development of the district. The study blocks fall under the *bagri* region of Murshidabad. These three blocks are located in the east of Bhagirathi River.

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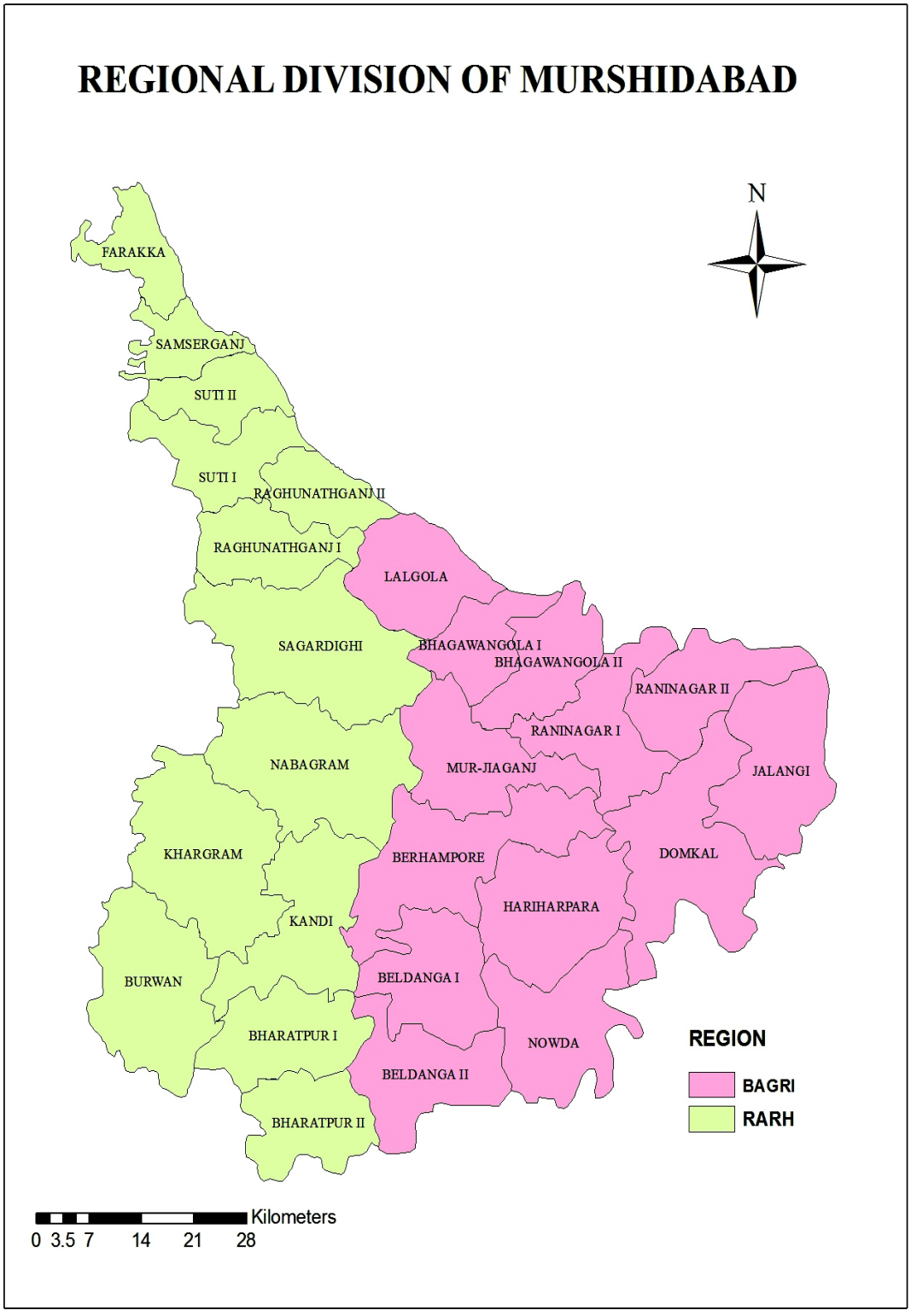
[10] Bagri- The Living place of bagh is characterized by alluvial soil, is derived from *"living place of Bagh* (Tiger)" which was bhujung (jungle Isle) surrounded by the river Padma and Bhagirathi and to the south almost jungle (Sunderbans).

[11] Rarh - *Rarh* means *"land of laterite*" located in the right bank Bhagirathi, derived from the word '*Lara*' a Jain community of 6th Century B.C (*Bhagabati Sutra*).

[12] Boro Dhan- Paddy Cultivated during winter with the help of Irrigation known as *Boro* Dhan



Map III.1 *Regional Divisions of Murshidabad*

III.3.1 BERHAMPORE

The Berhampore Community Development Block (CDB) is a part of Baharampur sub- division of district Murshidabad. Total geographical area of the block is 194.67 sq Km. The total population of Berhampore block is 446.887. The average population density in the block is 2300/sq Km. Out of the total population; about 75.55 percent people lived in the rural area, whereas 24.45 percent people lived in the urban area. The decadal growth rate is 23.70 percent, which is very much above the state average (17.84 percent). The literacy rate in the block is 73.51 percent, which is little less than the national average (74.04 percent) but quite above the district average. According to Census of India 2011, the Berhampore block has a number of Census towns like Goaljan, Kashim Bazar, Banjetia, Shib Danga, Gopjan, Gora Bazar, Chaltia, Haridasmati and Ajodha Nagar etc. In addition to this, the Berhampore block has numerous villages with above 5000 population. Among these, villages like Andar Manik, Moktarpur, Sahajadpur, Nishtintapur, Rajdharpara, Chumraghacha, Boro Satui, Chota Satui, Charmahula, Bezpara Sundipur, Narayanpur Purba, Naowda Panur, Kharasdanga, Tarakpur, Baircaghi, Kalikapur, Kadamkhandi, Hatinagar, Ustia, Kulbaria, Daulatabad, Chutipur, Selamatpur, Dadpur, Kaladanga and chaighari are important.

III.3.2 MURSHIDABAD – JIAGANG

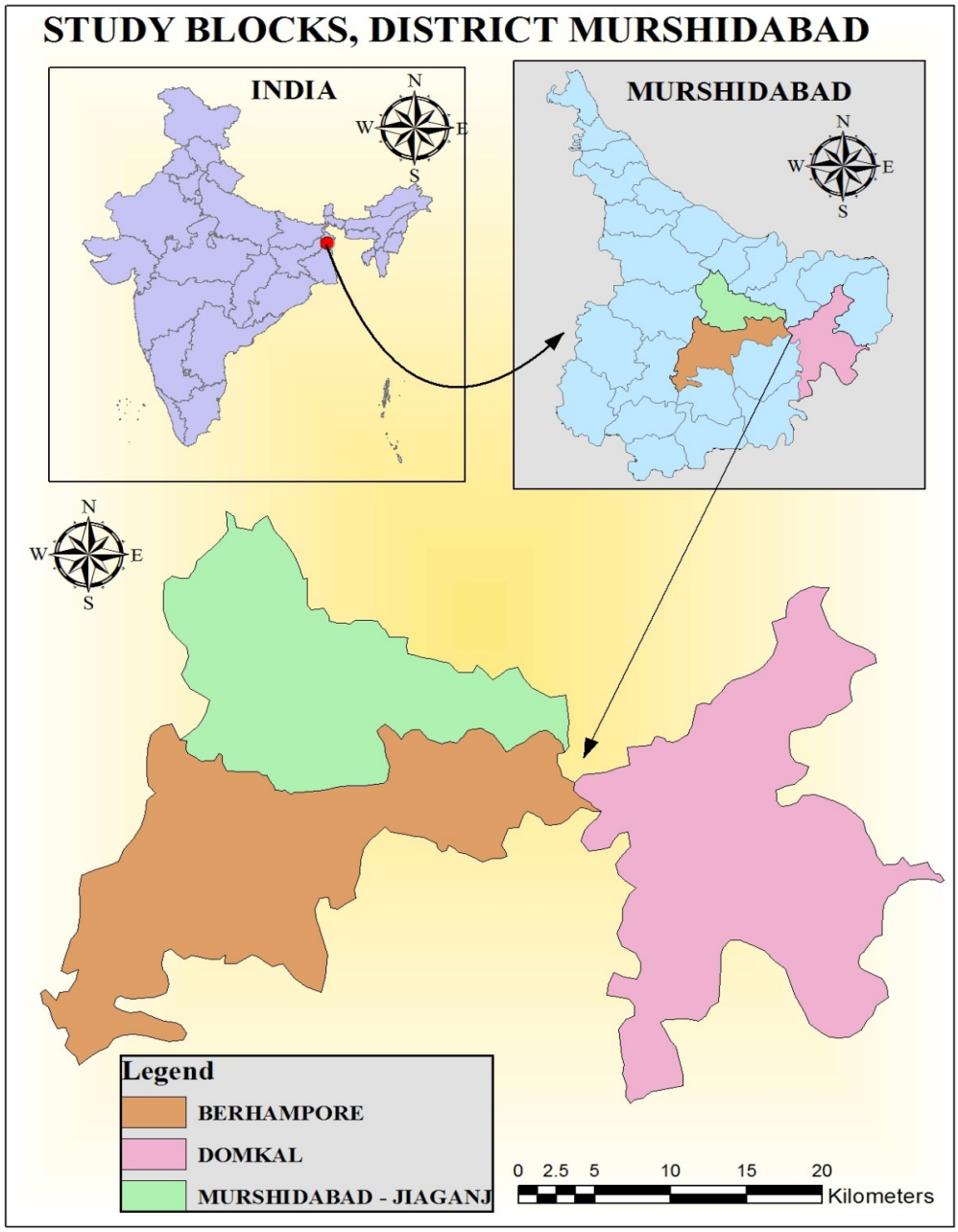
Murshidabad- Jiagang (M - J) Community Development (CDB) Block falls under the Lalbag Subdivision of District Murshidabad of the Indian state of West Bengal. The headquarters of the Murshidabad –Jiagang block is Murshidabad. The block is located in 24° 14' 00" North Latitudes and 88° 16' 00" East Longitudes. The M. J block is surrounded by Bhagawangola I & II in the North, Berhampore in the South, Nabagram in the west and Raninagar I in the East. Total geographical area of the

block is 208.62 sq Km. Total population of the M - J block is 234556. The urban development has bye passed this block and the entire population lives in rural area. The decadal population growth rate is 23.70 percent, which is quite higher than the state average (17.84 percent). The literacy rate of the block is 69.14 percent, which is quite less than the state average (Census 2011). In addition to this, the Murshidabad – Jiagang has a number of large villages with above 5000 population. Among this village like Sanyasidanga, Talgachi, Gudhiya, Chunakhali, Khanpur, Kapasdanga, Tetulia, Dharampur, Dangapara and Hasenpur are important.

III.3.3 DOMKAL BLOCK

The Domkal Community Development (CDB) Block is the part of the Domkal Subdivision of the District Murshidabad of the Indian state of West Bengal. The Headquarter of the Domkal block is Domkal. The block Domkal is located in 24° 08' 28" North Latitudes and 88° 31' 43" East Longitudes. The block is surrounded by Raninagar I & II in the North, Karimpur Community Development block of Nadia in the south, Hariharpara in the west and Jalangi Community Development block in the East. The total geographical area of the block is 304.27 sq Km. The total population of the Domkal block is 363976 (Census of India 2011) and almost all the people lived in the rural area. The share of SC & ST population in the Domkal block is 2.6 percent and 0.33 percent respectively. The decadal population growth rate in Domkal block is 23.70 percent, which is quite higher than the state average (17.84 percent). The literacy rate of the block is 55.89 percent, which is less than the state average (Census of India 2011). According to the Census of India 2011, the Domkal block has quite a good number of large villages with above 5000 population. Among these villages like Gobindapur, Gokulpur, Bhagarpur Ramna, Radhakantapur, Jitpur, Dhulauri, Jot Kamal, Par Raghunathpur, Taraf Rasulpurpatnipara, Bhatsala, Raypur, Basantapur,

Etbarnagar, Laxminathpur, Sibnagar Laskarpur, Sabalpur, Garibpur, Chandpur, Pardiar, Kushabaria, Juranpur, Aminabad, Juginda, Garaimari, Momenpur, Kuchemora, Kupila and Sahadiar are important (Census of India 2011).



Map III.2 *Study blocks, District Murshidabad*

III.4 Physiography

In term of Physiography, district Murshidabad is almost a flat plain. The average elevation of the district is about 29-30 meters. The river Bhagirathi divides the district into two micro regions i.e *Rarh* and *Bagri* as mentioned above. It was divided Bengal into four tracks namely *Rarh* in the south of the Ganga and west of Bhagirathi river. *Barendra Bhumi*[13] in the north of the Ganga and between the Mahanada and Karatoya rivers. *Bagri* or South Bengal and Banga or eastern Bengal (Omalley 1914).

The soil of the eastern half in general, is alluvial and rich in carbon content due to effect of inundation by the river during monsoon all around the track. Basically, the eastern half of the district is the interfluve region of river Padma and Bhagirathi. The river Padma flows roughly along the eastern border of the district and the river Bhagirathi in the west. The soil of the western half is lateritic in characters and mostly clay loam, reddish in colour. Geologically, this region belongs to the *Chotanagpur plateau*[14] and the surface of this region is undulating and consist of hard clay soil, whereas the east of the river Bhagirathi is low lying area and alluvial in nature. The south western part of the district is a confluence of the moribund and the Dwarka River. In the south western part of the district, have an area of 130 sq km tract of low lying region covers by water during rainy season. This low saucer-shaped depression is charactering with varying depth and popularly called *Hijal*[15]. The slope of the land in the west somewhat abruptly upwards, making the boundary of the true Rarh, while in the east a narrow line of high land forms the western bank of the Bhagirathi and

[13] Barendra Bhumi- The fertile Tract of North Bengal Located between the Mahanada and Karatoya River. It was the northern most provience of Bengal during Ballal Sen, King of Sena Dynasty.

[14] Chotanagpur plateau- The chotangpur plateau is an extention of great Indian peninpula covers the Indian states like Jharkhand, parts of Orissa, bihar and Chattishgarh. It is a mineral belt of Indian. Almost all the important minerals like coal, Iron ore, Manganese, copper, dolomite, etc. Found in this region.

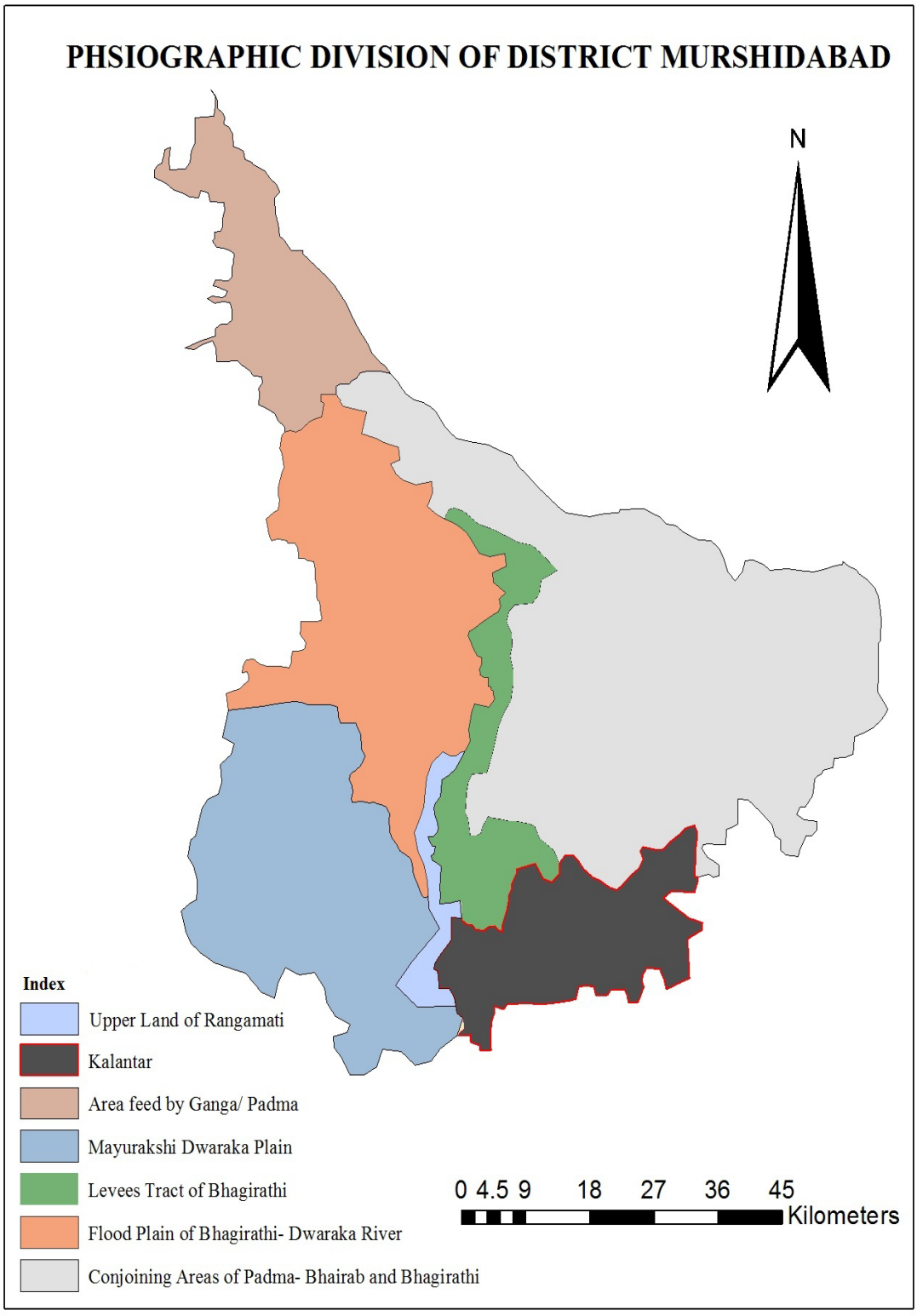
[15] Hijal – The low laying tract of the district located in the confluence of the Muriband and Dawraka River cover with Hijal tree.

end up in the cliff of Rangamati. The Hijal trees and thatching grass are very much abundant in the region. In winter this tract is using to cultivate *Rabi* crops like wheat, gram, mastered and linseeds. Another important depressed area is found in the south eastern part of the district. This depressed region is popularly called *Kalantar*[16]. This depressed region is also saucer in shape located in Bagri area between the narrow necks of the rivers Bhagirathi in the west and river Jalangi in the south east.

This is the vast area of swamps comprises with dark clay and it is also a land of *bills*[17] *and marshes.* The *Kalantar* is famous for *Amon Dhan*[18], but in rainy season water gets accumulated over the entire area and hampered the cultivation as well as causes of damage of standing crops. The entire Kalantar region looks like a vast lake in which villages appear as islands during the rainy monsoon. It is also believed that the area is an end depression of Bhagirathi river due to its shifting course which flows over this area sometime in the past. The general slope of the district Murshidabad is from the north to north east and south to south east (Halder 2012).

Brick industry always prefers soft and flat land. It is easy to dig the soft land and develops the kiln. The soft and flat plain land is also needed for laying the raw/mud bricks and drying of green bricks. Developing of flat level plain land in the *Rarh* is not an easy task due to the hard and undulating surface. To make this rigid and undulating terrain suitable for the brick industry may increase the total expenditure. But the soft and flat surface land of *Bagri* region helps owner avoid this additional expenditures. Thus, almost all the brick industries have developed in the *Bagri* region.

[16] Kalantar- The depressed land located in the south of the district Murshidabad characterized by seasonal flooded areas.
[17] Bills- The small marshy land detached from the main river known as bills
[18] Amon Dhan- The Paddy planted in late summer and Harvest in early winter Known as Amon Dhan.



Map III.3 *Physiographic divisions*

III.5 Soils of the District Murshidabad

The soils of the district Murshidabad belong to clay loam to sandy loam. The clay loam soil alone covers more than 50 percent net sown area (Halder 2012). The second dominant soil of the district is sandy loam. The sandy soil covers a negligible area in the district. The rich fertile loam and clay loam soils provided the base for agricultural development in the district. The soils of the district are mainly characterized by alluvial and lateritic in character. The soil along both sides of the river Bhagirathi evolved in distinct manner with respect to the geology of the district. The soils of the district formed by the sediments deposition brought by the various streams which flowing across the district which drained the great Gangetic plain.

The soil of *Rarh* is dominantly clay and lateritic in nature. The Calcareous nodules and lithomarge clay dominated on the surface which is susceptible to lateralization process. The lateralization process formed the surface soil of the *Rarh* region. The soil of the *Rarh* area is comparatively heavy in contrast, grey and red in colour. It is due to the presence of iron, iron oxide and low organic matter. Therefore, soil reaction is slightly acidic in nature (Khatoon & Mondal 2012). The soil of the *Bagri* region is characterized by light alluvial and fertile. The youngest alluvial deposit by the various rivers consists of silt, sand, clay, and gravel. The area is low in altitude and exposed to annual inundation as a result fresh silt deposition is observed. Hence, it is very fertile and suitable for agriculture pacrtices (Khatoon & Mondal 2012).

In the North-Western part of the district, few small detached basaltic hills surrounded by the stony jungle as well as with nodular limestone base *Kankur*[19] scattered hillocks are found (Bairagya 2013). Therefore, the soil of the *Bagri* area is very suitable for bricks due to presence higher amounts clay in the soil as compared to the *Rarh* area.

[19] Kankur- The noddle like stone known as Kankur

III.6 Population distribution in the district of Murshidabad

The population distribution and growth defines the socio - economic and levels of development. The parameters of development also related to population pattern which is influence the development process of any country or nation. The growth of population and aspiration are influenced by the natural and material features. The total population of the district Murshidabad is 7,103,807 in 2011 which is 7.78 percent of the total population of West Bengal. The population of this district has steadily increased from the 1901- 2011 except in the decade of 1911- 1921 where the decadal growth was negative in both in the district as well as in West Bengal. The negative growth of population was recorded in 1911-1921 due to spreading of the epidemic in the district (Sen 1988). However, after 1921's the steady decadal growth of population was recorded in the state (8.14 percent) as well as in the district (11.96 percent) in 1931 and 1941. The decadal growth of population in the district was 11.6 percent and 19.69 percent during 1931 and 1941 respectively. But in 1951, the decadal growth of district population was decreased by 4.61 percent due to natural calamities and spreading of diseases.

The highest decadal population growth in the district was observed in 1951- 1961 (33.46 percent) slightly higher than the state average (32.80 percent). However, the declining trends in the growth of population were recorded after 1961 and onwards except 1981, in the district as well as in the state. The decadal population growth in the district was 28.20 percent in 1981-91, 23.76 percent in 1991- 01, and 21.09 percent in 2001-11. It is notable that up to the 1951, the decadal population growth rate in the district was lesser than the state. But after 1961, the decadal population growth rate always remained high in the district's as compared to the state (Figure III.1).

Table III.1 Decadal Population Growth in the District Murshidabad and West Bengal (1911-2011)

Year	Murshidabad	West Bengal
	Total population	Total population
1901- 11	13,46,069	179,98,679
1911- 21	12,25,095	174,74,348
1921- 31	13,71,604	188,97,036
1931- 41	16,41,610	232,29,552
1941- 51	17,17,229	262,99,980
1951- 61	22,91,863	349,26,279
1961- 71	29,46,563	443,12,011
1971- 81	36,97,552	545,80,647
1981- 91	47,40,179	680,77,965
1991- 01	58,66,569	801,76,197
2001- 11	71,03,807	912,76,115

Source: *Compiled by Author after taking from District statistical abstract 2008, District statistical abstract 2011- 12 and Census of India 2011*

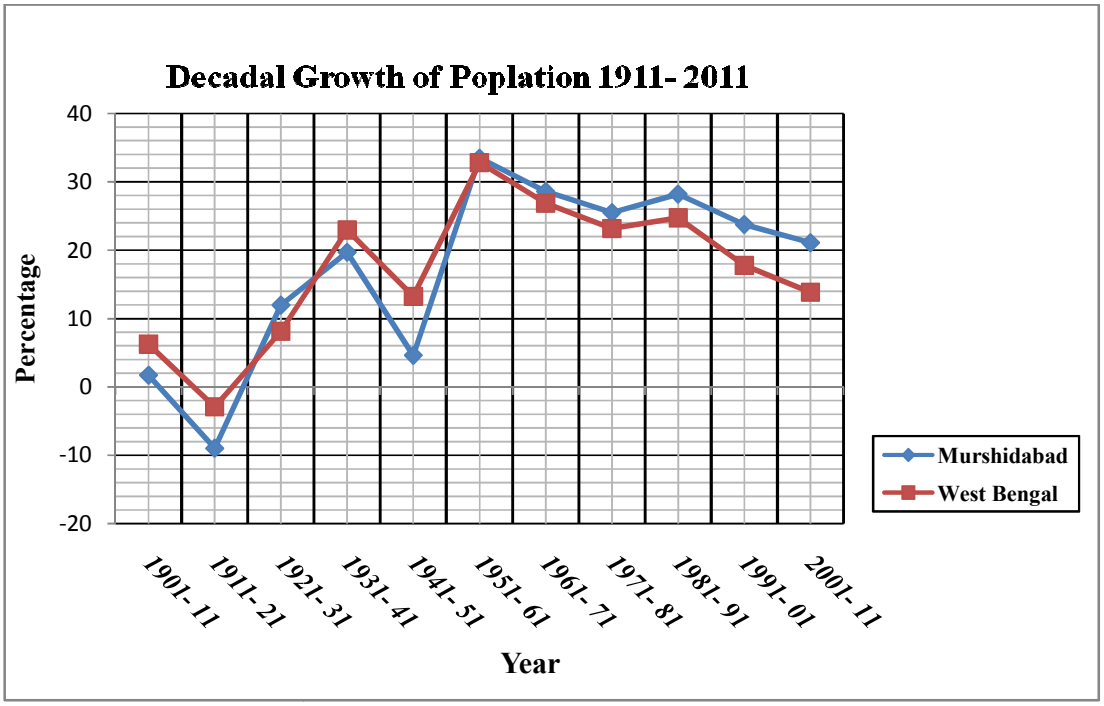


Figure: III.1 *Decadal Population Growth in Murshidabad*

III.6.1 Population Density in the District of Murshidabad

The population density[20] in the district is 1334 person/sq km. The density of population would help to understand the pressure of population on the available resources. The population density in the district has continuously increased from 1981 to 2011. The population density in the district was 688 people per sq km in 1981 which is increased to 1334 person per sq km in 2011. Thus, the population density has increased by two fold just within two decades from 1981 to 2011 in the district. The population density also varies from block to block in the district. The highest density of population is found in the blocks like; Suti –II (2510), Raghunathgunj (2182), Farakka (2065), Beldanga –I (1892) and Berhampore (1442). The fertile (land) tracts of Ganga and Padma are responsible for large concentrations of population in the above-mentioned blocks. However, there are a few pockets in Jalangi, Bhagawangola – II and Raninagar- II block which has recorded low population concentration due to the presence of *Char*[21] land, frequent flood and river bank erosion (Table III.2).

Table III.2 Block Wise Population Density in the District Murshidabad

Block Name	Population Density (Person/sq Km)			
	1981	1991	2001	2011
Berhampore	962	1185	1206	1422
Beldanga I	873	1267	1536	1892
Beldanga II	-	864	1011	1205
Hariharpara	592	734	876	1018
Nawda	568	713	848	980
Domkal	631	833	1021	1193
Jalangi	605	1418	1024	1199
Raninagar I	628	731	1052	1287
Raninagar II	-	678	892	1090
Lalgola	720	1543	1452	1822
Bhagawangola I	631	846	1201	1485

[20] Population Density – Population density refers to the number of people living in per sq km.

[21] Char – Land Island within the river bed formed by the deposition of silts.

Bhagawangola II	-	753	741	902
Murshidabad- Jiagang	820	859	1042	1221
Raghunathganj I	943	1163	1096	1388
Raghunathganj II	-	1496	1583	2182
Farakka	911	1192	1658	2056
Suti I	773	792	971	1252
Suti II	-	1450	1919	2510
Sagardighi	455	577	730	899
Nabagram	404	524	641	742
Khargam	530	534	737	858
Kandi	680	670	849	968
Barwan	592	706	749	859
Bharatpur I	623	712	821	940
Bharatpur II	-	1290	947	1113
Samserganj	455	597	730	899
District	677	890	1102	1334

Source: *Compiled by Author after taking from the District statistical handbook 1981, 1999& 2000, 2008 and 2011-12*

III.7 Urban population and Trends of urbanization, District Murshidabad

Figure III.2 shows that the share of the urban population in the district of Murshidabad is rising steadily from 1991. After 1991 the share of the urban population significantly rising and in 2001 about 12.49 percent district population started living in urban area. The share of urban population is increasing by 7.0 percentage points during 2001 -2011. But it is interesting to note that the decadal variation in the growth of the urban population in percentage point in the district of Murshidabad was higher from 1991 to 2011; as compared to the state of West Bengal. The decadal variation in the growth of urban population during 1991- 01 was 2.06 percent point in the district, whereas 0.55 percentage point in the state of West Bengal. Similarly, the decadal variation in the growth of the urban population in the district during 2001 - 11 was 7.29 percent points, whereas it was 3.06 percent points in the state of West Bengal.

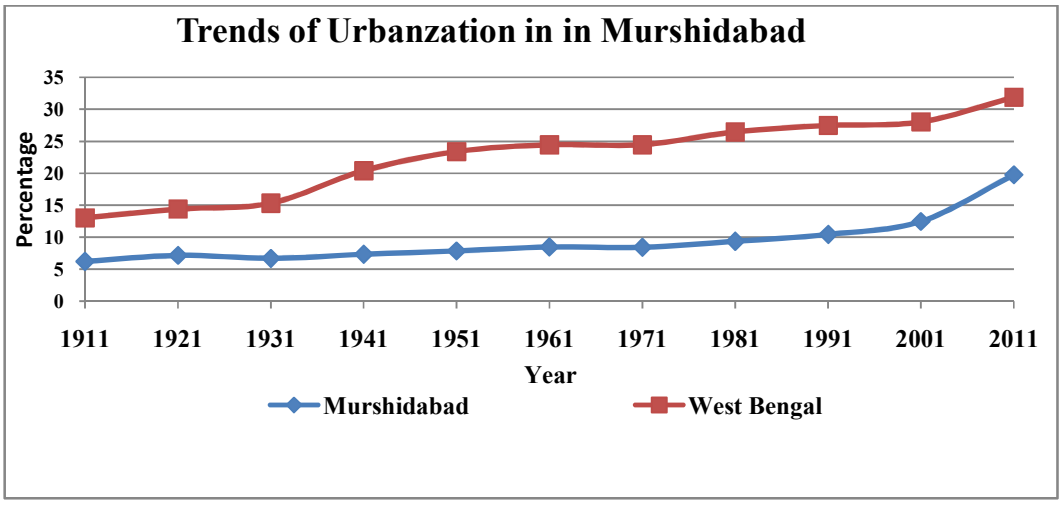


Figure III.2 *Level of Urbanization in the District of Murshidabad*

III.8 Workforce structure in Murshidabad

The Workforce structure refers to the availability of labour resources and its involvement in various activities (Vaidya 1997). It represents a regional scenario of development. The concept of the workforce and the main activities in Indian Census was introduced in 1961. The concept of marginal activities was introduced in the Indian Census in 1971 (Bhagat 2008). In the Census 1981, efforts have been made to include female workforce in the census to get a detailed profile of working characteristics of the population.

A worker refers to the ability of population in labour activities. Workers are categorized into main and marginal workers since 1981. Later on Census 1981 and 1991, workers were categorized into nine industrial categories.

According to the definition (Census of India 2001), the main workers are those who engaged economically in productive activities for a major part of the preceding year at least 183 days, while marginal workers mean those who has less than six months of employment, but not for the entire sixth month.

III.8.1 Work force participation

The workforce structure in Murshidabad has significantly changed from 1981 to 2011. The worker participation rate in 1981 was 28.93 percent. But it reached to 36.24 percent in 2011. Similarly, share of the main worker in 1981 was 27.22 percent. The share of main workers increased to 27.94 percent in 2011. The share of the main worker is slightly improved in the last three decades. The share of the marginal worker was 1.71 percent in 1981 which has increased to 8.3 percent in 2011. Therefore the share of marginal workers is increased by approximately five fold in the last three decades. Or one can also look into these data through the lenses of India's liberalisation and globalisation approach.

In addition, workforce participation rate in the study blocks has gone up steadily from 1981 to 2011. The work participation rate in the study blocks forms during 1981 was 27.12 percent in the Berhampore, 28.34 percent in the M J block and 26.80 percent in the Domkal block respectively. But it reached to 34.53 percent in the Berhampore, 36.46 percent in M J block and 35.24 percent in the Domkal in 2011.

The share of the main worker in the study blocks has gone through the ups and down from 1981 to 2011. The share of the main workers in the Berhampore block was 26.37 percent in 1981 which was rising to 28.63 percent 1991 and again decreased to 27.0 percent in 2001, and again increased to 27.64 percent during 2011. Similarly, the share of the main workers in the M J block was 27.21 percent in 1981 which was increased to 29.64 percent 1991 and again decreased to 29.0 percent in 2001 and again increased to 29.83 percent during 2011. In addition to the share of the main workers in the Domkal block was 25.69 percent in 1981 which was rising to 29.40 percent 1991 and again decreased to 26.0 percent in 2001, and again increased to 27.54 percent during 2011. Therefore, the major fluctuation in the share of main

worker is recorded in Domkal block from 1991 to 2001. Little negative changes in the share of main workers are also recorded in Murshidabad- Jiagang and Berhampore block during 1991 to 2001(Figure III.3). The major features of work participation rate in the study area are as follow:

- Work participation rate in the study blocks always remain below the district average accept 2001. In 2001 the average work participation in the study blocks was higher than district average.
- Share of main worker's participation rate always remain low in study blocks upto 1991. After 1991 blocks has shown little bit higher share of main worker's than district average.
- Similarly, the share of marginal workers has been continuously increasing in the study blocks as well as in the district of Murshidabad.

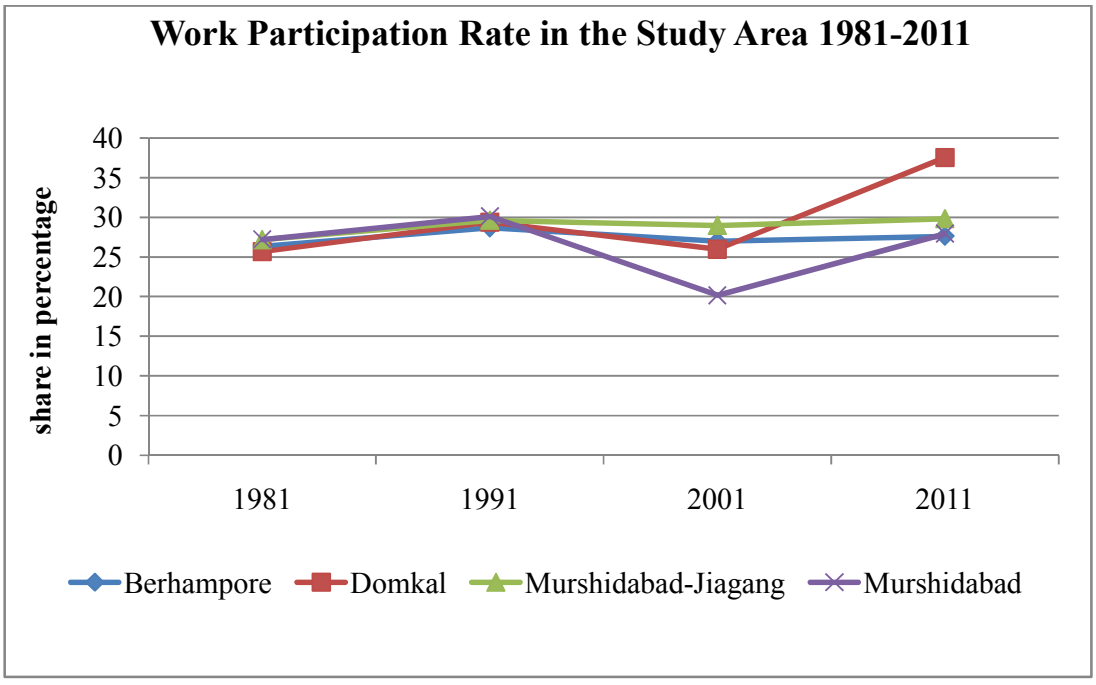


Figure: III.3 *Work participation rate in the study area, district Murshidabad*
Source: *Compiled by Author after compiling from the District Statistical Abstract 1981, 1995 & 1996, 2008 and 2011-2012*

III.9 Workers Participation in the study blocks and in the District of Murshidabad

The workforce participation rate in respect of main workers undergoes though significant changed in last three decades in the district (Table III.3). The share of agriculture based (Cultivators, Agricultural Labourers) main workers was 68.42 percent in 1981which is reduced to 51.27 percent 2011.

The share of the cultivators was 35.14 percent 1981 which is reduced to more than half (15.98 percent) in 2011. But the share of the Agricultural Labourers is increasing by 2 percent in last three decades. Similarly, the share of Household Industrial labourers was only 5.72 percent in 1981 which is increased by three (17.59 percent) fold in last three decades. In addition to this, the share of the other workers was 25.82 percent in 1981 which is increased to 31.14 percent. Hence, the share of other workers is increasing by 5.5 percent in last three decades.

Therefore, the significant percentage of withdrawals of the workforce from the cultivators was recorded in last three decades in one hand and on the other hand, the significant improvement in the share of household industrial labourers and the other workers was recorded in the last three decades in the district.

Similarly, study shows the share of the different category of the main workers in the study blocks has gone through the changes from 1981 to 2011. The share of agriculture based (Cultivators + Agricultural Labourers) main workers' was 54.19 percent in the Berhampore, 77.8 percent in the M J block and 84.12 percent in the Domkal during 1981, which is reduced to 52.13 percent in the Berhampore, 62.41 percent in the M J and 68.61 percent in the Domkal in 2011.

The share of cultivators in the Berhampore block was 27.42 percent in 1981 which was reached to 34.12 percent in 1991 and again dropped to 17.22 percent in 2011. Similarly, the share of cultivators in the M J block was 36.68 percent in 19981 which has dropped by fifty percent within three decades and reduced to 18.06 percent in 2011.

In addition, the share of cultivators in the Domkal block was 43.79 percent in 1981 which has also dropped by fifty percent within three decades and reduced to 22.62 percent in 2011. But the share of the Agricultural Labourers, Household Industrial Labourers and other workers is significantly increased in the last three decades in the three study blocks from 1981 to 2011. The share of the agricultural labourers in the study blocks was 26.77 percent in the Berhampore, 41.12 percent in the M. J block and 40.33 percent in the Domkal during 1981 which goes up to 35.12 percent in the Berhampore, 43.06 percent in the M. J block and 42.16 percent in the Domkal block respectively.

In addition, the share of the Household Industrial Workers was 2.28 percent in the Berhampore, 2.72 percent in the M J block and 6.11 percent in the Domkal block in 1981 to which is rising to 4.23 percent in Berhampore, 5.99 percent in the M J block and 6.94 percent in Domkal block in 2011.

Therefore, the share of household industrial labourers is getting double in last three decades. In case of other workers; the share is little bit dropped in Berhampore block from 1981 to 2011. Similarly, share of other workers in M J block gets double in the last three decades from 1981 to 2011. In addition, share of other workers in Domkal block is increasing by three fold in last three decades. The salient feature of different categories of main workers participation rate in the study area are as follow:

- Share of cultivators continuously decreased during 1981 to 2011 across the study blocks as well as in the district of Murshidabad.
- The share of agricultural labourers continuously increased during 1981 to 2011 in the study blocks as well as in the district.
- Share of Household Industrial workers steadily increased during 1981 to 2011 across the study blocks and in the district.
- Share of other workers continuously increased in the study blocks and in the district of Murshidabad after 1991.
- Share of cultivator rapidly decreases after 1991 to 2011 in all the study blocks and district.
- Share of Household Industrial workers gets almost double in the study blocks during 1991 to 2001.
- Share of other workers also gets almost double in the Domkal and Murshidabad-Jiagang blocks during 1981 to 2011.
- Share of other workers remain almost remain same in Berhampore block during 1981 to 2011.

Table: III.3 Percentage of main workers by industrial categories, District of Murshidabad (1981-2011)

Blocks Name	Cultivators				Agricultural Labourers				HH Industrial Labourers				Other workers			
	1981	1991	2001	2011	1981	1991	2001	2011	1981	1991	2001	2011	1981	1991	2001	2011
Berhampore	27.42	34.19	20.37	17.01	26.77	33.88	33.14	35.12	2.28	2.31	3.86	4.23	43.53	29.62	42.63	42.63
Murshidabad Jiagang	36.68	31.78	21.52	18.06	41.12	44.03	41.89	43.06	2.72	3.37	6.83	5.99	19.48	20.82	29.76	32.88
Domkal	43.79	41.73	27.04	22.62	40.33	38.84	41.57	42.16	6.11	4.93	9.61	6.94	9.77	14.49	21.78	28.29
Murshidabad	35.14	33.47	20.53	15.98	33.28	30.91	30.69	35.29	5.72	13.62	19.36	17.59	25.82	21.99	29.43	31.14

Source: *Compiled by Author after taking from District Statistical Abstract 1981, 1995 & 1996, 2008 and 2011-2012*

III.10 Workforce Participation by Industrial Categories in Murshidabad

The nine fold classification of workers gives more insight story of workforce structure in the district of Murshidabad. The study shows that the share of all sectors except cultivators and agricultural labourers are increasing in 2001 and in 2011 Census in the district with respect to 1991. The share of cultivators has declined sharply in the district in 2001 and 2011 as compared to previous decade.

In the same way the share of agricultural labourers was 29.28 percent in the district in 1991 which is decreasing by 2.27 in 2001 but in 2011 it shows an increasing trend in the share agriculture labourers. But, the share of other categories of workers was increasing in 2001; in the district with respect to the 1991. The share of livestock's rancher, forest and fishermen has slightly increased in 2001 as compare to 1991. Similarly, share of mining and quarrying sector is also improving in 2001 as compared to 1991. But, after 2001, share of these sectors show a declined trend in district.

In addition to it the share of manufacturing sectors has significantly increased in the district in 2001 as compare to the 1991. The share of manufacturing sectors was 17.98 percent in 1991 which is increased to 25.30 percent in 2001. Within manufacturing activities, the share of household industries shows significant improvement in 2001 with respect to previous decade. Study further shows that the share of construction sector also increases in 2001 corresponding to 1991. In 2011, share of manufacturing sectors again start declined in the district of Murshidabad. This study also demonstrates that the share of trade and commerce is steadily improving in the district of Murshidabad from 1991 to 2001 and 2011. Study further revealed that the share of transport, storage and communication sector is continuously increased in the district in 2001 and 2011 as

compare to the 1991. The share of service sectors also improved in 2001 and 2011 compared to 1991 (Table III.4). Therefore, study clearly shows that the share of agricultural sector is continuously declined in the district of Murshidabad. Within agriculture sector, the share of cultivators has declined in alarming rate; whereas share of manufacturing and other sectors has increased at significant pace upto 2001. After 2001, share of these sectors slightly declined in the district. The overall, study clearly indicates the shifting trends in economic activities from the primary to the secondary and tertiary economic sectors.

Table III.4 Trends in different categories workers in Murshidabad, West Bengal

Categories		1991		2001		2011	
Cultivators		31.46		20.70		17.11	
Agricultural labourers		29.28		27.01		31.01	
Livestock, forestry, fishing, etc.		1.92		1.96		1.22	
Mining and quarrying		0.04		0.30		0.26	
Manufacturing	Household Industries	13.64	17.98	17.63	25.3	15.17	20.07
	Non Household Industries	4.34		7.00		4.90	
Construction		3.53		5.15		9.90	
Trade and Commerce		7.72		9.78		7.45	
Transport, storageand Communication		1.94		2.81		3.24	
Others Service[22]		6.10		7.21		11.48	

Source: *Compiled after taken from the Census of India, 1991, 2001 and 2011*

[22] *The Census of India classified the workers into nine different industrial categories like cultivators, agriculture labourers, 'livestock, forestry, fishing', mining and quarrying, manufacturing, construction, trade and commerce, 'transport, storage and communication' and others services like Real Estate, business and renting, public administration and defence, Financial Intermediation, Public, social security, Health, Education, social and personal services, social work, private household with employed Persons and employment in Extra territorial Organisations and Bodies in both Census 1991 and Census 2001. But Census 2011 further classified the services gas, electricity and water supply, arts and entertainments, professionals, scientists and technicians etc. To compare the Census of India 2011 data with the previous year's Census on India (1991&2001) all these new categories considered as others services to compare with 1991& 2001 data.*

Summary of the Chapter

The district Murshidabad looks like an isosceles triangle with the apex in the North West at Farakka. The district is bounded by Bangladesh in the east, Santal Paraganas of Jharkhand and Birbhum in the west, Malda in the north and Nadia and Burdwan in the south. The whole district is broadly divided into two equal halves by the river Bhagirathi namely the *Rarh* located in the west of Bhagirathi and the *Bagri* located in the east of Bhagirathi. Both the parts are distinct in respect of geology, soil, cropping pattern, etc. The *Rarh* is predominately rice belt whereas *Bagri* is rice and jute belt. The general orientation of the district is from North West to the southeast.

The western part is predominately red clay soil and the eastern part is predominantly alluvial soil. Apart from this, there are large tracts of low lying areas, which are popularly called *Hijjal.* In addition, there is another continuous narrow depression in the south east of the district called Kalantar. These vast swamps are called *Bills*. As the land of the district is very fertile and temperature and rainfall are quite good therefore, it offers an opportunity to the people to intensively cultivate their land and support the large population.

The total population of the district is 7, 103, 807 (Census of India 2011). District Murshidabad is one of the most densely populated districts of West Bengal. The average density of population is 1334 per/ sq km. The majority (above 70 percent) of the district's population lived in villages and agriculture is the main source of their livelihood. The average decadal population growth rate in the district of Murshidabad is quite higher than the state of West Bengal. Similarly, the decadal population growth rate in the study blocks is also higher than the district as well as the state of West Bengal (Census of India 2011).

The workforce structure of the district of Murshidabad has significantly changed from 1981 to 2011. The average rate of worker participation in 1981 was 28.93 percent. But it is increased to 36.24 percent in 2011. The share of the main worker in 1981 was 27.22 percent. The share of main workers reached to 27.94 percent in 2011. Thus, share of the main workers slightly improved in the last three decades.

Similarly, average work participation rate in the study blocks during 1981 was 27.12 percent in the Berhampore, 28.34 percent in the M J block and 26.80 percent in the Domkal block respectively. But it increased to 34.53 percent in the Berhampore, 36.46 percent in M J block and 35.24 percent in the Domkal in 2011. The share of the main worker in the study blocks has gone through the significant ups and down during 1981 to 2011.

The changes in the share of the different categories of main worker are also recorded during 1981 to 2011. The share of agriculture based main workers was 68.42 percent in 1981which is reduced to 51.27 percent 2011. The share of cultivators is reduced by more than half in the last three decades in the district. Similarly, the share of Household, Industrial labourers are increasing by three fold in last three decades. In addition to the share of the Other Workers is increased by 5.5 percent in last three decades.

In similar way study also shows that the steady improvement in the share of workforce participation in the study blocks from 1981 to 2011. The share of the main workers in the Berhampore block was 26.37 percent in 1981 which was rising to 28.63 percent 1991 and again dropped to 27.0 percent in 2001, and again increased to 27.64 percent during 2011. Similarly, the share of the main workers in the M J block was 27.21 percent in 1981 which was rising to 29.64 percent 1991 and the share is dropped to 29.0 percent in 2001, and again reached to 29.83 percent during 2011. In

addition to the share of the main workers in the Domkal block was 25.69 percent in 1981 which was rising to 29.40 percent 1991 and the share is dropped to 26.0 percent in 2001, and again the share of main worker is reached to 27.54 percent during 2011. Therefore, the significant percentage of withdrawal from the cultivators is recorded in last three decades in the district of Murshidabad. On the other hand, significant improvement is recorded in the share of Household Industrial Labourers and the Other Workers.

Therefore, the major fluctuation in main workers' participation is recorded in Domkal block during 1991 to 2001. Little negative changes in main workers' participation recorded in Murshidabad- Jiagang (M. J) and Berhampore blocks during 1991 to 2001. The share of the different categories main workers in the study blocks has gone through the significant changes from 1981 to 2011.

The share of agriculture based main workers was 54.19 percent in the Berhampore, 77.8 percent in the M. J block and 84.12 percent in the Domkal during 1981 which is reduced to 52.13 percent in the Berhampore, 62.41 percent in the M J and 68.61 percent in the Domkal in 2011. The share of cultivators in the Berhampore block was 27.42 percent in 1981 which was reached to 34.12 percent in 1991 and again dropped to 17.22 percent in 2011. Further, study shows that the share of cultivators in the M. J block was 36.68 percent in 1981 which has decreased by fifty percent within three decades and reduced to 18.06 percent in 2011.

In addition, the share of cultivators in the Domkal block was 43.79 percent in 1981 which has also decreased by fifty percent within three decades and reduced to 22.62 percent in 2011. But the share of the Agricultural Labourers, Household Industrial labourers and other workers is significantly increased in the last three decades in the study blocks from 1981 to 2011 (Table III.4). The share of the agricultural labourers

in the study blocks was 26.77 percent in the Berhampore, 41.12 percent in the M. J block and 40.33 percent in the Domkal during 1981 which goes up to 35.12 percent in the Berhampore, 43.06 percent in the M. J block and 42.16 percent in the Domkal block respectively. In addition, the share of the household industrial workers was 2.28 percent in the Berhampore, 2.72 percent in the M. J block and 6.11 percent in the Domkal block in 1981, which is rising to 4.23 percent in Berhampore, 5.99 percent in the M J block and 6.94 percent in Domkal block in 2011.

Therefore the share of the household industrial labourers is getting double in last three decades. In case of other workers; the share is little bit dropped in Berhampore block from 1981 to 2011. The share of the other workers in the M. J block is getting almost double in the last three decades (1981- 2011). Similarly, the share of other workers in the Domkal block is increasing by three fold in the last three decades.

Therefore the share of work participation rate is slowly improving in the district Murshidabad as well as in the study blocks. In addition, the share of the main workers is also improving slowly in the last three decades in the district of Murshidabad as well as in the study blocks. But the share of cultivators within the main workers is significantly dropped in the last three decades in the district as well as in the study blocks. Similarly, quite significant improvement is recorded in the share of Household Industrial Labourers and other workers in the district as well as in the study blocks in the last three decades.

The nine fold classification of workers has given more insight story of workforce structure in the district of Murshidabad. The study shows that the share of cultivators and agricultural labourers declined in 2001. The share of cultivators is decreased by approximately eleven percent in 2001. Similarly, the share of agricultural labourers is dropped by 2.27 percent in 2001 with respect of 1991. But, share of agriculture

labourers increases in 2011 with respect to 2001. In addition to it, the share of other categories of workers like livestock's rancher, forest and fishermen, mining and quarrying, manufacturing sectors significantly increased in 2001 and 2011 as compare to the 1991.

Within manufacturing activities, share of household industries workers shows significant improvement in 2001 in respect to 1991. Furthermore, study demonstrates that the share of people involves in construction sector, trade and commerce, transport, storage and communication also steadily improved in last decade in the district of Murshidabad. In respect to service sectors, growth rate is quite good (Table III.4).

Thus, from the discussion it is very clear that the share of agricultural sectors continuously declined in the study blocks as well as in the district of Murshidabad. Within agriculture sectors, the share of cultivators is declined in alarming rate in last decade whereas share of manufacturing sectors is increased in significant pace in the study blocks and in the district of Murshidabad upto 2001. Therefore, study clearly indicates that the shift in economic activities from primary to manufacturing and service sectors in the study blocks as well as in the district. It is gradually shifting from primary sector to the secondary and tertiary sectors.

Hence, the surplus labour forces of agriculture sector are being absorbed by the other sectors including small scale brick kiln industries. The cheap labour force, fertile alluvial soil, rapid rate of urbanization, raising demand for building materials in urban, rural areas and other geophysical condition creates favourable environment for brick industries as well as different agencies and stakeholders played their respective role in the development of numerous brick kiln industries in the district of Murshidabad. In the next chapter we will discuss about the distribution of brick

industries, its functional mechanism, nature, pattern and its status within the framework of industry.

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Chapter IV

Brick Industries in the District of Murshidabad: Present status and Functional Mechanism

IV.1 Introduction

Brick manufacturing industry is one of the oldest industries in human history. It is very difficult to trace the exact time table of brick manufacturing history in India. The evidence of bricks manufacturing is found in Harappa civilisation. Likewise, it is also very difficult to trace the exact time table of brick manufacturing history in Murshidabad. It is assumed that the history of brick manufacturing in the district is contemporary to the history of brick manufacturing in West Bengal. The ruin of Karnasubarna[23](600 - 638 AD) shows the evidence of brick manufacturing in the district of Murshidabad. It shows the people of the district were familiar with brick manufacturing technique since ancient time. The improvement in brick manufacturing techniques also traced in the 17th-century buildings like *Katra Masjid, Hazar Duari Palace, Imam Bara, Moti Masjid* etc in the district.

However, the motive of the brick making of that period was very much different from today. During that period, the king of Murshidabad (Nawab) used to dig several *Dighi*[24] or canals around the capital to protect the kingdom from the enemy attacks. The soils of these *Dighi's* were used to produce the bricks. These bricks were used to build such giant buildings. These large *Dighi's* were used to protect their capital from outside attack. On the other hand, these *Dighi'*s were also used as a source of fish, drinking water, boating, and other purposes. Thus, the tradition of brick making from clay burnt in small kiln with the help of wood (fuel) is still prevailing among the

[23] Karnasubarna- It is a capital of 7th century famous Bengal king Shaskanka. The place located 9.6 km south west of Berhampore, Murshidabad.
[24] Dighi- Long and narrow pond is called Dighi.

villagers. The only difference between the past and today's bricks is their size and width. The size of the bricks was small and width was thin as compared to the present day's bricks. The method of brick making is still more or less the same.

The district has witnessed unparalleled growth of the brick manufacturing industry in the recent past (not more than 20 -30 years). At present, the district has more than 670 working brick manufacturing industry (DL& LR 2015-16). Most of these industries are spread over the vast area of *Bagri* region. It is not true that people of the district were not familiar with brick making and burning process before thirty or forty years ago. There is ample evidence which suggests that people were very much familiar with the process of brick making and burning.

It is very difficult to identify the first commercial brick manufacturing unit in Murshidabad due to lack of evidence and reliable official record. Nevertheless, it is evident that the very few commercial brick making/manufacturing units were established between 1980- 1990. After 1990s, a steady growth of brick manufacturing sector was observed in various parts of Murshidabad and most of the products were consumed in the urban areas of the district. The villagers were unable to buy these thermal bricks due to their poor economic condition. However, they were very much familiar with the use of unburnt and burnt bricks; those were produced by themselves in their houses. The implementation of the new economic policy[25] in 1991 accelerated the process of urbanization, industrialization, construction, and infrastructure development across the country. At the same time, similar developmental activities also started in different parts of the state. The rapid growth of these sectors had accelerated the demand for building materials including bricks. To fulfil the rising

[25] **New Economic Policy**- the Government of India open up it market to global giant 1991 for rapid economic development. The new economic policy allow the foreign investor to invest in different economic sector of country to boost up the economic growth, creation of employment, reduce the poverty etc.

demand for bricks in the district as well as in the state, numerous new brick manufacturing units started to flourish in Murshidabad like other parts of the state.

The evidence indicates that a steady growth of the brick kiln industry, as a commercial informal industrial sector of the economy has taken place in the district from 1990 - 2000. The rapid development in the infrastructure sector led to a pull of rural landless labour force to the urban areas. The majority of the rural landless, unskilled, agricultural labourers were employed in the construction sector. The construction work offers them an opportunity to earn a lump sum amount of money as well as introduces them to a urban lifestyle.

After coming back to their respective villages, they started making houses made of brick for themselves. Therefore, aspiration among the villagers started changing and they are trying to replace their traditional houses (muddy houses) with brick made Semi Pucca or Pucca houses. As a result, the demand for thermal/fire clay bricks also started rising tremendously in rural areas.

To fulfil these rising demand for bricks a number of new brick manufacturing units established in the district. In this regard, the real growth of the brick industry in the district has taken place during 2000 – 2010. The development of brick kiln industry offers employment to thousand of rural landless, unskilled agricultural labourers in Murshidabad. Therefore, it is important to understand the status, nature, function and pattern of the brick industry.

VI.2 Distribution of brick industries in District Murshidabad

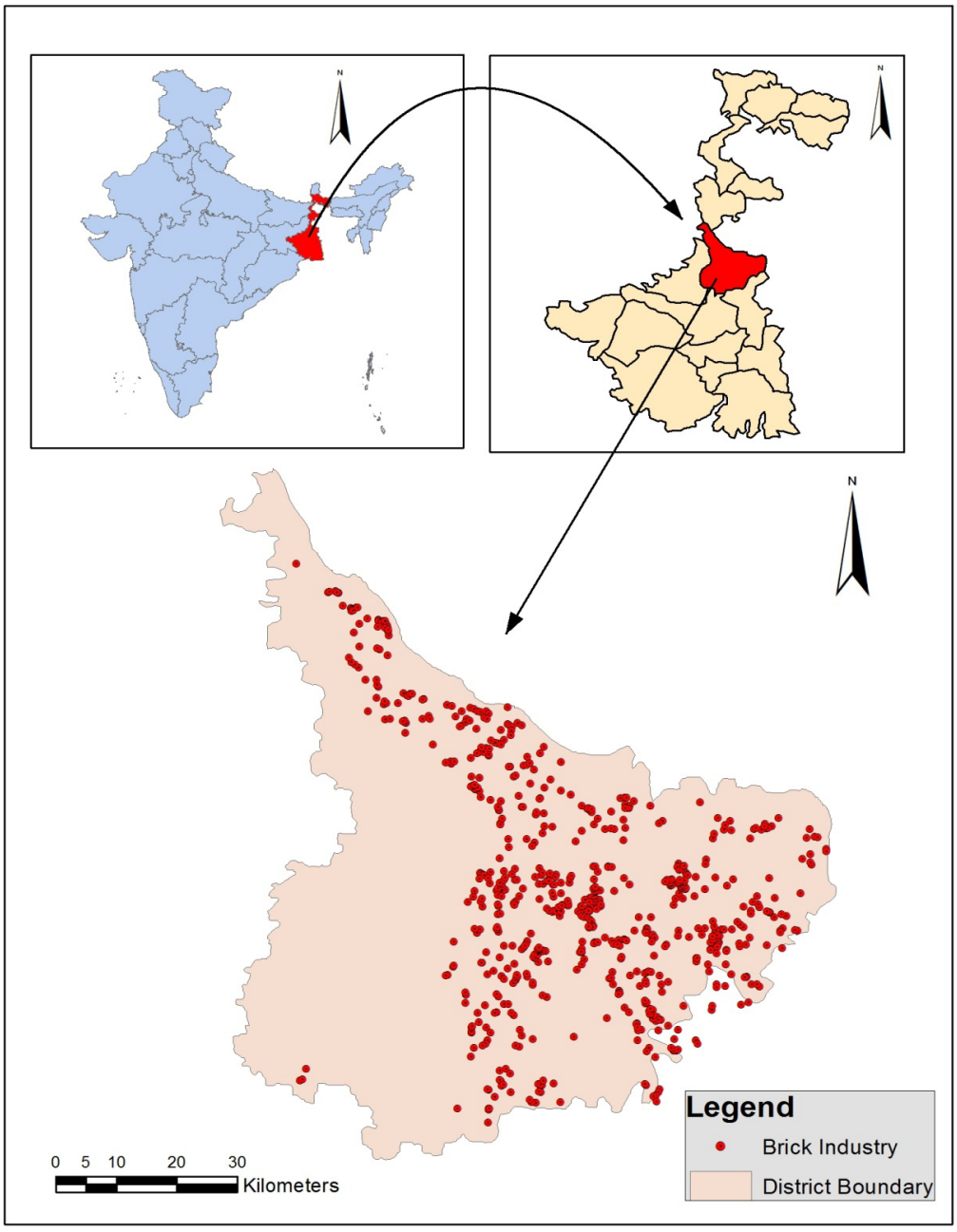
Rapid and unparalleled growth of brick manufacturing in the district has been witnessed only after the 2000s. But it is very difficult to identify the first commercial brick manufacturing unit in the district because of inaccessibility of reliable official record regarding the brick manufacturing industry of Murshidabad. The steady growth

of brick industries has been observed during the 1980s - 1990s in the district. The statistical record has shown that the real growth of the brick industry in the district has been taking place during 2000 – 2010.

Now it has more than 670 working brick manufacturing industries in the district (Report on Brickfield, Office of the SRO Murshidabad, Government of West Bengal' 2015 - 2016). Most of these industries are spread over the vast area of *Bagri* region of the district (Figure IV.1). Table IV.1 has shown the present spatial distribution of brick industries in district Murshidabad.

Within *Bagri* region, the maximum number of brick industries is found in Berhampore block and it holds the first position in terms of the number of brick industries (104). Domkal block occupies the second position in terms of the number of brick industries (63). The Hariharpara blocks hold the third position (52). Beldanga I, Lalgola and Jalangi occupy fourth, fifth and sixth position respectively. In addition to this other 7 blocks have less than 40 but above 20 brick industries (Table VI.1).

DISTRIBUTION OF BRICK INDUSTRIES, DISTRICT MURSHIDABAD, WEST BENGAL



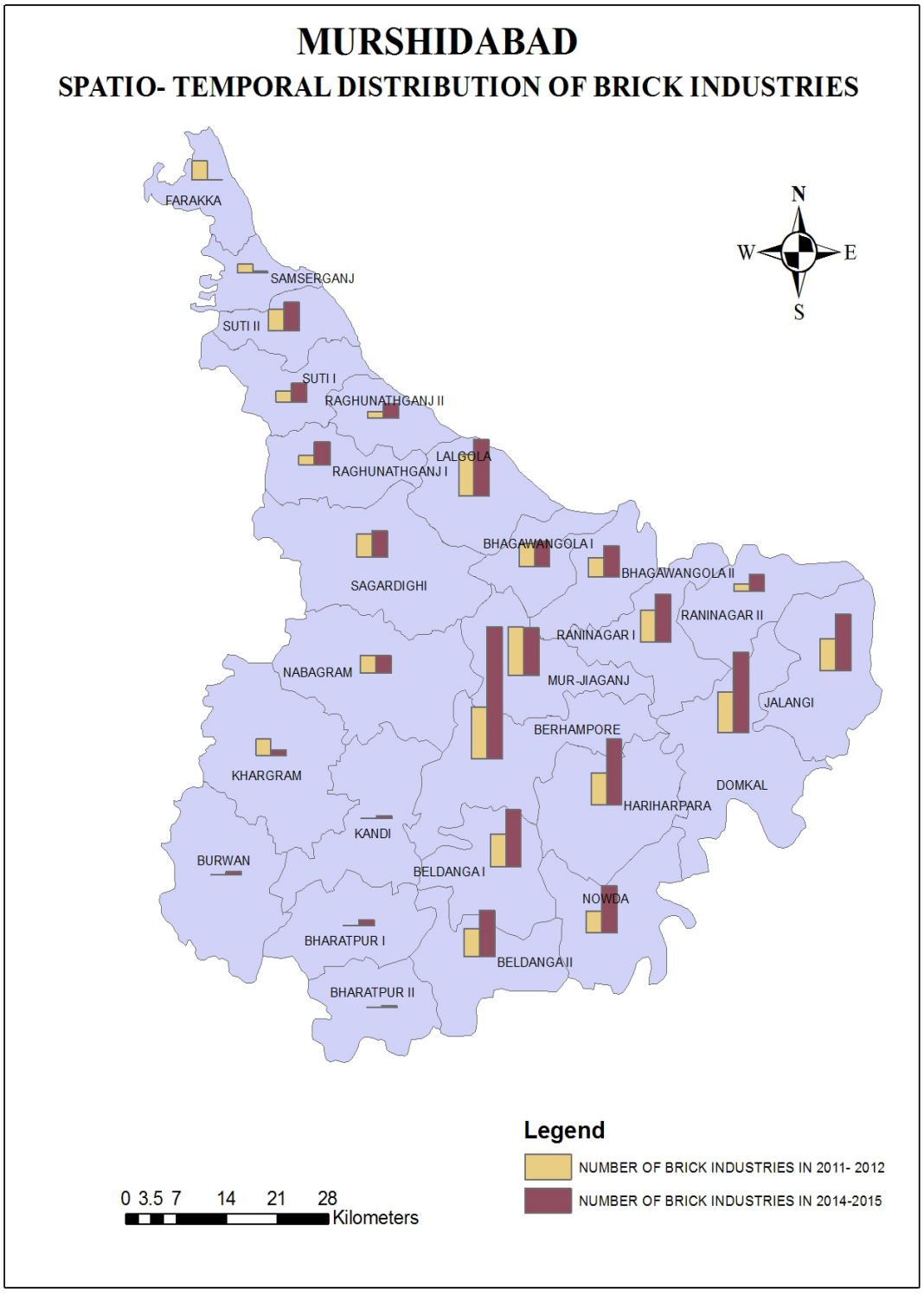
Map IV.1 *Distribution of brick kiln industries in the District of Murshidabad*

Source: *Map prepared by Author*

Table IV.1 Spatial-Temporal Distribution of the Brick Industries in the Murshidabad District, West Bengal

Name of the Block	The number of brick Industries 2010- 12	Number of Brick Industries 2014 – 15
Berhampore	41	104
Beldanga I	26	45
Beldanga II	22	36
Nawda	17	37
Hariharpara	25	52
Bhagawangola I	17	20
Bhagowangola II	15	24
Lalgola	32	44
Murshidabad Jiagang	38	37
Nabagram	14	14
Domkal	32	63
Jalangi	25	44
Raninagar	25	37
Raninagar –II	6	13
Raghunathgang –I	7	18
Raghunathgang – II	5	11
Sagardighi	18	21
Suti – I	9	15
Suti - II	17	23
Khargram	13	04
Burwan	NA	03
Kandi	NA	02
Bharathpur – I	NA	04
Bharatpur - II	NA	01
Farakka	15	00
Samsergang	7	01
Total	**416**	**672**

Sources: #*Report of Brickfield, Office of the district land and land reform officer Murshidabad, Government of West Bengal, (2011 - 2012)*
Report on Brickfield, Office of the SRO Murshidabad, Government of West Bengal, (2015 - 2016)
NA- Data Not Available



Map IV.2 *Spatio- Temporal distribution of brick industries, District of Murshidabad*

Source: *Map prepared by Author*

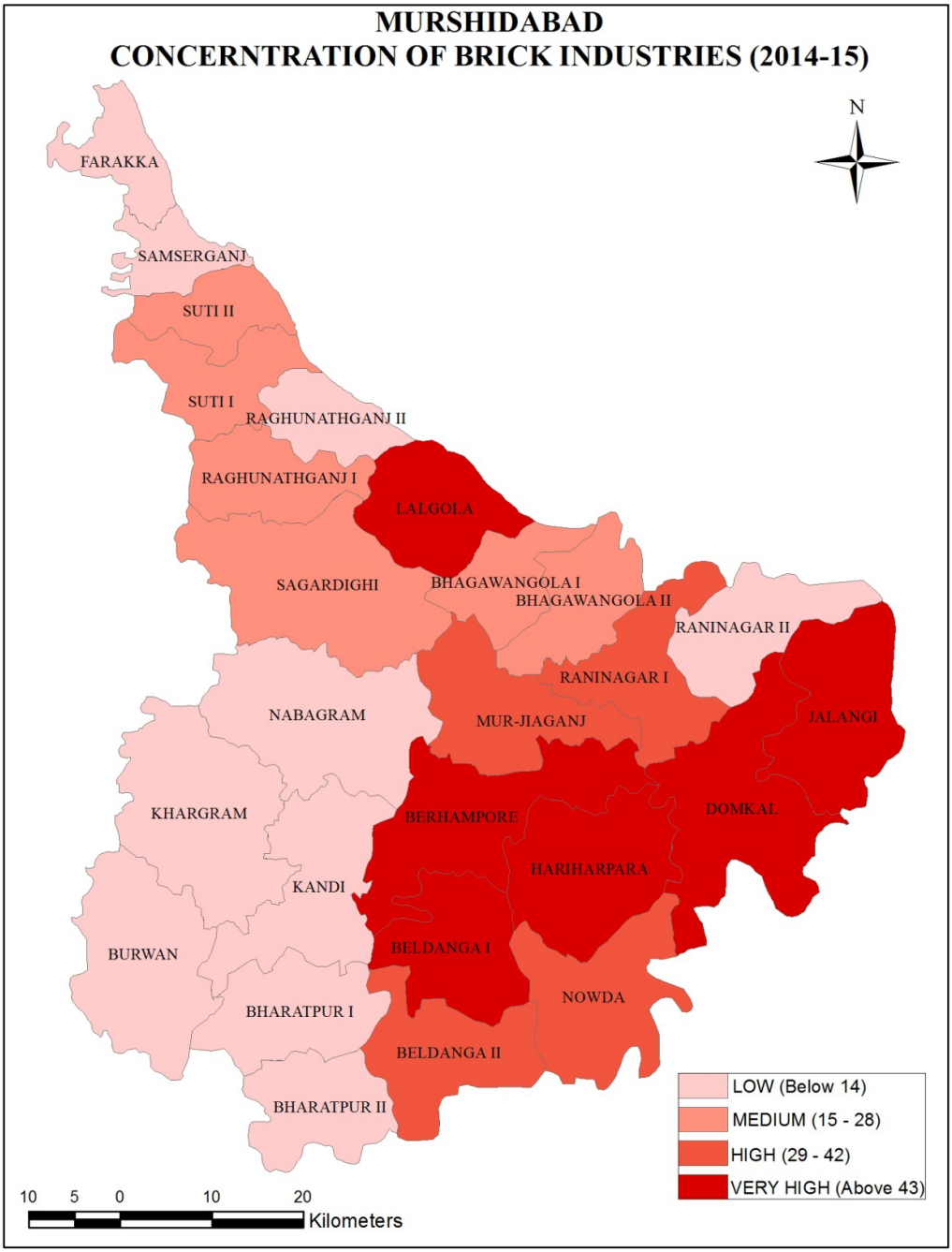
Table: IV.2 Block Wise distribution of Brick Industries in the District Murshidabad (2014 – 2015)

S.l	Name of the Blocks	Brick Industries	S.l	Name of the Blocks	Brick Industries
1.	Berhampore	104	14.	Raninagar –II	13
2.	Beldanga – I	45	15.	Raghunathgang –I	18
3.	Beldanga – II	36	16.	Raghunathgang – II	11
4.	Nawda	37	17.	Sagardighi	21
5.	Hariharpara	52	18.	Suti – I	15
6.	Bhagawangola – I	20	19.	Suti - II	23
7.	Bhagowangola – II	24	20.	Khargram	04
8.	Lalgola	44	21.	Burwan	03
9.	M. J block	37	22.	Kandi	02
10.	Nabagram	14	23.	Bharatpur – I	04
11.	Domkal	63	24.	Bharatpur - II	01
14.	Jalangi	44	25.	Farakka	00
13.	Raninagar – I	37	26.	Samsergang	01
District					**672**

Source: *Report on Brickfield, Office of the SRO Murshidabad, Government of West Bengal, (2015 - 2016)*

 # *M. J -* *Murshidabad Jiaganj*

The table IV.2 shows that district of Murshidabad has about 672 brick industries comprises of Moveable kiln chimney, fixed chimney and Hawa chimney brick industries. This study further unfolded that majority of the brick industries located in the *Bagri* part (East of Bhagirathi River) of the district of Murshidabad. Very high concentration of brick industries have been recorded in the blocks of Berhampore, Lalgola, Hariharpara, Beldanga I, Domkal and Jalangi. In addition to it, high concentration of brick industries have been recorded in the blocks of Beldanga II, Nawda, Murshidabad- Jiagang, Ranigagar I. Similarly, medium concentration is recorded in the blocks of Suti I and II, Bhagawangola II and II Sagardighi and Raghunathganj I. Remaining blocks have less number of brick industries (Map IV. 3).



Map IV.3 *Block wise Concentration of Brick Industries in the District of Murshidabad*

Source: *Map prepared by Author after taken information from Office of the SRO, Berhampore, Murshidabad, West Bengal 2016*

Table IV.3 Legal Status of the Brick kiln Industries in the District Murshidabad, 2014- 15

Number of brick industries						
Name of the Blocks	Total	Author-ized	Un-authorizd	Operational		
				Total	Author-ized	Un-authorized
Berhampore	104	29 (28%)	75 (72%)	88	22 (25%)	66 (75%)
Beldanga – I	45	04 (09%)	41 (91%)	35	04 (11%)	31 (99%)
Beldanga – II	36	00 (0%)	36 (100%)	24	00 (0%)	24 (100%)
Nawda	37	00 (0%)	37 (100%)	35	00 (0%)	35 (100%)
Hariharpara	52	00 (0%)	52 (100%)	52	00 (0%)	52 (100%)
Bhagawangola – I	20	02 (10%)	18 (90%)	13	02 (15%)	11 (85%)
Bhagowangola – II	24	00 (0%)	24 (100%)	14	00 (0%)	14 (100%)
Lalgola	44	04 (9%)	40 (91%)	41	04 (9%)	37 (91%)
M. J Block	37	06 (16%)	31 (84%)	31	00 (0%)	31 (100%)
Nabagram	14	00 (0%)	14 (100%)	9	00 (0%)	09 (100%)
Domkal	63	14 (22%)	49 (78%)	48	13 (27%)	35 (73%)
Jalangi	44	00 (0%)	44 (100%)	21	00 (0%)	21 (100%)
Raninagar – I	37	08 (22%)	29 (78%)	30	06 (20%)	24 (80%)
Raninagar –II	13	00 (0%)	13 (100%)	9	00 (0%)	09 (100%)
Raghunathgang –I	18	13 (72%)	05 (28%)	18	13 (72%)	05 (28%)
Raghunathgang – II	11	07 (54%)	04 (46%)	11	07 (64%)	04 (36%)
Sagardighi	21	02 (10%)	19 (90%)	16	02 (12%)	14 (88%)
Suti – I	15	03 (20%)	12 (80%)	12	03 (25%)	09 (75%)
Suti - II	23	02 (9%)	21 (91%)	22	02 (9%)	20 (91%)
Khargram	04	00 (0%)	04 (100%)	4	00 (0%)	04 (100%)
Burwan	03	00 (0%)	03 (100%)	3	00 (0%)	03 (100%)
Kandi	02	00 (0%)	02 (100%)	2	00 (0%)	02 (100%)
Bharathpur – I	04	00 (0%)	04 (100%)	4	00 (0%)	04 (100%)
Bharatpur - II	01	00 (0%)	01 (100%)	1	00 (0%)	01 (100%)
Farakka	00	00 (0%)	00 (0%)	0	00 (0%)	00 (0%)
Samsergang	01	1 (100%)	00 (0%)	1	1 (100%)	00 (0%)

Source: *Office of the SRO, Additional District Magistrate, Land and Land Reforms Officer, Murshidabad, (2015- 2016), 14/02/ 2016.*

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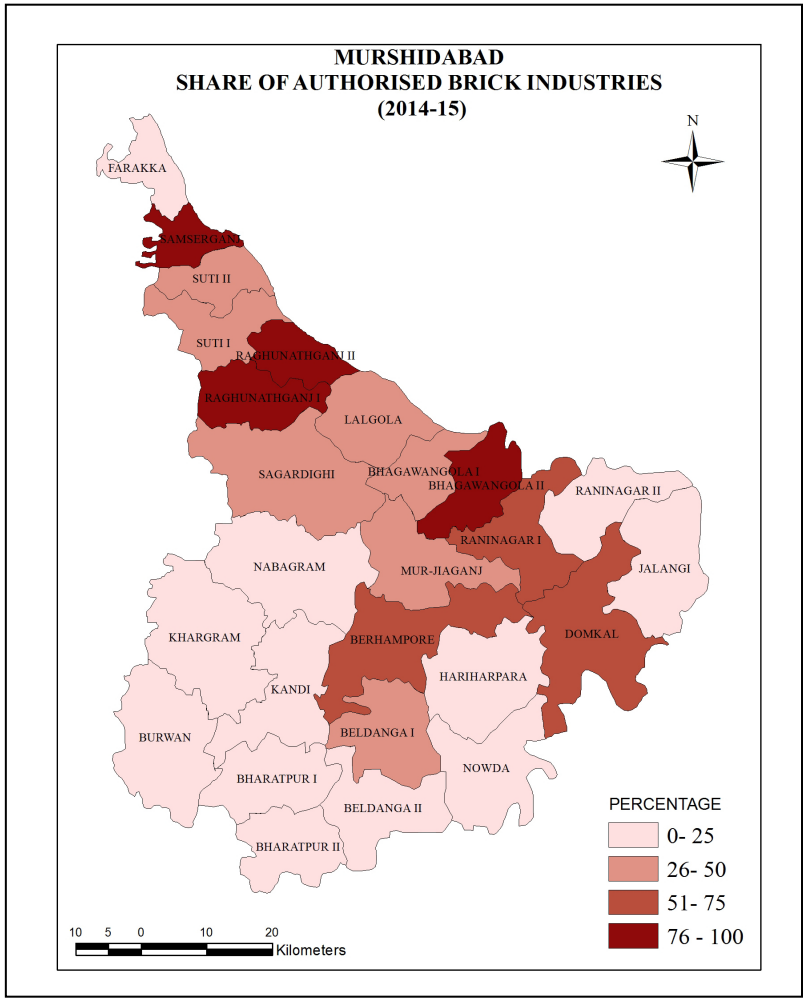
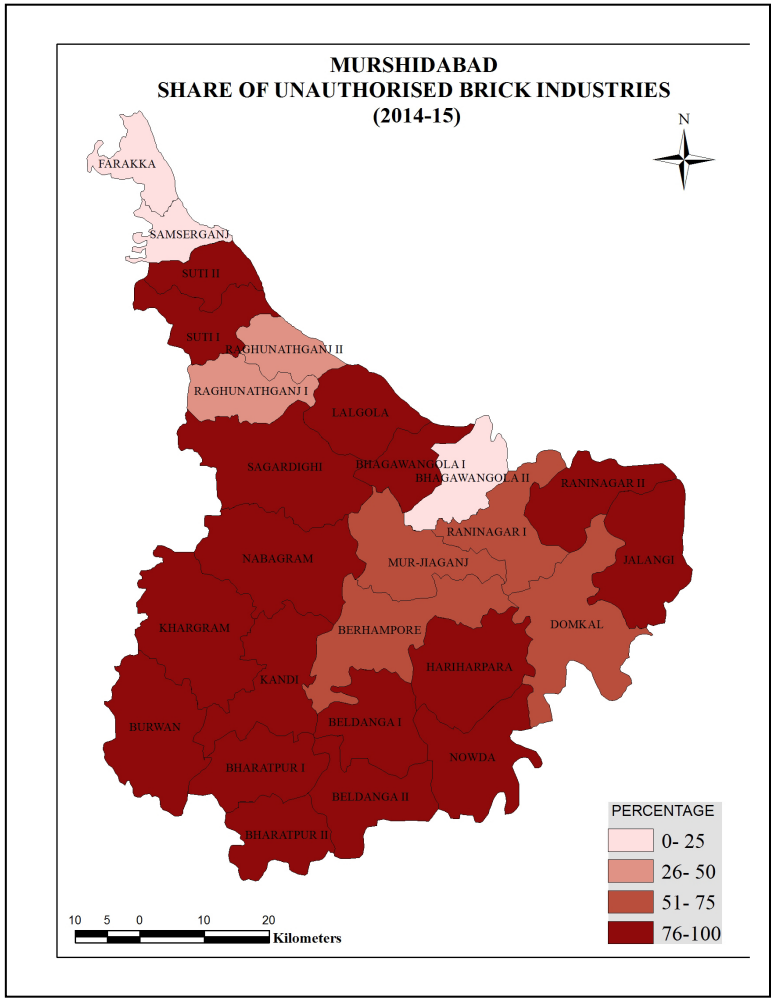
[26] **Authorised and Unauthorised Brick Industry**- The brick industries which are functioning in the district of Murshidabad is categorising into authorised and unauthorised by the Stare Pollution Control Board (SPCB) on behalf of Government of West Bengal based on documents. According to the SPCB, the brick industries which have valid "Concent to Operate" certificate and other valid documents are considered as Authorised whereas the brick industries which does not have valid "Concent to Operate" certificate and other valid documents but still functioning are considered as Unauthorised industry.

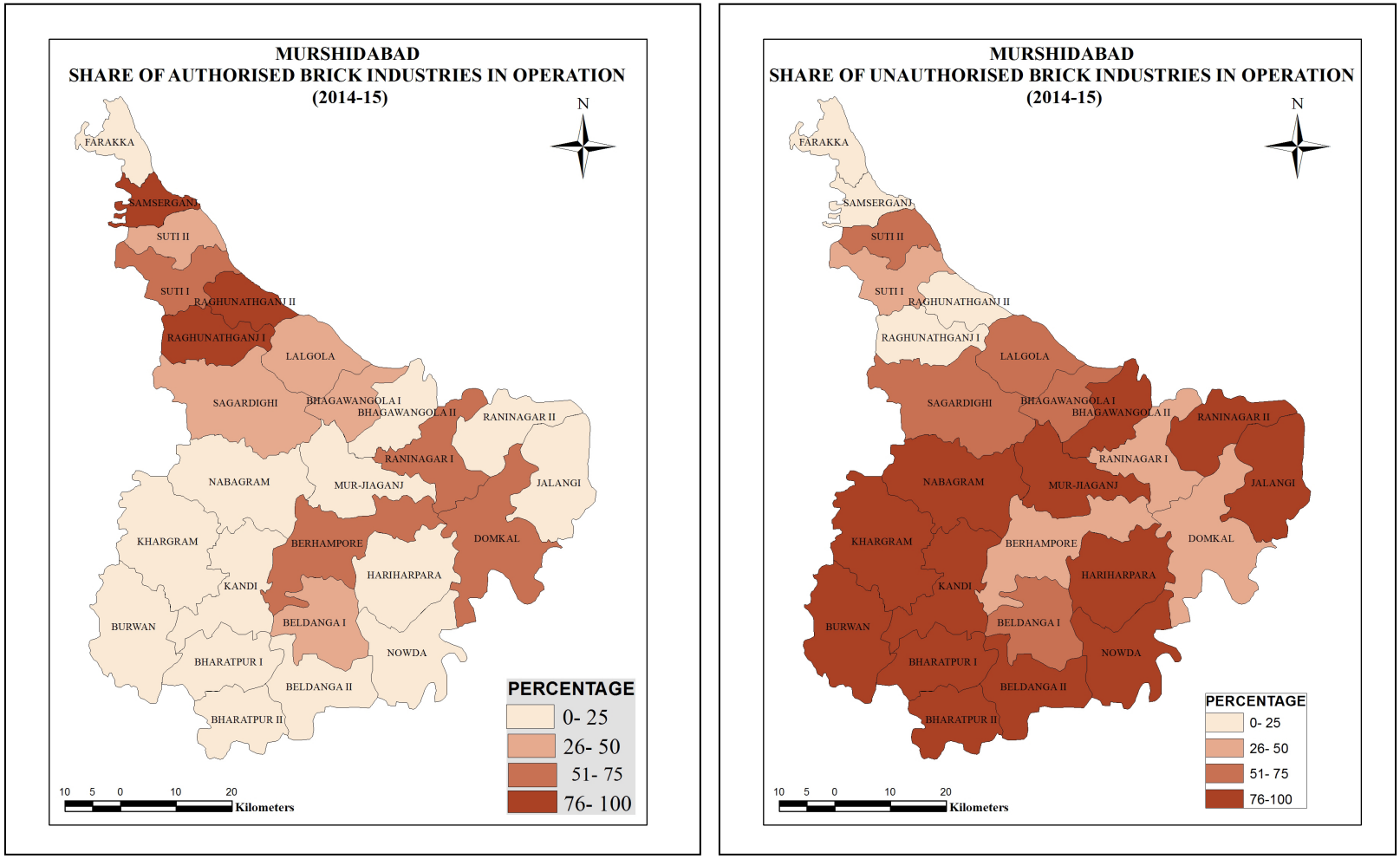
Share of Authorised and Unauthorised Brick industries in the District of Murshidabad





Map VI.4 *Distribution of brick industries by their legal Status.*

Share of Authorised and Unauthorised Brick industries in Operation in the District of Murshidabad



Map VI.5 *Share of Authorised and Unauthorised Brick industries in Operation*

Source: *Map prepared by author after taking information from Office of the SRO, Additional District Magistrate*

Table IV. 4 Temporal Growth of Brick Industry in District Murshidabad

Year	Authorised	Unauthorised	Total
2000-02	-	-	50
2007-08	67	179	246
2014-15	94	578	672

Source: *Compiled by Author after taking from District Gazetteer (2003), Directorate of brick production, Government of West Bengal (2008), Office of the SRO, Land and Land Reforms Department, District Murshidabad, Government of West Bengal (2014-15)*

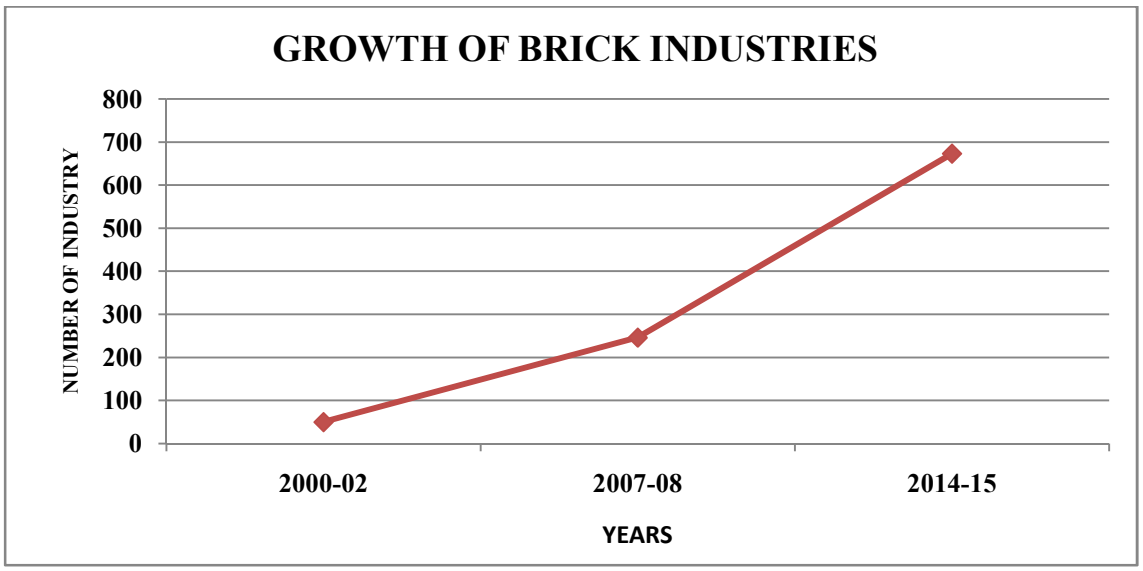
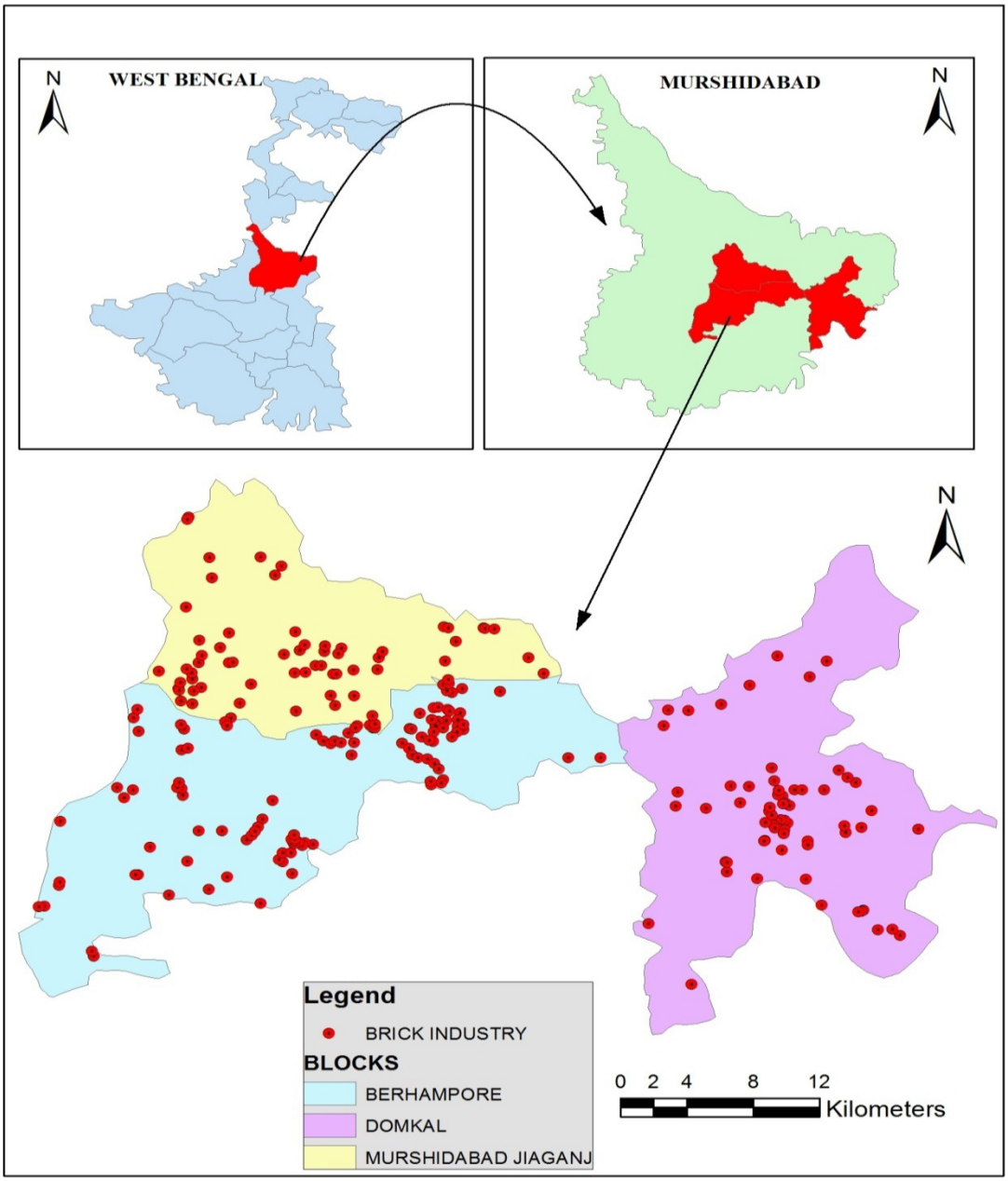


Figure VI.2 *Temporal growth of Brick Industry in Murshidabad, West Bengal*

The figure IV.2 shows that out of the total number brick industry in district was only 50 before 2002. The number of brick industries reached to 246 in 2007- 08. In addition to it the number of brick industries reached 670 in 2014-15 in the district. Similarly, the number of authorised and unauthorised brick industry was 67 and 179 in 2007-08. This study further shows that the number of authorised brick industries increases by nearly 50 percent whereas the number of unauthorised brick industries increases by more than 300 percent from 2007-08 to 2014-15 (Table IV.5).

DISTRIBUTION OF BRICK INDUSTRY IN STUDY BLOCKS, DISTRICT MURSHIDABAD



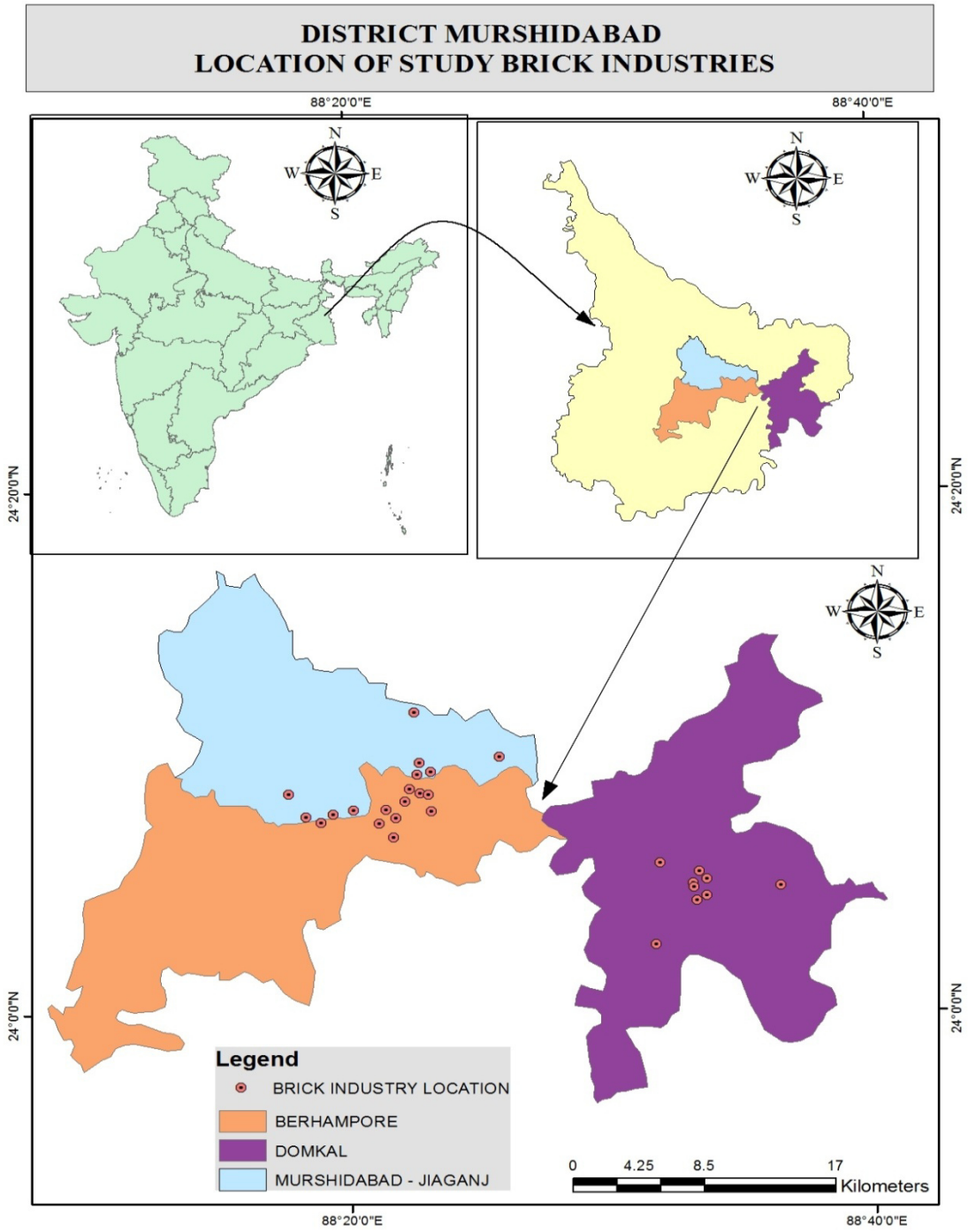
Map IV.6 *Spatial Distribution of Brick Industry in the Study Blocks, Murshidabad*

Source: *Map prepared by Author*

Table IV.5 Location, Types, and Area of Land Used by Samples Brick Industries, District Murshidabad

BLOCKS	INDUSTRY TYPE	LOCATION	AREA (Ha)
Berhampore	Fixed Chimney	24° 08' 25.83"N 88° 22' 42.15" E	2.43
	Fixed Chimney	24° 08' 22.12 "N 88° 23' 03.57" E	2.16
	Fixed Chimney	24° 07' 45.33"N 88° 23' 09.80" E	3.42
	Fixed Chimney	24° 07' 28.46"N 88° 21' 47.85" E	2.60
	Fixed Chimney	24° 06' 44.10"N 88° 21' 42.53" E	2.32
	Fixed Chimney	24° 07' 20.86"N 88° 16' 57.56" E	2.55
	Hawa/Zigzag	24° 07' 48.92"N 88° 22' 31.81" E	2.94
	Hawa/Zigzag	24° 07' 48.44"N 88° 20' 12.62" E	2.68
	Hawa/Zigzag	24° 07' 48.83"N 88° 21' 25.24" E	3.05
	Moveable	24° 08' 07.26"N 88° 22' 10.15" E	2.60
Murshidabad-Jiagang	Fixed Chimney	24° 09' 46.83 "N 88° 25' 47.01" E	3.13
	Fixed Chimney	24° 09' 14.89 "N 88° 23' 07.38" E	3.68
	Fixed Chimney	24° 09' 35.25 "N 88° 22' 37.61" E	2.28
	Fixed Chimney	24° 08' 35.30 "N 88° 22' 20.34" E	2.95
	Fixed Chimney	24° 07' 31.84 "N 88° 18' 21.52" E	2.39
	Fixed Chimney	24° 08' 26.57"N 88° 17' 43.34" E	2.53
	Hawa/Zigzag	24° 11' 31.63"N 88° 22' 31.73" E	3.28
	Hawa/Zigzag	24° 07' 38.06"N 88° 19' 24.13" E	2.70
	Moveable	24° 09' 09.15 "N 88° 22' 37.61" E	1.47
Domkal	Fixed Chimney	24° 04' 55.27"N 88° 33' 07.16" E	2.95
	Fixed Chimney	24° 05' 21.52"N 88° 33' 22.43" E	4.18
	Fixed Chimney	24° 05' 40.79"N 88° 31' 51.42" E	2.56
	Fixed Chimney	24° 04' 46.60"N 88° 36' 27.36" E	2.23
	Fixed Chimney	24° 04' 27.41"N 88° 33' 37.51" E	3.13
	Hawa/Zigzag	24° 04' 14.11"N 88° 33' 14.34" E	2.09
	Hawa/Zigzag	24° 02' 34.35"N 88° 31' 43.11" E	3.27
	Moveable	24° 04' 45.60"N 88° 33' 07.54" E	1.01

Source: *Compiled after conducting field investigation with GPS 2016*



Map IV.7 *Location of the samples Brick Industries, District of Murshidabad*

Source: *Map prepared by Author.*

Average Area of land Used to Establish Different types of Brick Industry

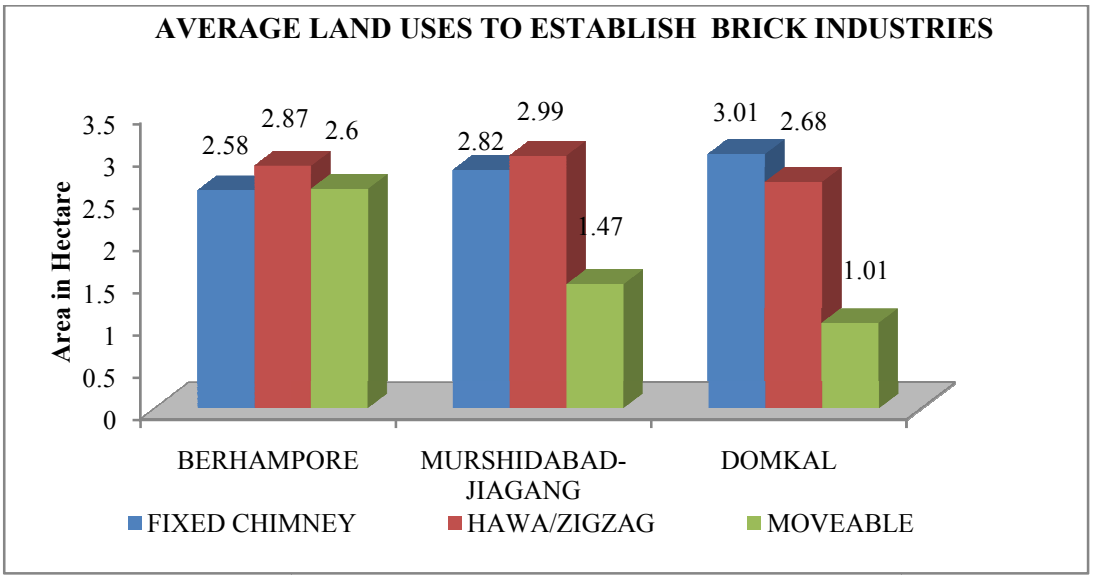


Figure IV.1 *Average amount of Land uses to establish different types of brick industry in the study blocks, District Murshidabad*

Land is one of the basic resource (Material) required to carry out any industry as well as other development projects. The brick industry fully depends on the availability of land. The industry prefers to locate itself near the source of raw materials i.e, soil. The study shows that brick industry requires land to locate kiln, dry green brick, store soil, sand, coal and dry green bricks etc.

Figure IV.1 shows that a movable chimney kiln brick industry uses the area about 2.60 hectares in Berhampore, 1.47 hectares in Murshidabad- Jiagang and 1.01 hectares land to establish a industry in the Domkal respectively. Similarly, a fixed chimney kiln brick industry uses about 2.58 hectares in Berhampore, 2.82 hectares in Murshidabad- Jiagang and 3.01 hectares in Domkal respectively. In addition, a Hawa chimney kiln brick industry uses about 2.87 hectares in Berhampore, 2.99 hectares in Murshidabad- Jiagang and 2.68 hectares in Domkal respectively.

Growth of Brick Industries in the Study Blocks, District Murshidabad

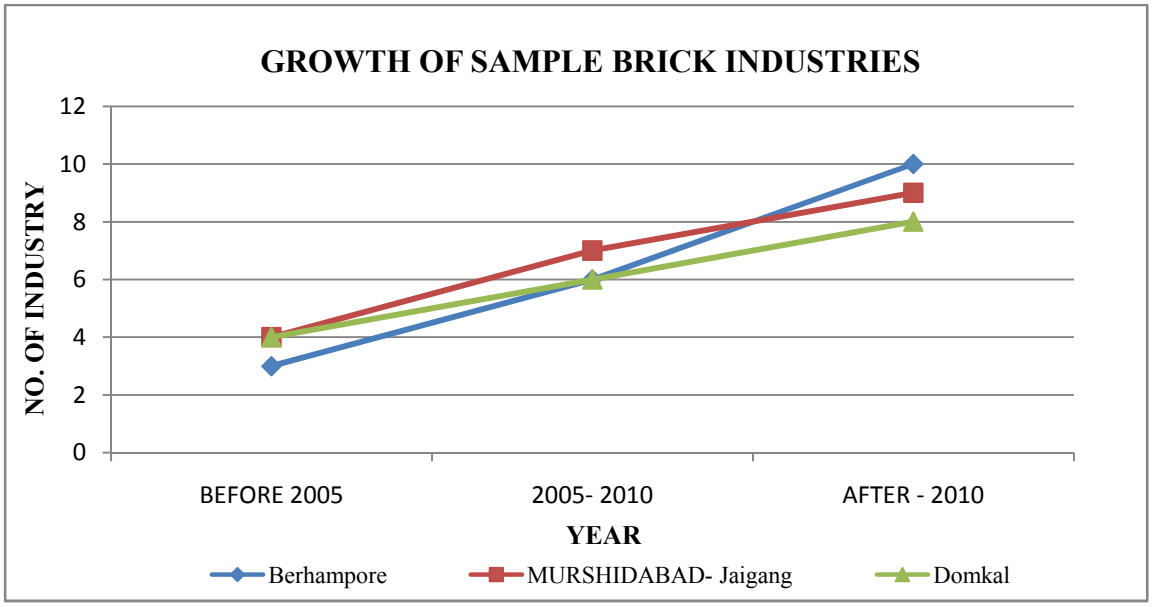
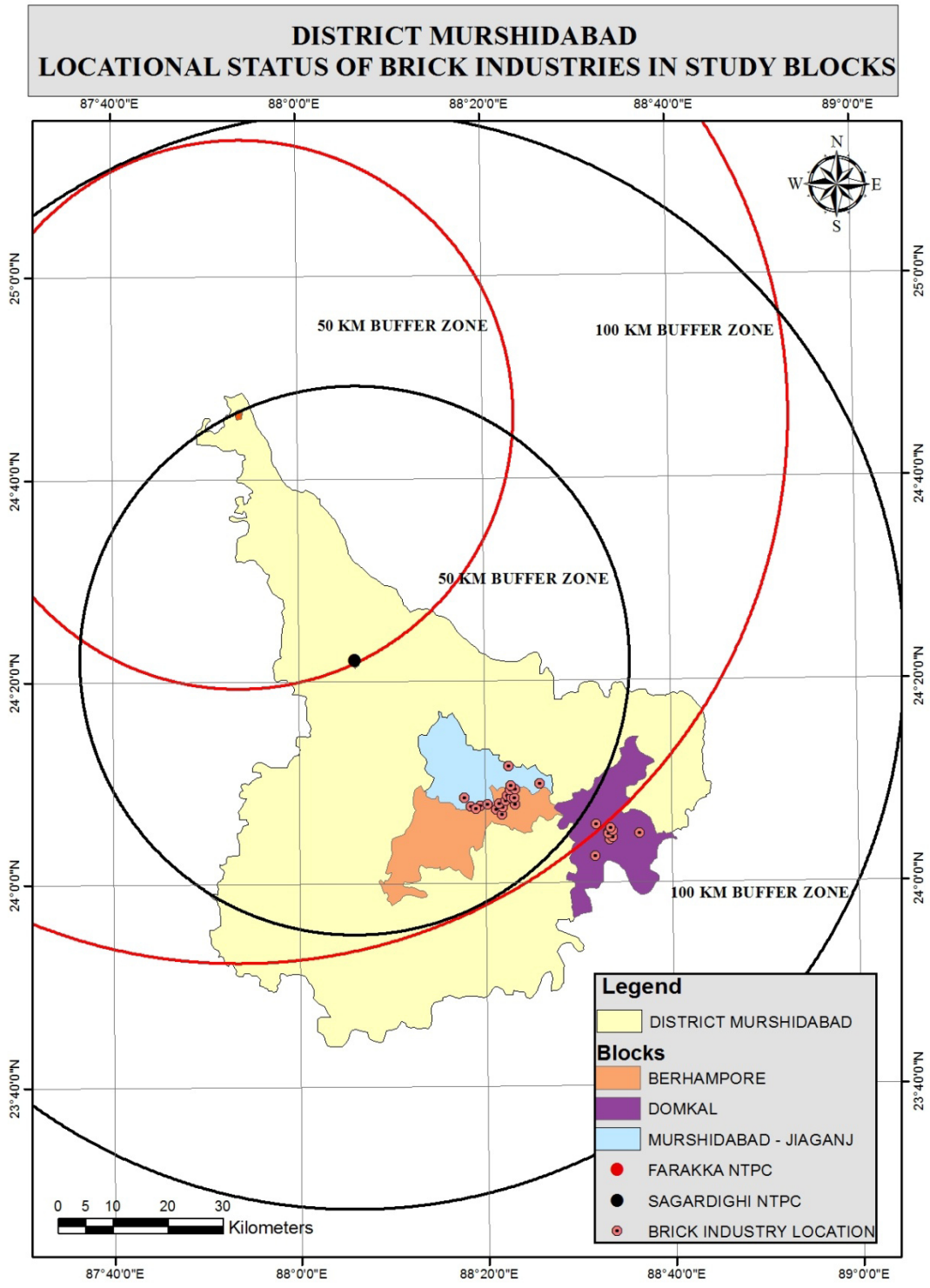


Figure IV.3 *The growth of (samples) brick industries in study blocks, District of Murshidabad*

The figure IV.3 shows that out of the total twenty-seven sample brick industries of the study only 11 brick industries were established before 2005. Other seven brick industries in the study were established in between 2005-2010. Remaining nine industries were established after the 2010s. Similarly, out of ten sample brick industries in Berhampore block, only three were there before 2005. Other three brick industries were established in between 2005-2010. Remaining four was established after 2010. In addition, out of nine samples brick industry of the M. J block, only four was there before 2005. Other three brick industries were established in between 2005-2010. Remaining two was established after 2010. In the case of Domkal, out of eight sample brick industries only four was there before 2005. Other two brick industries were established in between 2005-2010. Remaining two was established after 2010.



Map IV.8 *Distance of brick industries from the thermal power station in the study blocks, District Murshidabad*
Source: *Map prepared by the author after compiling the ground coordinate with the help base map taken from the state water investigation Directorate.*

Table IV.6 Check list for the study brick industries in the district Murshidabad, West Bengal

Name of the Industry	Functioning on		Located within 100 meters from the			Within 200 meters from highway	Within 200 meters from river	Within 1.6 km from the mango garden	Having green belt/ wall along the edge	Uses 25% fly ash as raw material	Top soil quarried in ratio of 1:3
	Agriculture land	Orchard/ Forest	Hospital	School	Religious places						
N B F	**Yes**	**N. A**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N. A**
ASTHA	**Yes**	**N.A**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
JAS	**No**	**N.A**	**No**	**Yes**	**No**	**No**	**Yes**	**No**	**No**	**No**	**N.A**
SOLEX	**Yes**	**No**	**No**	**No**	**Yes**	**No**	**Yes**	**No**	**No**	**No**	**N.A**
S M T	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
BHARSA1	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**	**N. A**
B B F	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**	**N.A**
BHARSA2	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**	**N.A**
KOLTA	**No**	**Yes**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**	**N.A**
NAWAB	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
DIAMOND	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
STAR	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
M B F	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
TIGER	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
SONA	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
SAMRAT	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
POWER	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
HANIF	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
SHAKTI	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
INDIA	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**N.A**
TITAN	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
STONE	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
DELUX	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
RADHA	**Yes**	**No**	**No**	**No**	**No**	**Yes**	**No**	**Yes**	**No**	**No**	**N.A**
FAMOUS	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
5 STAR	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**
B. B. M	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**N.A**

Source: *Prepared by author, after field investigation with the help of # Google Earth Satellite Imagery on 10/06/2015.# Ground coordinates of the sample brick industries with the help of GPS in 1st Dec – 15th Dec 2015.# Questionnaire survey regarding the status of industry has been conducted between the periods of December 2015 – July 2016*

The study shows that the development of brick industries in the study area took place by ignoring number of functional rules and regulation. The Map IV.8 and table IV.6 helps to find out the level of violation of functional rules and norms by the brick industries. Further, table IV.6 and map IV.8 also reveals false claims made by the brick industry regulating Government Authority regarding authorised industries. It is mentioned in the documents[27] that if the land is agricultural/ orchard/forest land, brick industry should not be regularized[28]. But the data collected from the field reveals that all the samples brick industries violates these rules and still functioning on agricultural land. It is also mentioned that the brick industry should be located 200 meters away from national/state or District highway, but it is found that about 18 percent brick industries are located within 200 meters from the highways[29]. Similarly, it is also mentioned in the functional guideline[30] that the brick industry should be located at least 200 meters away from the river bank/embankment. But 7.04 percent industries are located within 200 meters from the river bank. In addition to this, the functional guidelines also stated that the brick industry should be located at least 1.6 km from the mango garden. But it is found that 37 percent industries are located within 1.6 km from the mango gardens. The functional guideline further mentions that the brick industry should develop a multi-layer green belt along the edges as well as industry should use at least 25 percent fly ash as substitute raw materials[31] unfortunately, not a single brick industry follows above the noted rules.

[27] 1250-M/M/LR/A-A-II/M&M-26/2010.

[28] West Bengal Land Reforms Rules 1965 read with section 4C of the WBLR Act 1955; West Bengal Minor Minerals Rules 2002.

[29] DEA/Vide No 1004- EN/3C-01/2013.

[30] DEA/Vide No 1004- EN/3C-01/2013

[31] The Kolkata Gazetteer: Fly Ash Utilization Rules 1999.

IV.3 Functional Mechanism of Brick Industries

The brick industry is an emerging sector of informal economy in Murshidabad. At present brick industries offers employment to about sixty thousand landless labourers for a period of six months. The establishment of brick industries has also brought changes in social relation and environment. Therefore, it is very important to understand the whole process of operation of brick kiln industries in the district of Murshidabad. Study reveals that, though it is an informal, unorganized sector of economy but its function is very much systematic as well as organised too.

The production process of brick industries started with quarrying and collection of soil from the field. The soil is supplied by the soil contractors. They secure the continuous supply of good quality top soil throughout the production season. The next responsibility is on transport facilitators to carry the top soil from the quarrying ground to production site. The trucks and tractors owners make available transport facility to carry the soil from quarrying ground to the production site. The trucks and tractors owner engaged their transport vehicles day and night to facilitate the brick industries.

At the production site labourers are divided into different categories like *Pakmill* workers, brick Makers, brick Transporters, *Mistry*, *Rubbishmen* and *Firemen* based on age and skills. The youth are involved in Pakmill to prepare mud. They are responsible for preparation and supply of mud suitable for bricks. These labourers join their work at 2.30 A.M or earlier. They complete their mixing (soil and water) activity before the brick makers reached at the field.

The brick makers reach their respective allocated site 3.30 A.M or earlier and continuously shape the bricks till 8- 9 .A.M. To carry out their task industry provides them one dice, water pot, one mud cutter. It is observed that the industry appoints

most efficient, skilled and trustworthy people as bricks maker. If anyone is absent from their duty then the entire production process gets hampered. To avoid the disruption in production owners depend on labour contractors for supply of skilled and trustworthy brick makers. The brick makers are not only responsible for making bricks but also responsible for drying and store the dry bricks in defined places.

After producing the required quantity of bricks, the kiln is opened for the firing process. To carry the dry bricks from field to kiln transporters are deployed. The brick transporter comprises all ages and sex categories including tribal girls. The boys, girls and young people carrying bricks on head load whereas aged people use Toli Van to carrying the bricks from the field to the kiln.

In the kiln *Mistries* are engaged in stacking the bricks in a sequence. Here it is very important to note that the quality of product and consumption of coal depends upon the bricks stacking skills of these *Mistries*. They are the most respected person inside the industry. Meanwhile the coal businessmen supply the adequate coal for the fuel. The coal suppliers are not only making sure for instant requirement but also make possible continuous supply of coal throughout the production season.

After completing the loading of bricks inside the kiln, the *Rubbishmen* are deployed to wrap up the surface of the bricks with the help of polythene to prevent the leak. Then they cover up the top surface upto three inch thick layer with the help of sand, soil and rubbish. After that firemen are positioned to carry out the baking activity. The entire kiln is divided into several parts. To complete the baking of bricks of each section requires 18- 20 hours continuous firing. The firemen are working round the clock and according to shift. The whole firing time is divided into three shifts. One shift is 6 – 7 hours long. Two firemen are responsible for each of the shifts. On an average every kiln has six firemen. After completing the backing, a kiln is kept for cooling for one –

two weeks. After completing the cooling process, the transporters are deployed for carrying the finished product to the different selling point according to grade of bricks. Thus the entire process of production cycle is going on throughout the season.

IV.4 Pattern of Brick Industries

The growth and development of any business enterprise follows some general pattern which would help us to understand the behaviour of such industries. Hence, the brick industry emerged as an unorganized sector of the economy; therefore, very little attention is given towards the pattern and spatial distribution of this industry. But continuous careful monitoring of this industry has revealed the underlying truth that it has followed a unique pattern of development. Most of the brick industries have developed in and around the urban fringes or city centres. The cities/towns are the main buyer/consumer of the bricks where infrastructure development activity is much faster than other areas. Due to bulk in nature, the brick production units are located in and around the source of raw materials, especially near the quarrying ground. Other inputs like coal, water and labour are cheaper in terms of transport cost as compared to soil, the primary raw material. The industries are located on land which is relatively higher in altitude as compared to the surrounding land to avoid water stagnation. Good communication facility is essential to export the finished product (bricks). Good road connection facility is always a prime concern for the brick industrial owners. Therefore, owners always try to locate the production unit approximately one to two km from the main road.

IV.5 Nature of Brick Industries

Like other hazardous industries, the brick industry is also an environmentally hazardous industry. The industry has an immediate impact on the surrounding land and environment. The land rapidly changes its nature in terms of quality and quantity

(areas) due to quarrying of top soil. The function of brick industry generates a huge amount of solid waste. The solid waste is in the form of coal ash, rubbish and broken bricks. The dumping of such solid waste causes many environmental problems.

The dumping of such solid waste material has changed the soil chemistry of the dumping ground. Moreover, the dumping ground is working as a breeding ground for various diseases during the rainy season. During monsoons, rain water is mixed with all these burnt dusts and half burnt coal and soil. The mixing of water with these solid waste changes the toxicity of the soil. In many places the mixing of these toxic elements with water helps in creation of hazardous gases, which is harmful for the environment.

In addition, air pollution is another important environmental issue arising from the brick industry. The brick kiln smoke contains high percentage of Co_2, Co, and other gases. Sometime it produces sulfur dioxide and black smoke due to the burning of semi dry bricks (Pandey 1997; Baum 2010). This smoke also carries small dust, coal ash particles and it remains for a long time in the air. It causes dense fogs during winter. In the summer this smoke covers a large area and moves one area to other areas.

All these suspended material falls down in nearby areas or its immediate surroundings. If there is any vegetation, these dust particles deposit on the leaf of such vegetation and prevent their natural growth (Avita, Antonio and Mora 2012). The suspended material also pollutes the water bodies like small ponds, streams and river channels. The addition of all these suspended matter with the water creates disturbances for the aquatic ecosystem. The continuous addition of these waste materials ultimately changes the physical characteristics of the water and poses a threat to the ecology of the surroundings.

IV.6 Status of Brick Industries

The brick kiln industry is one of the important unorganized sectors of the informal economy which has employed about 30 million people (Prayas 2004, Baum 2010) in India. In the district of Murshidabad too the brick kiln industry has been offered employment to approximately 60 thousand (BFOA 2015-16) landless labourers for a period of five to six months in a year. Yet, the exact number of employees in this sector is unknown. None of the agencies have accurate information about the number of people involved in the brick industry because, this sector is still considered as unorganized and informal sector of the economy. In addition to this, the per capita consumption of the brick and tile in India is 0.12 tonnes (FAO 1993) as well as per capita consumption of the bricks in India is about 250 pieces (Heilrili and Maithel 2008). Therefore, it is very important to understand the status of the brick manufacturing units and its position within the framework of the industry. Here are the few important facts about the brick kiln industry.

i) The brick industry is the third largest consumer of fossil fuel, mainly coal (Maithel, S., Uma, R., Kumar, A., Vasudevan, N. 1999).

ii) The brick industry consumes 15 – 20 million tonnes of coal per year (Maithel, S., Uma, R., Kumar, A., Vasudevan, N 1999).

iii) The brick industry has provided employment about to 30 lakh unskilled landless labourers in the country (Prayas 2004).

Can we consider the brick kiln an "industry" from the above facts. The general definition of industry is an enterprise which is involved in rising, producing, processing or manufacturing of the product. According to the Department of Commerce and Industry (Model I - Introduction to Business), the term industry refers to those business activities which are concerned with;

i) pre-production

ii) Processing and converting raw materials into finished products.

Thus, the activities of human beings engaged in the extraction, production, processing, construction, and fabrication of goods comes under the domain of industrial arena.

In another sense, industry means a group of factories usually specializing in a particular product line (e.g. all those factories which produce cotton textile together constitute Cotton Textile Industry; all the cement factories together constitute Cement Industry). From this above definition of the industry, it can be safely stated that brick manufacturing units is not a simple production unit but an industry. Numerous scholars across the country have used the term "Industry" to identify the brick producing units in their writings. Among the notable scholars;

i) Grewal & Kuhad (2002) in their work on soil desurfacing impact on productivity and its management have used the term industry to identify the brick industry.

ii) USAID (2003) in its report on brick and tiles – entitle "brick and tile production: resource efficient and cleaner production briefing and resource guide for the micro & small enterprise" has used the word industry to denote the status of brick kiln.

iii) Yadav (2003) also used the term industry to specify brick kiln as an industry in his work entitled – "remote sensing based management of degraded soil due to the brick industry for sustainable development: a case study"

iv) Iqbal (2006) in his study on bonded labourers in Pakistan has used the term industry to specify the status of the brick kilns.

v) In addition, Gupta and Narayan (2010) in their study on brick kiln entitled – "brick kiln industry in long term impacts on biomass and diversity, structure of plant communities" has used the term industry to assign the brick production unit.

Thus, we can safely say that the brick manufacturing unit is an industry. But again an important question arises about its nature; whether the brick manufacturing industry comes under the organized or unorganized sectors?

According to the Annual Survey of Industries (ASI) it covers all industrial units (called factories) registered under the Sections 2 (m) (I) and 2 (m) (II) of the Factories Act, 1948. In addition to the sections 2(m) (i) and 2 (m) (II) of the Factories Act, 1948, *bidi* and cigar units employing 10 or more workers with power and 20 or more workers without power, and registered under the Bidi and Cigar Workers (Conditions of Employment) Act, 1966 are also covered in the ASI as organized industry.

According to the National Commission for Enterprises in the Unorganised Sectors (NCEUS; 2010) definition, 'organized' and 'unorganized' sector of industry can be classified on the basis of various factors including enterprise type, the number of workers and social benefits. NCEUS includes all the enterprises under the domain of the Government/public sector, public/private Ltd. Company, cooperatives, trusts, etc. as organized. The enterprise type is organized entails a partnership with members of the same household or members of different households; and employer's households coupled with the number of workers, which should be 10 or more. If the enterprise type is not known (missing or other than mentioned above) and employs 10 or more workers considered as organized. When both the organized type and number of workers are not known but enterprise provides social benefit to its worker, then

considered as organized. The remaining sectors considered as unorganized (Meherotra, Gandhi, and Sahoo 2012).

The National Accounts Statistics (2012) compiled by the Central Statistical Organization (CSO), have categorized all the sectors as registered and unregistered. The National Accounts Statistics (NAS) have considered all the public sector units as organized while private sector enterprises which are registered under some Act, for example, the Factories Act, Sales Tax Act or the State's Shops and Establishment Act are also considered as organized.

From the above discussion, it is very clear that the brick manufacturing unit qualify the status of an organized sector of industry if we exclude the phase of 'social benefits to the workers'. But still, there is a debate about the status of brick manufacturing units. If we compare the brick manufacturing units with other small and micro units which are considered as an industry, then it will be clearer to us about the question of the status of the brick industry. For example, sugar industry, where few people are involved with a small amount of machinery. It also functions for a few months (one - two) in a year, but it comes under the purview of industry. On the same line, the brick kiln industry also qualifies the status of an industry because; the brick industry employs about 100 workers for a period of four to five months a year.

In terms of fuel consumption, brick industry is the third largest sector in India after thermal power plant and iron steel industry (Maithel, S., Uma, R., Kumar, A., Vasudevan, N 1999). If we have taken the application of machinery as criteria to qualify the brick manufacturing units as industries then we have to accept that today's brick industry is far from its traditional method of production process. The majority of the brick manufacturing industries have moulding machines to improve the quality of bricks. In addition to this, almost every industry uses improved fuel efficient kilns to

maximize the production and minimize the fuel (coal) consumption. Therefore, after going through the above discussion, it is very clear to us that the brick kilns/ brick production unit is an organized sector of Industry.

Chapter summary and Conclusion

From the above discussion it is shows that majority brick industries in Murshidabad district spread across the vast area of *Bagri* region of the district and exploits the agricultural top soil. The brick industries grew steadily during 1980-1990s. The new economic policy (1991-1992) brought rapid growth of urbanization and infrastructure development with other economic activities. The rapid growth of urbanisation and infrastructure development accelerates the demand for building materials including bricks. Therefore, the number of brick kiln industry flourished to fulfil the demands of bricks. In addition, the demands of brick also increased among the villagers due to the improvement of social – economic condition.

To catch this growing market hundreds of brick industries flourished in the district. The brick industry is owned by the lower middle-class businessman. These businessmen influence the local politicians to get the permission to establish brick industries. Two things motivate them to invest their money in the brick industry; i) it will help them to get an alternative source of earning as well as turn their black money into white. ii) They may escape from actual tax by manipulating the government official about the real production.

The highest concentration of the brick industries is found in the blocks like Berhampore, Domkal, Hariharpara, Jalangi, Raninagar, Beldanga, Lalgola, Murshidabad- Jiagang, Nawda etc. Among the study blocks, the maximum number of brick kiln industry is found in Berhampore followed by Domkal and Murshidabad-

Jiagang. The maximum number of unauthorized industry is also found in Berhampore followed by Domkal and Murshidabad-Jiagang.

The study shows that almost all the brick industry violates locational guidelines as well as functional guideline issued by the concern Government Authorities. The study also shows that about 18 percent brick industries located within 200 meters from the highway. Similarly, 7.04 percent brick industry located within 200 meters from the river bank. In addition, about 37 percent brick industries situated within 1.6 km from any mango gardens. The functional guideline mentioned that, brick industry should develop a multi layer green belt along the edges as well as it should, use at least 25 percent fly ash as substitute raw materials. But unfortunately, not a single brick industry follows these rules. Though the brick industry is an important sector of economy in the district and provides employment to about sixty thousand landless labourers.

The study shows that the brick kiln industry has fulfilled almost all the criteria to become an industry. But, the brick kiln industry is still considered a manufacturing unit rather than an industry. Further, the study also shows that the brick kiln industry follows certain pattern, layout and developed parallel to the road/highway along the periphery of the urban centres. Study further shows that the brick kiln fulfils almost all the criteria to become an industry mentioned by the different Government Department and Agencies. In this regard, considering brick kiln manufacturing an industry may helps to minimize adverse consequences by proper monitoring its function. But, Contempraliy, to be precise brick industry remains one of the most informal sectors is working in most formal way. However, the development of brick industries in the district has brought many changes in relation to small and marginal farmers, landless labourers, society as well as environment.

Before going to discuss about the changes brought by the industries in the study area we need to understand the role of different stakeholders at different stage of development of the brick industries in the study area. In the next chapter we will discuss about different agencies and their role in brick industrial development in the district of Murshidabad.

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Chapter – V

The Role of Agencies in the Development of the Brick Industries:

V.1 Introduction

As we discussed about the distribution of brick kiln industries in the district in previous chapter, here we are going to discuss about different agencies and their respective role in the development of brick industries in the study area. The brick industry is one of the most important and equally volatile sectors of informal economy in the district. It has provided around 60 thousand employments to the landless agricultural labourers as well as also benefited another few hundred small and marginal farmers of district of Murshidabad, West Bengal in the production year 2015-16 (Brick Field Owners Association[32]).

In addition, there are another few hundred people who are engaged in the brick trading, coal business, land and labour contract and transport facilities. Along with it, this is also a site of nexus among the contractors, local politicians, moneylenders, officials and politically motivated local armed groups who are involved in various kinds of money making activities.

The agencies or actors involved in brick industrial development in the district of Murshidabad can be grouped into two distinct categories:

i) Concerned government officials.

ii) Other stakeholders like politicians, local armed groups, labour contractors, land contractors, trucks and tractor owners, small businessmen, Builders etc.

[32] **Brick Field Owner Association-** It is a common platform of Owner of Brick Industry constitutes an organization for discussion the common issues related to the function of brick industries like labour daily wage, price of bricks, any legal issue which face by the industries etc.

The concerned Government officials belong to various levels starting from village Panchayat to District administration and mainly from the Department of Land and Land Reforms, Regional office of Pollution Control Board, Department of Environment, PWD and Department of Commerce etc. Therefore, it is important to understand the area of jurisdiction to find out their role in the process of development of the brick industry in the district. Following are the important government authorities who play crucial role in the regulation, supervision and functioning of brick industry in the district of Murshidabad.

V.2 Gram Panchayat and the development of Brick Industries:

The process of establishing a brick industry starts from the Gram Panchayat. West Bengal has got three tiers Panchayat system. The *Gram Panchayat*[33] is the main and prime government agency/establishment in the rural villages of India. It has the authority to issue consent certificate to any small and household enterprises at the village level to promote the village economy. The higher authorities also prefer to contact the Panchayat to cross-check the various claims and concerns of the people and enterprises. The owners have to first get the clearance from the Gram Panchayat to establish any enterprise which comes under its administrative jurisdiction. The Gram Panchayat issues 'No Objection Certificate' to the owner if it feels satisfied with the application and allows the owner to identify the land in the village to establish the industry. The owner has to get another 'No Objection Certificate (NOC)' from the farmers whose lands are located around/surrounded the proposed industrial site ensuring them that their land would not be affected by it. This study shows that the Gram Panchayat has always been very helpful to the owners and they cooperate with them to identify the suitable areas for establishing the brick kiln industry.

[33] Gram Panchyat- It is a local self Governing Body/Organization at the village consists of several Census Villages Administrated by the Village Council Head.

As a local authority, the Panchayat has the records of each and every detail about land, and other resources under its jurisdiction. In addition to it, local politics also plays very important role in the villages. The powerful owners influence the local politics and play very significant roles in the elections. Their involvement in the local politics makes them closer to the Panchayat which help them to get necessary support from it. Therefore, the Panchayat always tries to manage a cordial relation/goodwill with these owners.

V.3 Department of Land & Land Reforms, Government of West Bengal

The primary responsibility of the Department of Land and Land Reforms (DL&LR) is to monitor the functioning of the brick industry. The Department has been authorised to issue permit, to identify the location of the industry and to monitor its status. The District Land & Land Reforms Officer (DL&LRO) is the Ex – Officio Environmental Officer (EOEO) within their respective jurisdictions. This official has been authorised to grant the permission for the establishment of brick industries[34]. The field investigation shows that majority of the brick kiln industries in the study areas do not have proper documents. Therefore, it is significant to raise the issue of running of numerous brick kiln industries which are operating across the district without proper documents. In addition to this, the majority of the brick industries in the district are established on the agricultural land. But the locational guidelines issued by the Land and Land Reform Department, Government of West Bengal clearly prohibit the use of agricultural land for the purpose of brick kiln industries[35]. It is also possible that the

[34] (1250- M&M/LR/A-II/M&M-26/2010). The EOEO also works on behalf of the State (West Bengal) Pollution Control Board (WBPCB)

[35] mentioned that 'if the land is restored for the agricultural purposes or the land is recorded as the agricultural /orchard/forest land, whether it is situated within the Jurisdiction of the municipality or Panchayat, the brick industrial operation shall not be considered for regularization (1250- M&M/LR/A-II/M&M-26/2010).

Land Reforms Officer bends the rules or be more flexible to support the development of the brick industry in the district. In addition, the absence of proper monitoring system at the brick industrial site may help the owners to manipulating the departmental authority about the ground reality.

V.4 The Regional office of the West Bengal Pollution Control Board

Like Department of Land & Land Reforms, the State Pollution Control Board is another important Government Authority which is involved in brick industrial development in the district. The regional office has been assigned to receive, review and issue the Consent to Operate (CoO) certificate to the brick industries. They have to check and verify the trade license of the brick industries, validity of pollution cess challan, royalty cess receipt, land rent receipt which is being issued by the Department of Land and Land Reforms and the photographs of the working of the chimney and the pollution control system of the brick industries in order to grant permission.

But during our fieldwork, we found that only 22 out of 672 brick industries have proper permission having the above mentioned required documents from the West Bengal Pollution Control Board[36]. The violations of the prescribed rules and procedures by the brick industries indicate the failure of the government machinery to implement the laws properly. But, the officials argue that they support and promote the brick industries in the area and they are more flexible in the implementing of the laws in accommodating the needs of the practical requirements on the ground.

V.5 Department of Environment, Government of West Bengal

Similarly, the Department of Environment (Government of West Bengal) is another important agency which has the authority to issue the Environmental Impact clearance

[36] Consent –to – Operate (Office of the SRO District Murshidabad, Government of West Bengal dated 14/01/2016, WBPCB.

certificate to the brick industries in the district. The District Environment Authority (DEA) on behalf of the State Environment Impact Assessment Authority (SEIAA) performs the task of Environmental Impact Assessment (EIA) of the brick industries on surrounding environment and issues the Environment clearance certificate[37].

After going through the rigorous Environmental Impact Assessment, the District Environment Department issues few regulatory measures to the brick industries to minimize the adverse impact of the brick industry on the environment. The locational as well as functional guidelines regarding the brick industries issued by the District Environment Authority (DEA) are as follows:

i) The brick kiln industry must be located 1.0 km away from the registered hospitals, schools, public buildings, religious places etc.

ii) The brick kiln industry must be located 5.0 km away from the sensitive areas such as zoo & wildlife sanctuaries, historical monuments, museums etc.

iii) The brick kiln industry must be located 200 meters away from the both sides of the railway track.

iv) The brick industry must be located at least 200 meters away from the state, national or district highway etc.

v) The brick industry must be located at least 200 meters away from the river banks, embankments etc.

vi) The brick industry should be located at least 1.6 km from the mango orchards, etc., with adequate pollution control and types of equipment as per regulations part – III of Central Pollution Control Board (CPCB).

[37] Office of the SRO, Government of West Bengal, Vide Notification No EN/202/3C-01/2013).

vii) The industry should be located at a safe distance from the inhabitation and it would ensure that no harm would be done from the functioning of the brick industry.

In addition, DEA is also authorised to issue the Operational Guidelines for the brick industry to minimize the environmental impacts. The operational Guidelines issued by the DEA on behalf of the State Environment Department and Ministry of Environment and Forests (MEF), Government of India are as follows;

i) The brick industry located within the radius 100 Km from any coal based power plant should use at least 25 percent fly ash as the raw materials of requirement (The Gazette of India: Fly Ash Utilization Rules 1999).

ii) The brick industry must be created multi layer Green belt of (10 meters wide) along the edge of industry or a 3 meters high wall shall be constructed on the sides where land is not available for the development of green belts to prevent the escapee dust emission.

iii) DEA also issued the guideline regarding the top soil quarrying to minimize the soil erosion. According to the DEA, straight cutting of earth should be avoided to minimize the damage of the surrounding agricultural land. The cutting should be made in the slope ratio of 1: 3 to avoid the solid erosion of the agricultural lands (Land and land reforms Department: West Bengal Land Reforms Rules, 1965 read with section 4C of the WBLR Act 1955; The Kolkata Gazette 2002).

The field investigation has revealed that there are numerous brick industries spreading across the district do not follow the above-mentioned rules and regulations issued by the District Environment Authority. These industries are still functioning in the

district by violating above mentioned environmental norms. In addition to it, we found that very few brick industries are following the above operational guidelines.

V.6 Department of State Irrigation, Roadways & Waterways/PWD

The Department of Irrigation and Waterways under the PWD[38] is another agency which is involved in the development of the brick industries in the district. It is responsible for monitoring the operational/functional impact of brick kiln industry on the public roads, bridges and culverts. The authority can stop the brick industries located close to the river embankment, canals, rivers, drainages or on its natural flows or if they violate the guidelines.

Thus, until/unless getting clearance from the above Department, it is impossible to establish any brick industries under their administrative area. But it is observed that numerous heavy vehicles have entered in the villages with heavy loads (especially coal trucks and brick export trucks) every day. In addition to this, it is also observed that numbers of trucks are engaged in sand collection from the river bed (Bhairab River near Islampur, Murshidabad).

As a result of it, the natural flow of the river is getting disturbed. The movements of these heavy loaded vehicles (Coal supply trucks, bricks truck, and soil transporting trucks) have numerous adverse impacts on the available public roads and culverts since these roads are not made for the movement of such heavy vehicles. The collection of sand from the river bed obviously affects the natural flow of the rivers and streams (Spakale 2011; Das 2014).

So from this evidence, it is very clear that the Department of Irrigation & Waterways either ignores these facts before giving clearance to extend it helps to the brick industries or it just only considers the interest of the brick industrial owners.

[38] PWD- The Public Work Department, A Government Body responsible for construction and Maintenance the Public Buildings, Roads, bridges, culverts, Irrigation Systems, Railways etc.

V.7 Trade License Issuing Authority

Trade Issuing Authority under the Department of Trade and Commerce is another important agency involved in the brick industries. They also issue trademark (TM) for marketing the products which is the legal permit for any commodity with a particular brand name. The Trade Licensing Authority on behalf of the Department of Trade and Commerce certifies the quality and standard of the bricks.

In this way, the trade licensing authority facilitates the brick industrial owners for marketing their respective brands and to send their product beyond the district as well as major towns and urban centres of the state.

Besides these above-noted Government authorities, there are numerous other agencies they play very important roles directly or indirectly by helping them in the growth and development of brick industries in the study area. There are other stakeholders who are directly involved in the process of development of the brick industries in the study area are as follows:

V.8 Role of the local Politician and Political Parties:

The brick industrial owners and the local politicians need each other to fulfil their interests. To establish the brick kiln industry, the brick industrial owners try to convince the politician about their reciprocal benefit from the brick industry. Since the owners need the permission from people residing next to the propose site for establishing their industry, they approach the local politician and ask them to popularize the benefits of the brick industry among the local people. In the villages, the local politician has their own influence among the masses.

They are capable of mobilizing the local mass in favour of the brick industry. They convince the farmers by telling them the monetary as well as other benefits they would get by leasing out their agricultural land. They have also popularized the idea

among the farmers that their agricultural land would remain productive even after being used by the industry and they can continue their agriculture practices on their land later on as well. Thus, local politicians try their best to convince the farmers as well as local masses by telling them the coming up of prosperity and development along with the establishment of brick industries in the village which will ultimately transform their economic status as well as the standard of living.

V.9 Local Armed groups and Brick Industries:

The role of the local armed groups is very important in the process of development of brick industries in the study area of Murshidabad. These groups are popularly known as '*Mastan*[39]*'* in the villages. They are mostly politically backed by the ruling political party. They work as a force to punish the people who raise any objection in establishing the brick industry in their village. During the campaign, those who oppose the projects are being identified by the politicians and the local leaders with the help of their local workers and later on informed to these *Mastans*.

These mastans visit them later on to warn them not to do so. Even if after their warning, they don't give up their resistance, they are being silenced by physical forces, very often by beating, torturing even family members as well. In certain cases, the outcomes of opposing the brick industry by the local farmers become very painful. Sometimes, the farmers are threatened with death by these *Mastans* if they don't give their signature on NOC.

To avoid these threats, the local farmers are (under forced) giving their signature on the 'No Objection Certificate' (NOC) which is necessary to get the clearance from the district authorities to establish the new brick kiln industry.

[39]Mastan-Mastans are local arms group backed by the political parties. These types of local arm groups are very visible in every part of West Bengal. They are working as pressure group on behalf of the politicians and political party.

V.10 Labour Contractors and Brick Industries:

The Labour contractors are another important agent involved in the brick industry. They play a role of mediator between the brick industrial owners and the labourers. These labour contractors are both from the villages of the labourers as well as from outside of the villages. Among the outside labour contractors, majority are from District of Birbhum, West Bengal and the states of Jharkhand and Uttar Pradesh. These labour contractors assure the brick industrial owners about the adequate supply of labourers at the beginning of the production season. These contractors have well-managed network and information about landless agricultural labourers. They visit the socio-economically poor villages during the agricultural lean season to find out the target groups (families) those are in the need of financial help.

During the financial stress of the landless labourers, these labour contractors come up with the money to help these poor landless labourers. In lieu of advance payment, these landless labourers and their families give verbal confirmation to the fellow labour contractor that they will work under him in the brick industry. Since the poor and helpless peoples get help from these labour contractors during the agriculturally lean season and facing financial stress; the landless labourers and their family consider them as a savior (Gupta 2003; Isabelle, Bhukuth, Augerndra, Parthsaasrathy & Subramanian 2007).

It is a continuous and cyclic process for these labourers. Every year these contractors visit the villages after the rainy season (monsoon season) with a certain period of interval and start advertising through the families those already benefit from these labour contractors during financial stress. Once the labourers and their families are trapped by these contractors, they are never able to get out of their work. In a cyclic order, they are forced to work under the same contractors for years. But it is very

difficult to establish these facts through the documents/evidence because all these are done verbally. Apart from this, it is also impossible to know the amounts of advance money paid by the contractors to these landless labourers or families.

The field work has revealed that the amount of advance paid by these contractors are both in the form of cash as well as brick. In case of migrant labourers it is always in cash. The amounts paid in advance are upto 10,000 or less than that. For the local labourers, these advance payments are both cash as well as bricks. Since the majority of these labourers are still living in *kachha* house or inadequate living space as compared to their family member; therefore, they prefer to take the bricks instead of money.

In case of the migrant labourers, the advance is always in the form of cash. The form of the advance in the context of migrant labourers includes the cost of transportation from their native districts or states to the brick industries, food expenditure (during Journey), and medicines for the children and women. All these expenditures account as an advance for the migrant labourers. The amount of advance paid by the labour contractors to these migrant labourers or families at their native place varied from person to person and family to family. It is determined on the basis of the type of works performed by the individuals or number of working people per family.

Thus, the role of labour contractors in the brick industry is very important. They secure the supply of the manual hard working labour force for the industry. They also assure the owners about the supply of capable, skilled, hard working, quality brick producer and trustworthy labour force.

Therefore the owner would be in a position to estimate the yearly output/profit at the beginning of the production season without taking any direct burden of labour on their

shoulder. In this way, the brick industrial owners make them free from the labour related issues and disturbance.

V.11 Land Contractors and Brick Industries:

The land or soil contractors (suppliers) are the other important agents involved in the brick industry. They also play their crucial role in the growth of brick industries. The land or soil contractors involve in the brick industries belongs to the small and petty business groups. These lands/soil contractors make sure the continuous supply of the topsoil (primary raw material of brick industries) throughout the production season. They are the people who anyhow motivate the farmers to lease out their land for top soil quarrying. Sometimes they use the tactic of the land levelling method.

It is found that the lands of the study area are depositional flood plain, part of great plain of India made by Ganga and its tributaries. Therefore, most of the agricultural land and their relative slope in the study area are little bit irregular in nature. This irregular slope of the existing land puts little bit obstruction for cultivation to the farmers. Therefore, these land contractors succeed to convincing the farmers whose land is at the higher level in which they face problem for irrigation than his immediate fellow farmers land.

They put forward two arguments, first the farmers will get a good amount of money in the form of royalty for top soil quarrying; second one is land will become more productive, free from top soil erosion as well as less effort would be required to irrigate their land. The question could come in our mind why the brick industrial owners are taking the help from these land contractors for top soil or top soil quarrying? Why not brick industrial owners make direct contact with these farmers for land? It is not so easy to answer these questions. But it is recorded from the field investigation and also informed by many people that, if the brick industry makes a

direct contract with the farmers for land, then it would become very easy for the Land & Land Reforms (L&LR) Department to find out and identify industry which uses this land for top soil. It also becomes very easy for the L & LR Department to estimate the amount of land used by that particular brick industry for soil quarrying as well as the amount of tax for utilizing top soil for that particular brick industry. Thus, it becomes very difficult for brick industrial owners to manipulate the L & LR Department Official from actual tax.

In addition, People are also informed that, if the brick industry personally conducts the top soil quarrying on any land, then it would remain responsible for making the land suitable for the agriculture. To keep away the brick industry from such responsibility and manipulate the amount of taxes brick industrial owners always prefer to buy the top soil (raw material) from the land contractors.

During our field visits, it is also noticed that land contractors always violates the environmental laws during top soil cutting. If this thing is done by any industry and anyone lodge a complaint against such brick industry; then the industry faces judicial punishment. To avoid such legal punishment from Government authorities, brick industry always encourages these Land contractors for supplying the top soil. In such way, Land contractors and brick industrial owners both are helping each other in the development the brick industry in the study area.

V.11.1 Mechanisms adopted by land Contractors to Encroach the Land:

The soil contractors on behalf of the industrial owners took lease agricultural land for top soil quarrying. It is very important to understand the mechanism used by the industrial owners to bring the agricultural land under them. The field study revealed that soil contractors have their own sympathizer/ agents in the villages. These agents are working on behalf of the soil contractors to identify the farmers going through the

financial stress or willing to lease out his land for top soil quarrying. After identifying the farmers who may be interested to lease out their land, the soil contractors try to convince the farmers by saying that he is going to pay a lump sum money for every foot top soil quarrying which not only helps him to come out of financial stress but also his land will remain in cultivable state. After convincing the farmers, the soil contractors deploy his men with clear instruction by saying that you must try to remove top soil beyond the contact/permissible limit as much as possible and I will manage the land owners (farmers) by paying extra money.

Here it is very important to note that after top soil quarrying, the quarrying land turns into the relatively low land as compared to his immediate neighbours farmer's plot. As a result of this, farmers owning land next to the quarrying land starts facing the problem of topsoil erosion, boundary destruction, etc. during heavy rain in the monsoon season. To overcome these problems neighbour farmers force to lease out their land for top soil quarrying and bring down land according to the level of land which is already use for top soil quarrying.

When immediate farmer's land is levelling down, then, next farmers started facing the same problems like top soil erosion and boundary destruction during heavy monsoonal rain. To protect his land from such problems (top soil erosion and boundary damage) he is compelled to lease out his land to brick industry for top soil quarrying. Hence the chain of destruction continues and engulfs every farmer within its limit.

The land boundary failure becomes a normal phenomenon in the study area, mainly at the time of heavy downpour. The failure of land boundary immediately hampers' the fertility of relatively high land by eroding the top fertile clay layer on the other hand these eroded materials dumped on the already quarried land. If that land (immediate

quarried land) is under cultivation it damage the standing crop of (top soil quarrying) land. The loss of standing crop due to dumping of eroded materials leads to the foundation of conflict among the farmers. In many places, the soil contractor uses the conflict as a tool to exploit the farmer to getting their agriculture land for top soil quarrying. The top soil quarrying not only down the areas 3- 4 feet deep as compared to existing altitude but also alters the area's natural slope by transforming the relatively high agricultural land into lowland.

The repetition of the same process is going on until or unless the entire agricultural tract (village's agricultural land) is levelled down by top soil quarrying or it is interrupted by the *bills* (small marsh), roads, ponds, bills, river, channels. Such mechanism is used in other areas to bring the agricultural land under brick industrial quarrying either taking advantage of the financial stress of farmers or conflicts among the farmers in the villages.

V.12 Truck and Tractor Owners and Brick Industries:

The role of local Truck and Tractor owners or transport agencies can't be ignored in the development of the brick industry in the study areas. The Truck and Tractor owners and brick industrial owners mutually cooperate with each other for their mutual benefits. During the conversation with Truck and Tractor owners, it is evident that they have a verbal agreement based on following points for the sake of their mutual benefits.

i) The Trucks and tractor owners assure the brick industrial owner that their trucks/tractors will fully engage/provide transport facility for a particular brick industry throughout the year.

ii) The Truck and tractor owners also agree to take their payments at the end of the production season.

iii) Owners also assure to the Track and Tractor owners that their Truck and Tractor will get full employment during the production season.

iv) The brick industry owners also agree that if any local trip will be available from their brick industry that is also offered to the same owner. If they are getting any local trip it will help them to generate addition Rs 400 per trip.

Thus, on the basis of the agreements, Truck and Tractor owners make sure about providing the transport facilities for a particular brick industry without taking any instant payment. Thus, the verbal agreement helps the brick industrial owners to reinvest in the transport related expenditure for production until the production season comes to an end. Besides these direct agencies, there are few more people/agencies played their respective roles in the process of development of the brick industries in the district of Murshidabad. Among them, Small brick businessman, Builders and Building promoters are important.

V.13 Small Businessman and Brick Industries:

Small businessmen like brick traders, coal suppliers are also involved in the brick industry. Brick businessmen are involved in trading with bricks. The brick businessman provides financial support to the brick industrial owners at the beginning when the brick industry is about to start for the production. In return, the brick traders get bricks at a relatively cheaper rate from such brick industry than the actual market price. In this way, the owners of the industry and businessman both get benefited. The Coal businessmen supply the coal to the brick industry without taking any payment at the beginning of the production season. It is evident that many coal suppliers are involved in one type of barter trade with the brick industry. In place of direct payment in the form of currency, they are preferred to the take bricks from the industry and sell it at the local market. In such a way, both of them run their business with cooperation.

V.14 Builders and Building Promoters and Brick Industries:

It is very difficult to establish the direct link between the brick industrial owners and building promoter at the ground. It is also very difficult task to linking them due to lack of any written documents either from the government or any other agencies. But the field study has shown that there are few builders and building promoter belonging to brick industrial owner's family or the relatives of the brick industrial owners. Therefore, it can be assumed that these builders and building promoters also somehow indirectly help the brick industry to flourish in the district of Murshidabad.

V.15 Owners of Brick Industries:

The people who own or have invested their money in brick industry were mostly involved in various types of businesses. It is very difficult to specify or identify the types of business in which the owners were involved in. During our field investigation, it was found that the majority of them were avoided or hesitated to disclose their previous occupation by simply replying their involvement in some kind of business.

In our further interactions when we wanted to know about them, they simply avoided. But some of the workers who did not want to be identified due to various security reasons informed that the majority of the present owners of the brick industry were involved in a small border trade. They also informed that the majority of owners were involved in the border trade activities in the Indo-Bangladesh border. A significant number of them were involved in the exchange of cattle and consumer goods. They used to bring these animals from the nearby state of Bihar and used to sell these animals in Bangladesh. Border trade was one of the important sources of earning of the present brick industrial owners. This border trade would help them to amass considerable profit.

However, with the changing situation along the international border and number of restrictions imposed by the law enforcing agencies on the cattle movement along the international boundary has affected significantly on the border trade. As a result, a considerable number of people have lost their source of livelihood. Therefore, these people were trying to shift their economic activities to find out new sources/ventures of income or desperately searching for a new sector to invest their capital.

The brick kiln industry has offered them such opportunity to invest their money. These jobless (border traders) people with the help of the other local small businessmen as partners have started their brick industry. Few of them simply just lend their money in the brick industry to get an alternative venture to invest their money. Subsequently, they become the owners of the brick industry.

In this way, the brick kiln industry has offered them an opportunity to invest their money and generate huge amounts of profit. It is easier to establish a brick kiln industry on lease land. The industry has also played an important role in converting their black money into white. As the money which is accumulated from the border trade is considered as black money, the owners of such money consider it wise to invest their money in the brick industry to escape from the tax payment or manipulating the exact amount of taxes.

Though, the brick industries are bound to pay some taxes to the government like land utilization tax, pollution tax, sales tax etc. However, the brick industrial owners make use of different loopholes of industrial laws, as their access to political power helps them to evade the taxes and violate the permit limit. It is also a risk-free business as the labourers are not organized and don't have any organized voices even if they are being exploited. At the same time, in a few cases, labourers also show their loyalty to the brick industrial owners for getting certain help during an agriculturally lean season

or financial stress. When they have no work and no means for survival, these brick industrial owners come to help these poor villagers. During such financial stress, the owners (through labour and soil contactors) appear to be benevolent to these small farmers and landless labourers, as they get the advance from such owners during the crisis. In this way both the labourers and the small farmers are getting tied up to the owners.

V.15.1 Socio- Economic Status of the Owners:

The study has shown that the religious composition of the brick kiln industry is quite interesting. The majority of the brick kiln industrial owners belong to the Muslim community. The share or representation of the Muslim in production and control other than the brick industry is very less according to their proportion. Though the study blocks are having predominantly Muslim population and the majority of them lived in the rural area. The figure V.1 shows that about 63 percent brick kiln owners are Muslim. The remaining 37 percent owners are Hindu by religion.

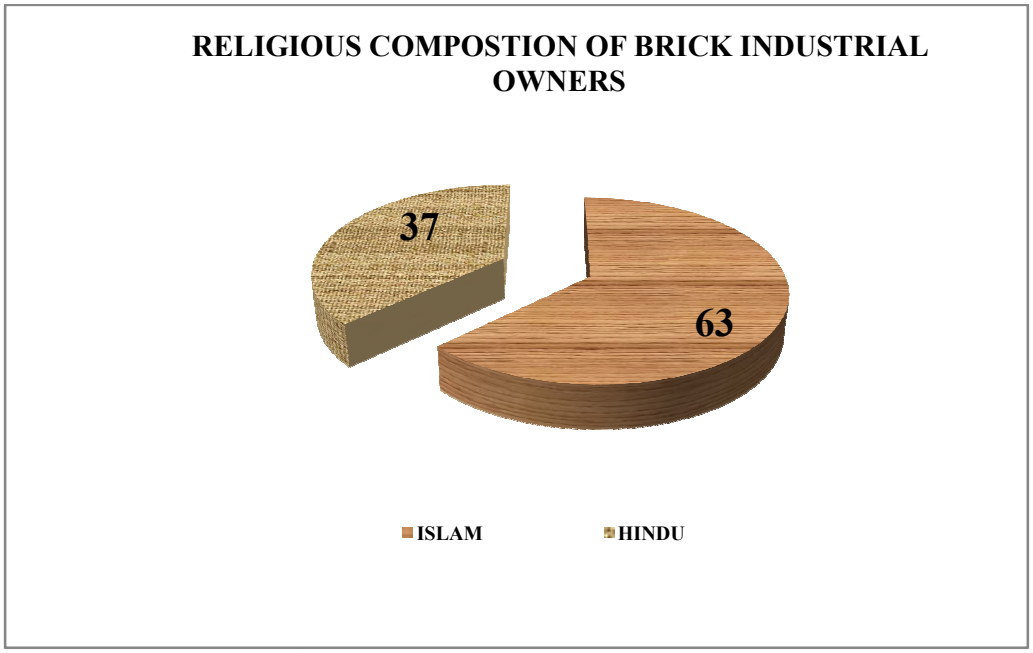


Figure V.1 *Religious Composition of the Brick kiln Industrial Owners*

V.15.2 Previous Occupation of the Owners:

Previous occupations of the brick kiln owners were very much diverse in nature. The main occupation of the present brick industrial owners was the business like border trade, agricultural Crops stocker, renowned politician, school teacher, Ex-Army personnel, brick and tile, wood, coal, transport businessman, land brokers and road contractors. The majority (40.7 percent) of the present brick kiln owners specifies their previous occupation as a businessman. Similarly, 11.1 percent owners' previous occupation was agricultural crops stock business. In addition, about 7.4 percent owners were school teachers and another 7.4 percent are not agreed to specify their previous occupation. Besides these Businessman, agricultural Crops stocker and teachers; Ex-Army personnel, Ex-Renowned Politicians, the bricks businessman, Tile businessman, Coal businessman, Wood businessman, Transport businessman, Road contractor and Land broker are the present brick industrial owners (Table V.1).

Table V.1 Previous Occupation of the study Owners

PREVIOUS OCCUPATION	NUMBER	PERCENTAGE
Teacher	1	3.7
Brick Businessman	1	3.7
Businessman	11	40.7
Coal Businessman	1	3.7
Ex -Amry	1	3.7
Land Broker	1	3.7
Not Specified	2	7.4
Politician	1	3.7
Road Contractor	1	3.7
Stock Businessman (Jute And Other Crops)	3	11.1
Retired Teacher	2	7.4
Tile Businessman	1	3.7
Transport Businessman	1	3.7
Wood Businessman	1	3.7
TOTAL	27	100.0

Source: *Field work 2016*

V.15.3 Ownership Status of Brick Industries:

The brick industry needs quite a good amount of capital at the beginning, therefore, it is very difficult for a rural middle-class business to own and run a whole brick kiln industry. Only a few people own an industry alone those have adequate capital as well as own family man power. Thus the majority of the industry is owned by two or multiple owners. The study has shown that about one third (29.60 percent) industries are owned by a single owner. Similarly, about half (48.10 percent) industries are owned by two owners. In addition, approximately one fourth (22.10 percent) industries are owned by the multiple owners (Figure V.2).

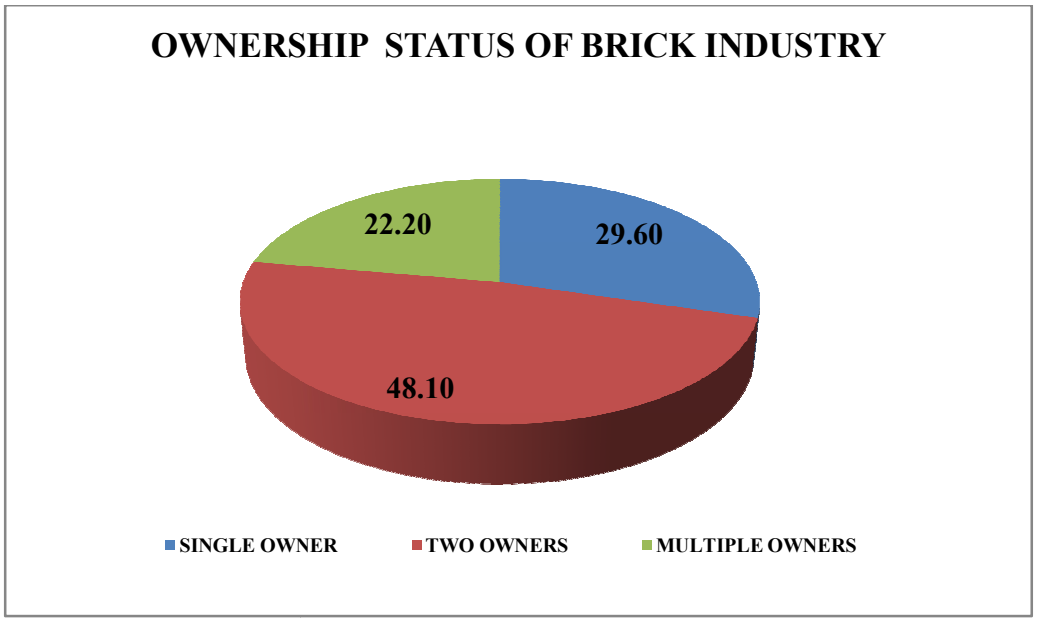
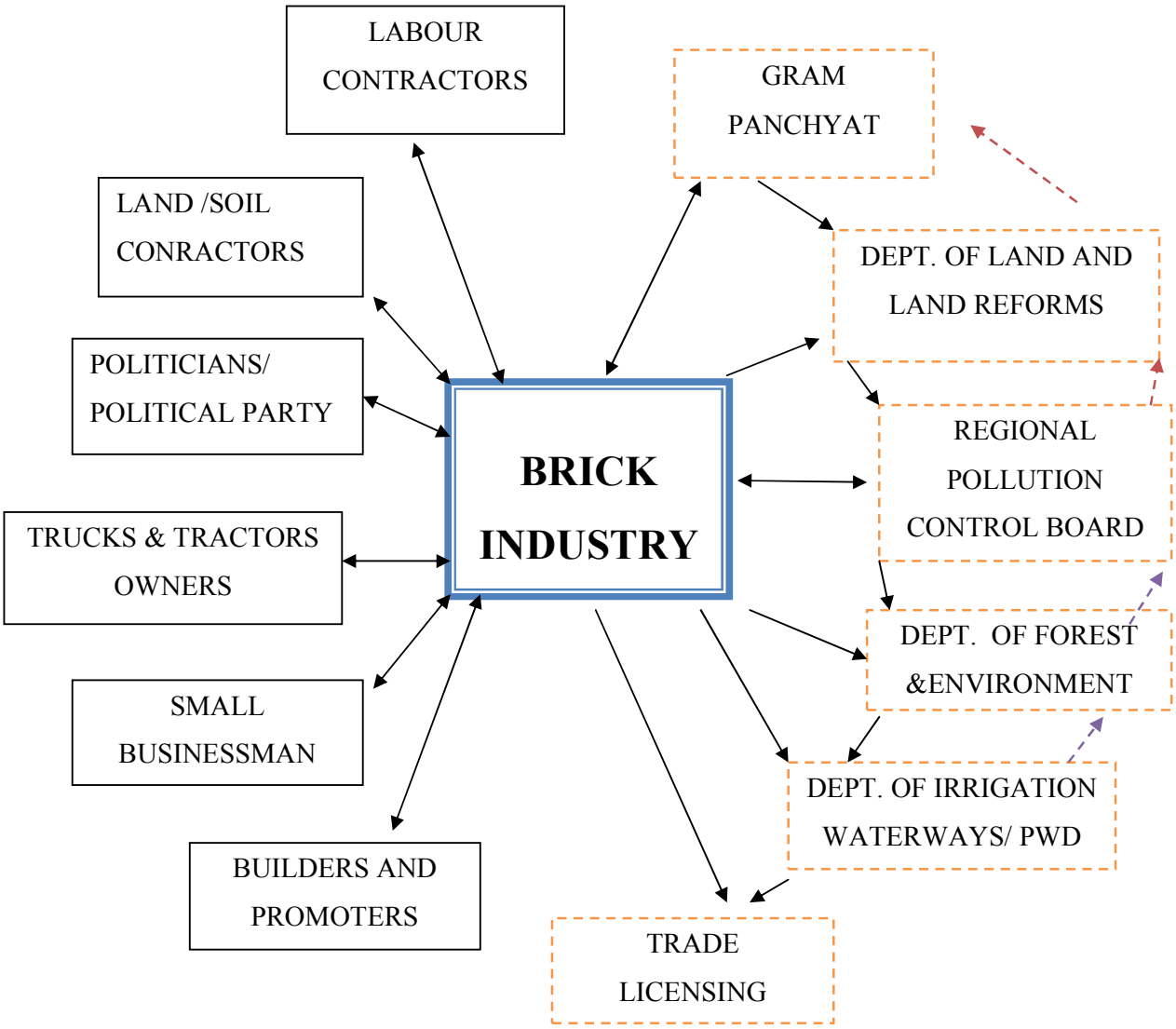


Figure V.2 *Shows share and the number of owners per Brick Industry*

Findings and Discussion

From the above discussion with the valid classified documents provided by the Government authorities (Office of the SRO and DL& DLRO; Berhampore, Murshidabad) as well as data collected from the field investigation, it can be safely stated that each and every agency has played their critical role in brick industries and its development. If we present it in a flow chart it would be clearer to us.



Shows the Owners Approaches to different Govt. agencies

Shows the Approaches of Owners to Other agencies

Shows the channel of Govt. official and their helps towards Brick industry

To establish brick industry, owners start his journey from Gram Panchayat to Land and Land Reforms Department. After getting clearance from the Land Reform Department owner reach to Pollution Control Board; after getting clearance from it they reach to Department of Environment and PWD and Trade Licensing Authority to gets environmental clearance and to produce and sell brick under his own Brand

name. Mean while others stakeholders like local politicians, Labour contractors, Land contractors, Trucks and Tractors Owners, Small Businessman, pressure group (*Mastan*) have played their crucial respective role in the development of brick industry in the study area. In addition, each of them also tries to find out their personal source of income either directly or indirectly by involving them in the brick industry.

The Government authorities have tried their best to extend their support to the brick industrial owners by ignoring the important facts related to agricultural land use, land conservation and environmental protection. So we can assume that either Government official simply ignore the interest of the larger section of the society or very much reluctant to protect the interest of brick industrial owners or unable to take any action against the violators. Thus, elite nexus dominate the whole process.

Further, these political influential brick industrial owners may influence the government authorities, to make the rules flexible at ground in respect of brick industries. Thus it is all about corrupt political culture of the state where financially influential people are able to manage the policy implementing authority at ground in favour of them. The owners of the brick industries wisely exploit the corrupt system to run their industries without obeying the rules and regulation. They are also able to manage a network to take advantage of the financially stressful small and marginal farmers to exploit their land with the help of land contractors. These all factors create an environment of socio - economic oppression.

Further, the supply of cheap landless labourers by the labour contractors added additional advantage to these owners to make the use of them in exploitative production process. The absence of any form of union with regard to these labourers further expands the scope of production and reproduction by exploiting the labourers.

In addition to these government agencies, a considerable number of private agencies

or stakeholders like the small, petty businessman, soil (land) and labour contractors as well as trucks and tractors owners played their respective role in the development of the brick industry in the district of Murshidabad. Further, the sympathy of the regulating official, larger market economic interest, owners influence on the officials make the officials to ignore the interest of poor masses even their means of livelihood are getting exploited by the brick industrial owners.

Association of the owners with the ruling political party and active donor of ruling party allow the owners to ignore many functional issues regarding brick industry. In addition to it, making soft target to the people who are really concerned about people and environment by the brick industries prevents them to act against the industry. The continuous surveillance on researchers and other people those are working on different aspects of brick industry prevent them (researchers) to get desire information. If anyhow they are managing to get the desired information, the Brick Field Owners Association request them (researchers) not to use harsh language or not to write harsh reality of brick industries. On the other hand, they are trying to convincing the researcher to work on the positive side of the brick industry and allow him/her space to become part of that nexus.

Therefore, the result of mutual support and co–operation helps in rapid development of brick industry in the district of Murshidabad. The development of brick industries have brought many changes in the study area in respect of landless labourers, small and marginal farmers, agricultural practices, society and environment.

In the next chapter we will discuss about the role of brick kiln industries in the life of rural landless labourers and society as whole in the study area. In addition to it the chapter we will also discuss about overall changes observed in the study area due to brick industrial development.

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Chapter VI

Socio- Economic Contribution of Brick Industries

VI.I Introduction

As we have already discussed about the development and functional mechanism and agencies involved in brick industries in Chapter IV &V in Murshidabad; here we are going to discuss about the workers of brick industries as well as the contribution of brick industries in changing socio- economic status of these workers. It has been observed that the majority of brick industrial labourers consist of landless, marginal, unskilled, poor coming from downtrodden section of the society. Majority of them are net buyers of food stuff in exchange of their labour. A significant section among these people depends on daily wage for their income (agriculture, agro-allied sectors).

But, the scenario has been getting changed after the brick industry came into existence in the villages of the district of Murshidabad. Brick industries not only absorb the surplus rural landless labour force of the villages but also create a sufficient number of employments for these landless labourers.

These labourers are recruited in brick industries through the labour contractors for a period of 5- 6 months for production. Inside the brick industries they are working under a person called "*Mohara*[40]". He is responsible for supervising the workers working under him. Brick industries offer number of working option to its labourers according to their skill and capacity. Moreover, the average daily wages is relatively higher in brick industries as compare to agriculture and allied sectors. In addition to this, industries also have employed migrant labourers coming from the nearby district like Birbhum as well as states like Jharkhand, Bihar and Eastern Uttar Pradesh.

[40] Mohara- Person who supervises the worker during working in Brick Industry called Mohara.

Therefore, in this chapter of the study we would try to evaluate the contribution of brick industries in changing socio- economic status of this landless village poor. In addition to this, we are also exploring the shifts of economic activities among these landless labourers. Furthermore, this chapter also tries understanding the contribution brick industries in the life of small and marginal farmers those who leased out their land to brick industry.

VI.I.1 Labour process and labour market in the Brick Industries:

The season of works in brick industries depends on the weather condition of the area and mostly falls from late October to April. The workers are recruited through labour contractors of the brick kiln industrial owners. The form of recruitment is mostly accompanied by advance payment to the workers for a specified period of five to six months. In case of local labourers the advance is both money and bricks. On the other hand advance for migrant labourers always in cash. Due to the advance payment, the entire family, comprising husband, wife and children (it is very much visible in case of migrant labourers) is working as a unit until the operating season is getting over.

But the role of woman and children remains uncounted in the process of production and their contribution to the process of development does not account within the economy.

Various studies in other part of the country are also revealed the similar results regarding the role of women workers in brick industry (Gulati 1975; Gupta 2003). These women and children work as a supplementary to other labourers. The children of the family have included the younger brothers of the worker, workers own children, and orphan children (Gulati 1975; Gupta 2003; Plant 2004; Isabelle Bhukuth, Augerndra, Parthsaasrathy & Subramanian 2007, Das 2015; Majumdar 2015).

VI.I.2 Division of Labour and Production process:

The brick industry is an important sector of informal economy in the district of Murshidabad and provides employment opportunity to approximately 60,000 people (BFOA 2015-16). The workers inside the industries are divided into five to sixth categories according to their age, skills and working capability.

The healthy and physically strong people are appointed for mud preparation and carrying/supplying to the brick makers. They are popularly known as *Pakmillworker,*[41] they reach their workplace at 2:30 A.M or before. They are daily wage labourers. The average wages of these labourers is Rs 290. To carry out their task the brick industry provides them basic equipments like spade, water pots, soil carrying baskets and mud carrying *Toli*[42].

The next category of the worker is brick makers. These brick makers are popularly called "*Pathre*[43]". The brick makers are most efficient and skilled workers in the industry. Owners always prefer to appoint most efficient and trustworthy person as brick makers to secure the best quality as well as to ensure sufficient and continuous production. If anyone is absent from their task then the entire production process gets affected. Almost all the *pathre* reaches their workplace at 3:00 A.M or before and work continuously till 9:30 A.M. After finishing their designated works they reach their home at 10- 11 A.M. Their wages are based on the number of bricks they produce per day. The present rate of making one thousand bricks is Rs 310. It is observed that an efficient brick maker is able to produce one thousand to one thousand five hundred bricks per day. To perform their task the industry provides one

[41] Pakmillworker- workers involved in preparation and supply the mud to the Brick Makers

[42] Toli- wood made one wheel (in the front) small mud carrying basket like pot push from back by one person to transport the mud from the pakmill to the field.

[43] Pathre- the Labourers involved in brick making are called as pathre by the local people.

forma[44], one water pot and one *dhanuk*[45]. Here it is very important to note that, if the newly made raw bricks get damaged before drying or while storing due to rain then the payments would not be made. Therefore, the risk of damage is entirely carried out by the brick maker not the owners. In this way, the owner tries to avoid the risk of economic loss by putting the risk of damage on the brick makers.

The next category of workers involved in the brick industry is the brick transporters. Their job is to carry the dry (green) brick from the field to the firing point (kiln) for baking and from the kilns to the selling/store point after baking. The brick transporters are comprised of workers of all age groups ranging from children, adults, boys & girls, middle age to old age. The children, adults, boys and girls transport bricks on their head whereas middle and old age people use the *Toli*[46] van to carry the bricks. Here it is important to note that their duty is divided into two shifts; the morning shift and the evening shift.

In the morning shift, they (brick transporters) are engaged in carrying baked brick from the kiln to selling lots/store. The morning shift starts at 6:00 A.M and continues till 9:00 A.M. The evening shift starts at 2:30 P.M and continues till 5:30 P.M. In the evening shift, they (transporters) are engaged in carrying raw bricks from the field to the kiln. The payment system for the transporter is also based on the number. The present rate of transporting one thousand bricks is Rs 140 (average). But the rate of transporting the same number of bricks by Toli van is Rs 130. The payments are made at the weekend. The next category of workers of the industry is *Mistry* and *Rubbishmen*. The duty of the *Mistry* is to set the raw bricks into the kiln. It is very important to note that the level of fuel consumption and the quality brick produced is

[44] Forma – The Dice use to shaping the Bricks known as Forma
[45] Dhanuk- It is use to cut the mud during shaping
[46] Toli- It is especially design with one wheel and two handle for carrying mud and bricks.

based on the expertise of the *Mistry*. Therefore, they are the most demanded and respected people in the industry. The duty of *Rubbishmen* is to plaster/cover the surface of the kiln after loading the green/unbaked brick in the kiln with sand, mud and rubbish and also to remove the sand, mud and rubbish after firing/baking the bricks. In addition to this, the rubbishmen also has another important responsibility that is to plaster each and every point which leaks the air. Normally, the *Rubbishmen* is working under the supervision of the Mistry. The Rubbishmen are daily wage labourer whereas the Mistry is a salaried worker. The daily wage of Rubbishmen is Rs. 250 per/day whereas the monthly salary of the Mistry is Rs 8000- 9000.

The last category of the brick industrial worker is fireman. The fireman is responsible for firing the raw bricks in the kiln. On an average six firemen are working in a brick kiln industry. The whole kiln is divided into a number of sections or parts. Therefore, to complete the baking/firing of one section/part requires 16 – 20 hours continuous firing. The duration of firing mainly depends on the dryness of the bricks. Firemen are working round the clock. The whole baking time is divided into three shifts and each shift is 6 -7 hours long.

Two firemen are responsible for completing one shift. Here it is very important to note that the majority of these firemen are migrant laborers. They come from nearby districts like Birbhum and states like Jharkhand, Bihar and Eastern Uttar Pradesh. These firemen are recruited through labour contractors for a period of 6 months or till the end of the production season, whichever is earlier. These firemen live within the premises of the brick industry.

The owner provides them very basic life supporting facilities like a tiny house made of bricks for the six firemen, Tubewell for water, small unhygienic toilets, and coal for cooking and electricity for lighting. These firemen are also salaried labourers.

Their average monthly salary is Rs. 8000 - 9000 and it is fixed for six months/season. Therefore the production system in the brick industry is totally based on the division of Labour. The entire process of production is about co-operation and coordination among the labourers. It is very interesting to note that though the different categories of workers performed their tasks in different period/sections of the industry, their methods of recruitment and the way of payment are similar except in the case of brick carriers. All of them get a portion of their income at the weekend and the remaining payment made after the sixth months or at the end of the production season.

The question arises here, as to why this kind of payment system? The answer to this question is not so easy. The continuous observation reveals the secret of this type of payment. This type of payment is developed to keep control over these workers. Despite this, the advance payment would also help the owners to maintain their influence or control over the labourers.

Thus, the production system in the brick industry is totally based on the division of labour and control. Once the workers start working in a particular industry, he is bound to work for six months/whole season. If anyone quits from the work before completing the season, his remaining balance is immediately frozen.

Therefore, to avoid economic loss, workers prefer to work for the whole season once they join any brick industry. So, the entire production process in the brick industry is running under the concept of division of labour and control environment. The works of Plant (2004), Isabelle Bhukuth, Augerndra, Parthsaasrathy & Subramanian (2007), Majumdar (2015) have demonstrated similar pattern of labour market in relation to the brick industry in other parts of the country. Their study also noted that advance payment and relatively higher wage force the labourers to work in brick industry as labourers (Majumder 2015).

VI.I.3 Social and Religious Background of Labourers:

We all know that the brick industries is one of the hazardous industries, therefore, normally people preferred to stay away from this type of hazardous works. Since the landless labourers do not have any other source of livelihood immediate to their hand during the agriculturally lean period therefore they are suppose to work in brick industries to generate income.

The income from brick industries in the form of daily wages helps these labourers to run their livelihood. Brick industrial workers constitutes of all religious as well as social groups. The study (Table VI.1) shows majority of these workers belong to Islam (62.6 percent) followed by Hindu (23.0 percent) and nature worshipers (14.4 percent).

This study further shows that (Table VI.2) brick industry workers belong to almost every caste groups. About 35.2 percent of the brick industrial workers belong to general category. About one third workers belong to (33.0 percent) O.B.C (Other Backward Community) category. In addition to it study shows that about one fifth (17.4 percent) workers belong to SC (Schedule Caste) category and remaining one seventh (14.4 percent) workers are ST (Schedule Tribe) category. Here it is important to note that the majority ST workers are migrant labour coming from adjoining district of Murshidabad and others states like Jharkhand, Southern Bihar and Eastern Uttar Pradesh. Almost all the ST workers involves in firemen and Brick Making activities.

Table VI.1 Religion Composition of the Respondents

Religion	Share in percentage
Islam	62.6
Hindu	23.0
Nature worshipers	14.4
Total	100.0

Source: *Field work 2016*

Table VI.2 Caste Composition of the Respondents

Caste group	Share in Percentage
General	35.2
O.B.C	33.0
SC	17.4
ST	14.4
Total	100.0

Source: *Field work 2016*

VI.I.4 Social Infrastructure at Labourers household:

Food, clothes, treatment, shelter are regarded as the basic needs for the sustenance of human beings. In addition to it sanitation, safe drinking water, electricity are also considered as important basic requirement to survive. The people works in brick industries are struggling to fulfill these requirement by working as daily labourers for major part (five to six months) of the year.

This study shows that very few brick industrial labourer have a Pucca house (6.7 percent). Majority of them is still lived in semi Pucca (60.0 percent) and in kachha (33.3) houses (Table VI.3). In addition to it about 30.0 percent brick industrial labourer household still doesn't have any sanitation facility. They are still using bush path or open fields to carry out the same. Study further reveals that about 51.5 percent respondent's have a traditional[47] sanitation facility at their household. The study further demonstrates that only 18.5 percent respondent's household have improved sanitation facility[48]. Similarly, study shows that, above two third respondents have own source (Tubewell) of

[47] Traditional- The sanitation facility developed by the Respondents themselves by digging the pit and polythene and others readily available materials use to make roof and wall.

[48] Improve Sanitation - The sanitation which is standardized by Government Authority and provided to the village through the Panchayat considered as improved sanitation facility

drinking water at their yard and above one third respondents depends upon PHE for fetching the drinking water. In addition to it quite significant percentage of respondents household has electricity connection (Table VI.4).

Study further illustrates that very significant number of labourers household has very basic consumer goods. Almost all the families have respondents having a bicycle (94.4 percent). Study further notes that about 22.2 percent respondents hold Radio set and about 84.1 percent respondents have a mobile set. Study further found that 41.5 percent respondents have T.V set (Table VI.5). The study further demonstrates that there are families who have multiple durable goods like bicycle, radio, mobile, T.V set, etc. (Table VI.7).

Table VI.3 House types among the labourers

House Type	Share in Percentage
Pucca house	6.7
Semi Pucca	60.0
Kachha	33.3
Total	100.0

Table VI.4 Basic amenities in the respondent's household

Items	Types	Share	Total
Sanitation	Traditional	51.5	100
	Improved	18.5	
	No sanitation	30.0	
Water Supply	PHE	35.1	100
	Tube Well	64.9	
Light	Electricity	81.9	100
	Kerosene	19.1	

Table VI. 5 Family has different type of goods in the house

Items	Yes	No	Total
Bicycle	94.4	5.6	100
Radio	22.2	77.8	100
Mobile	84.1	15.9	100
Television	41.5	58.5	100

Source: (*Table VI.3, VI.4, VI.5***)** *Field work 2016*

Table VI.6 Respondents household having multiple durable goods

Types of goods	Share in Percentage
Bicycle and mobile set	39.6
Bicycle, Mobile and T.V set	24.8
Bicycle, radio, mobile and T.V set	7.4
Bicycle, radio, mobile,	6.3
Bicycle, radio and T.V	4.4

Source: *Field work 2016*

VI. I.5 Access to the public facilities and amenities by the respondents:

The access to basic public facilities helps to understand the level of empowerment among masses and distributive justice of public facilities. To understand the nature of public facilities and access to these facilities by these labourers; availability of ICDS[49] centre, Water Supply, Primary School, Primary Health Centre and high School and its physical distances from their respective villages have been annalysed.

Study (Table VI.7) shows quite significant percentage (95.6) of respondent's village has ICDS centre, primary school (66.7 percent) and Pucca road facility (74.1 percent). In addition to it about one fifth (20.4 percent) respondents' villages have Primary Health Centre. On the other hand about two third respondents' villages do not have PHE for access to safe drinking water. Study further shows that four fifth respondents' villages do not have Primary Health Centre facility. Study further reveals that almost (97.8 percent) respondent's villages do not have high school facility.

[49] **ICDS**- The intrigated Child Development Services programme was launched in 1975 to provide preschool education, primary healthcare and food to the children less than 6 year of age and their mother. Later on, the programme was linked with Anganwadi in rural areas to provide preschool education, fighting malnutrition, ill health and gender inequality.

Table VI. 7 Respondents Having Access to Public Facilities and Amenities

Items	Yes
ICDS	95.6
PHE for Water supply	34.8
Primary School	66.7
Primary Health Centre	20.4
Pucca Road connection	74.1
High School	2.2

Source: *Field work 2016*

VI.I.6 Economic activity of the Respondents:

Brick industrial workers comprises of rural landless daily wage labourers. They depend upon daily wages for their livelihood. The economic activity and source of income of these respondents were mainly from agriculture and allied labour activities. The nature of employment in agriculture and allied activities mainly depend on cropping season. The duration of works in this sector varies from crop to crop as well as from season to season. The cropping season of the district can be broadly classified into summer, winter and monsoon. Rice and Jute are two main labour intensive crops cultivated in the district. They can be considered as cash crops also. The study area has witnessed two rice cropping seasons (summer and winter) in a year. During summer rice cropping season (April - September) respondents are getting approximately thirty days continuous employment (ten to fifteen days during plantation and remaining ten to fifteen days during harvest).

Further, during winter rice cultivation period (October- March) gets another thirty days continuous employment (fifteen days during plantation and remaining fifteen days during harvest). In addition to this, during jute harvesting (August- September) period these respondents (landless Agricultural labourers) get approximately twenty days continuous employment.

Therefore, respondents were getting about ninety to hundred day's employment in a year. Daily wage (present rate) is about one hundred fifty rupees. Therefore, during agricultural lean period these respondents use to migrate in other parts of the state in search of employment. The lack of skills compel them to works either daily casual labour or helper in construction sector. Some of them were doing their works at their destination till the new agricultural season suppose to start at their respective villages.

Field investigation shows that the respondents were getting on and average thirty days employment at their destination those were working in agricultural sectors. After the harvest season over, they got used to come back to their native village and waited for next season. The daily wage in agriculture sector at the destination is about two hundred rupees. The daily wages received for working other than agricultural sectors at their destination is approximately three hundred rupees per day.

VI.I.7 Shift in Economic Activities:

The sources of income for the poor landless rural villagers were either working as daily wage labourers in the agricultural sector or migrant labourer before brick kiln industry came into existence. But the brick industry had brought lot of changes in economic activity among these poor landless labourers. They are now engaged in industrial production processes and major part of their yearly income come from the brick industry as daily wage labour or salary rather than agriculture based production system. The economic activities of the respondents have gone through the significant changes after the brick industries come into existence in the study area. The study shows that these landless labourers were depended on agriculture based daily wage labour for their major part of yearly income. They were also incorporated through income from other sources like daily

wage labour from construction sector, daily wage labour from other places and from other daily causal activities. The study (Table VI.8) shows that about 33.3 percent respondents main source of income was agriculture based daily wages. In addition, about 37.03 percent respondent's main economic activity and source of income was daily wage from other than agriculture wage labour. Similarly about 26.3 percent respondent's main economic activity and sources of income was daily wage from different activities. Further about 3.3 percent respondent's main activity and source of income was daily wage from construction sector. But now major parts of income of these labourers are daily wage from brick industries. Therefore, significant shift in economic activities and income has been recorded among the respondents.

Table VI.8 Economic activities before join to Brick Industry

Type of Activities	Percentage
Daily agricultural wage labour	33.3
Daily wage labour working in other sectors.	37.03
Daily wage labour working in different activities	26.3
Daily wage labour working in construction sector	3.3
Total	100.0

Source: *Field work 2016*

VI.I.8 Share of brick industries in Annual Income

As we mentioned that the economic activities and sources of income of these landless labourers also comes from different sources and these sectors were constituted major part of their yearly income. These different sources were ranging from daily wage from agricultural labour, daily wage from other than agricultural sectors, daily wage labour from different activities and daily wage constriction sectors. But the earning pattern gets changed among these landless labourers after brick industries came into existence.

The major share of yearly income of these rural landless labourers are now coming from the brick industries either in the form of daily wages (*Pakmillers*, brick *Makers,* Transporters and *Rubbishmen*) or from the respective monthly salaries (*Mistry* and *Firemen*); as brick industries provides employment approximately six months (October – March) in a production season/year. The remaining period of the year these landless labourers earn from the different sectors of economic activities including daily wage from agricultural daily wage labour. Study (Table VI.9) shows that the total average income of *pakmiller's* from brick industry is about fifty thousand rupees per season and the income of remaining six months from other sectors is about twenty two thousand rupees. The share of brick industry in annual income of pakmillers is about 69.41 percent.

Similarly, average income of a *brick maker's* from brick industry is about above fifty four thousand rupees and the income of remaining six months from other sectors is approximately twenty three thousand rupees. Therefore, brick industry constitutes about seventy percent of brick maker annual income. In addition to it the average income of a *brick transporter* from brick industry is about twenty seven thousand rupees and the total average income of remaining six months from other sectors is approximately twenty five thousand rupees. Thus of income from brick industry for transporter is about fifty three percent.

Further study shows that the total average income of *Mistry* from brick industry is about fifty thousand rupees per season and the income of remaining six months from other sectors is about twenty four thousand rupees which about half of income generates from brick industry. Study also reveals that the average income of *Rubbishmen* and *firemen* from brick industry is about fourty five thousand and fifty two thousand rupees per

season respectively and the share of income from brick industry for rubbishmen and firemen is approximately sixty percent and seventy percent respectively (Table VI.9).

Table VI.9 Annual income of the respondents from all sources

Category Workers	Income from Brick Industry	Income from Other Sources	Annual Income from all sources	Share of Brick Industry	Share of other sources
Pakmill worker	50800	22388	73188	69.41	30.58
Brick Maker	54300	22745	77045	70.47	29.52
Transporters	27000	24375	51375	52.55	57.45
Mistry	50200	24240	74440	67.43	32.56
Rubbishmen	45000	30220	75220	59.82	40.17
Firemen	52,000	22,750	74750	69.56	30.43

Source: *Field work 2016*

VI.I.9 Household expenditure Pattern

Since, the majority of brick industrial workers are net buyers of foodstuff for major part of the year due to lack of access to cultivable agricultural land therefore, a significant portion of their income is spent on buying food stuff. Study shows that about 75.0 percent respondent's monthly income uses to buying the food and allied items. In addition to very little amount of their monthly spends to children education. The education expense includes admission fees, tuition fees, books, pen, pencil, bags, etc. study shows that there are many families unable to send their children to school due to economic crisis. Their children are working in shops, garbage picking etc. to support their family.

Study also shows that brick industrial workers suffer from many occupational health hazards and quite significant portion of their income goes into health issues (Singh 2002). Further, study demonstrates that, in order to fulfil the requirement of clothes for family members, respondents are bound to spend about ten percent of their monthly income. Further, study reveals that the respondents have others expanses to meet the expenditure of *Bidi,* gutka, pan masala etc. (Figure VI.1).

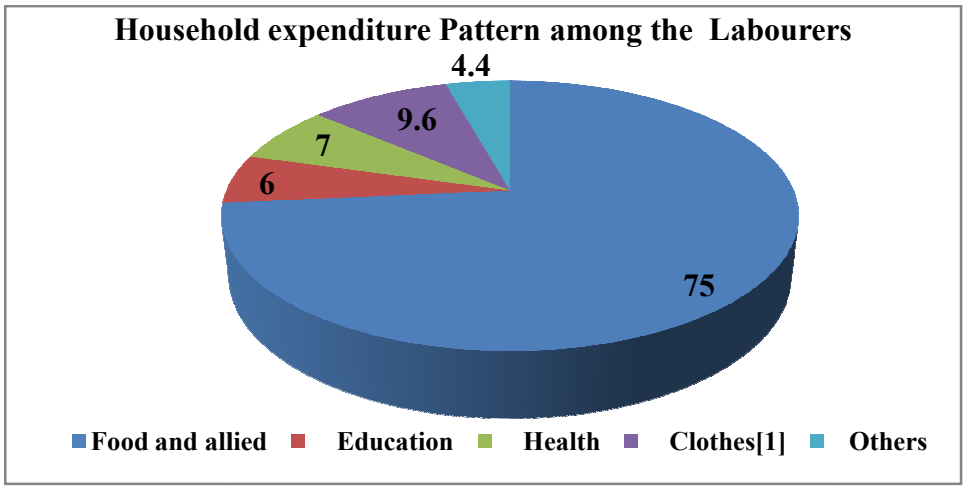

Figure VI.1 *Shows the Household Expenditure pattern among the Respondents.*

VI.I.10 Occupational Health Hazard among Respondents:

The brick industrial workers are performing their task in hazardous environment; with dust, smoke and heats. These dust, smoke and heat of kiln are the main causes of health hazards among the labourers (Singh& Asger 2002). The lack of awareness and basic health protective equipments push these workers into a more vulnerable situation. Majority of workers are exposed from number of common health problems like joint pain, wrist and waist pain, finger injury, etc (Manga, Singh and Bhardwaj 2012). Besides this, works specific health hazard is also very much pronounced among the workers.

The study shows about 60 percent respondents suffered from joint pain. In addition to it about 47 percent respondents suffers from finger pain/injury. Further, about 29.3 percent respondents experience severe headache. Similarly, about 75.5 percent respondents faced the problem of waist pain. Another 71.2 percent respondents suffers from the wrist pain and another 70.7 percent respondents suffer from suffocation. In addition, workers also suffered from eye irritation (25.6 percent), skin burn (4.1 percent) and chest/ heart pain (1.1 percent) (Table VI.10).

Table VI. 10 Health problem faced by the brick industrial workers

Health problems	Share in Percentage
Joint pain	60.0
Fingers Pain/Injury	47.0
Headache	29.3
Waist Pain	75.5
Wrist Pain	71.2
Suffocation	70.7
Eye Irritation	25.6
Skin Burnt	4.1
Chest/ Heart Pain	1.1

Source: *Field work 2016*

VI.I.11 Work Specific Health Problems among the labourers:

The brick industry one of the most hazardous sectors of the informal economy, therefore, the people involves in brick industries suffers from different types of health related issue. The health problems among the brick industrial workers are very much related to the task performed by them in the brick industries. The study (Table VI 11) shows that out of total fireman about 25.9 percent are suffering from the suffocation, eye irritation. Another 18.6 percent fireman is exposing from suffocation, eye irritation and headache. In addition, about 11.1 percent firemen are affected by the problem of suffocation, eye irritation, headache and heat stress. Further, 7.4 percent firemen exposes from finger pain, wrist and waist pain and headache. Similarly, 5.6 percent firemen suffers from suffocation, headache wrist and waist pain, finger injury and another 5.6 percent fireman exposes from headache, waist pain, finger injury.

Rubbishmen also suffers from different type of health issues related to their work. About 20.7 percent Rubbishmen are exposed from suffocation, joint and finger pain, headache, wrist and waist pain due to carrying, loading and unloading dust, rubbish and living near to kiln. It is further observed that another 13.8 percent Rubbishmen experiences joint and waist pain. In addition to it about 10.3 percent Rubbishmen have joints pain, finger injury, waist pain; 6.9 percent rubbishmen suffers from eye irritation. The Mistries engaged in stack the bricks inside the kiln for bake and unload the bricks after bake. The study shows that about 20 percent Mistries faces the problems like joint pain, finger pain and waist pain. Study further found that about 16.0 percent Mistries exposes from suffocation, eye irritation, headache, and wrist and waist pain due to their direct involvement inside the kiln. In addition to it around 12 percent Mistries shows that they

suffers from joint pain, finger pain, finger injury, headache, etc. and another 12 percent Mistries reported that they faced the problems like headache waist pain.

The brick makers mainly working on carrying, shaping and preparing the bricks, therefore, they are exposing from some specific type health problem related to mud moulding, mud carrying and shaping the bricks. The study shows that about 29.6 percent brick makers exposed from the joints pain waist pain. In addition to it 21 percent brick makers suffers from the joints pain, finger pain and wrist pain. Study further shows that about 12 percent brick makers experiences only waist pain. Similarly, 6.2 percent makers reported the problems of finger pain, wrist and waist pain and another 6.2 percent reported the problem like wrist pain, waist pain and headache, and only 3.7 percent maker's exposes from joint pain, waist and wrist pain, finger injury and headache.

Manual labour is employed in the brick industry to carry the bricks from the field to kiln for bake and after baking again it carries to the stock lot/store. They carry these bricks on their head. Therefore, the carrying of heavy head load is responsible for number adverse health effect. The study shows that about 22.2 percent brick carriers suffer from joint pain, finger pain and waist pain. Study further shows that another 13.6 percent carriers exposes from finger pain, wrist and waist pain, and another 13.6 percent suffers from joints and waist pain. In addition to it about 11.1 percent bricks transporters experience the problems like joints pain, finger pain, wrist and waist pain and headache.

Study further reveals that about 9.9 percent transporters suffers from headache, finger pain, wrist and waist pain, finger injury and 6.2 percent transporters exposes only from waist pain, and another 4.9 percent suffers from joint pain and headache, and 3.7 percent carriers experiences joints pain, finger injury, waist pain and eye irritation.

Table VI.11 Works related health problems among the brick industrial labourers

Occupational health problem * occupation Cross tabulation						
Health problems	Brick fireman	Rubbish men	Brick Mistry	Brick maker	Transporter	Total
Joints pain	.0	.0	.0	1.2	1.2	.7
Waist pain	.0	.0	.0	12.3	6.2	5.6
Joints pain, wrist pain, finger injury	.0	.0	12.0	3.7	6.2	4.1
Joints pain, wrist and waist and headache	.0	3.4	4.0	3.7	.0	1.9
Joints and waist pain	1.9	3.4	4.0	29.6	13.6	14.1
Finger pain, wrist and waist pain	3.7	6.9	.0	6.2	13.6	7.4
Headache, wrist and waist pain	3.7	.0	12.0	6.2	.0	3.7
Waist pain and suffocation	1.9	3.4	.0	1.2	3.7	2.2
Eye irritation	3.7	6.9	.0	.0	1.2	1.9
Joints pain, finger pain, wrist headache	.0	.0	.0	.0	2.5	.7
Joints pain, finger pain, waist pain	.0	10.3	20.0	21.0	22.2	15.9
Joints pain, headache, waist pain	.0	3.4	.0	10.6	4.9	4.4
Joints pain, waist pain,	.0	13.8	4.0	.0	.0	1.9
Finger pain, headache, wrist and waist pain	7.4	.0	4.0	.0	9.9	4.8
Joints pain, suffocation,	1.9	3.4	.0	.0	.0	.7
Joints pain, finger pain, headache, wrist and waist pain	.0	3.4	12.0	2.5	11.1	5.6
Joints pain, finger pain/injury, waist pain, suffocation	1.9	6.9	4.0	.0	.0	1.5
Joints pain, finger pain, waist pain, eye irritation	.0	.0	.0	.0	3.7	1.1
Suffocation, , eye irritation, skin burns	25.9	3.4	4.0	.0	.0	5.9
Suffocation, joints, fingers, wrist pain and headache	5.6	20.7	16.0	1.2	.0	5.2
Suffocation, eye irritation, skin burns, injury, headache	11.1	3.4	.0	.0	.0	2.6
Suffocation, , eye irritation, skin burnt and headache	18.5	.0	.0	.0	.0	3.7
Suffocation, finger injury, headache, waist pain	5.6	.0	4.0	.0	.0	2.2
Total	100.0	100.0	100.0	100.0	100.0	100

Source: *Field work 2016*

VI.2 BRICK INDUSTRY AND ITS MIGRANT LABOURERS

As we discussed in the earlier section of this chapter about the local labourers of brick industry; in continuation of that this section of the chapter mainly deals with the issue of migrant labourers; those are working in the brick industry in the study area. The study shows that the share of migrant labourers in the brick industries of the study blocks is very less. Therefore, to understand the condition of migrant labourers at the brick industries, their recruitment procedure, socio – economic background, income, expenditure was taken into account. In depth interview was conducted among the nine (three from each block) migrant labourers belonging to different socio-cultural groups as well as different parts/states of the country.

The study reveals that the task of the migrant labourers is confined within the brick firing and brick making. It may be due to relatively high daily wage and skills. One thing is common among all the migrant labourers that, they are recruited by middleman or labour contractors. The majority of them are recruited with the advance payment. They are recruited for a period of the sixth month. After getting recruited, they are supposed to travel with their contractors to the work place (study blocks) in advance before production gets started. In the industry, they are provided small tiny shed made of green bricks or baked bricks. The one room is allotted for 5-6 people. If the migrants have his family with them then, they are given one long room parted by the tin or plastic wall to accommodate several families.

In addition to it when these migrant family reach to the industry, they gets small quantity of rice and cooking fuel, small tiny unhygienic sanitation and tube wells for drinking water. The study has shown that the majority of these migrant labours working in the

brick industry in the district Murshidabad are coming from the state like Jharkhand, Bihar (especially south eastern Bihar) and Eastern Uttar Pradesh.

Box No. VI.2.1 Migrant fireman

Badruddin Sheikh a 50 years old brick fireman working in the Bharasa Brick Industry located at Keotala village, Berhampore, Murshidabad. He is from Azamgarh (U.P). He is recruited here by the person called Anwar Sheikh (name Changed). He has six members in his family including old mother. He is living in semi pucca house. He is the only bread earner in his family. His family does not have access to the sanitation facility at his home. But his house has tube well at yard and electricity connection. He belongs to the village which is lacked in basic facilities like ICDS centre, primary school and health Centre, safe water supply. His two daughter are studying in class eleventh and nine respectively. His earlier occupation was daily casual labour. Poverty, lack of working opportunity at native forces him to move in brick industry.

In the brick industry, he is living in a tiny pucca brick room with other sixth fellow firemen. The room is connected with electricity but lack ventilation. He has also provided fuel wood for cooking, small toilet shared with fellow fireman and water supply. His monthly salary is Rs. 8000. To carry out his weekly expenses owner gives him 600 rupees. In addition to it he gets additional two thousand rupees per month from his salary to send his family by his contractor. He is working with the lack of basic equipment like heat resistant shoe and clothes and musk. As results he is exposing from the number of health hazards like suffocation, heat stress, skin irritation and burn, weight loss, eye irritation etc. The significant part of his salary is expanding to treat him and meets the tuition fees for his daughters. He has reported that somehow he is trying to run his family.

Box No. VI.2.2 Migrant fireman

Hitesh Ram (Dalit: SC), 52 years old brick fireman working in the Shakti Brick Industry located at Village Rameshwarpur, Berhampore, Murshidabad. He is from Banaras (U.P). He is also recruited by labour contractor (unwilling to disclose the name). He has five members in his family. He lives in kachha house with lack of sanitation and water supply facility. His family member (mainly wife) fetches water from the road side tap. He is belonging to the village which is lacking in basic facilities like ICDS centre, primary school and health Centre etc. He and his younger son are bread earner in his family.

His earlier economic activity was loading and unloading of trucks coming from the cities. It was very irregular as well as his age do not permit him to carry out such works. To meet the family requirement and fulfil the basic needs compel him to join in brick industry as a fireman. In addition to it continuous sixth month's employment opportunity in brick industry also motivates him to join the brick industry.

In the brick industry, he is living in a tiny brick made room with other five fellow workers. The room is connected with electricity but the lack of ventilation. He has also provided fuel wood for cooking, small toilet shares with fellow fireman and water supply. His monthly salary is Rs. 8000. He is getting Rs. 500 per week from his salary to carry out his daily expenditure. Due to lack awareness and availability of protective equipments, he is also suffers from same type of health problems as other fellow firemen are faced. He has reported that he has a few thousand amounts of debts. Therefore significant part of his salary is going to repay interest of debts.

Box No. VI.2.3 Migrant fireman

Romesh Murmu (Santal: ST), 48 years old brick fireman working in the B. B. F Brick Industry located at Khordighi- Hikampore village, Berhampore, Murshidabad. He is from the Santal Parganas of Jharkhand. He is also recruited by the labour contractor, the person called himself as Subrata (Real Name). He has seven members in his family. He is living in kachha houses with lack of sanitation, safe water supply and electricity connection. His family member fetches water from Small River in summer and from wells in winter. He is belonging to the hilly village which is lacking in basic facilities like ICDS centre, primary school and health Centre pucca road connection. He does not hold any agricultural land. He and his younger son are bread earner in his family.

Earlier Mr. Murmu was working in construction sectors as helper in the city. The earning from this work was not sufficient to meet the family needs. The lack of working opportunities in native, poverty pushes him to come to the study area and join in brick industry. He has further reported that continuous working opportunity as well as works for other family members and other helps from his contractor has influenced him to join in brick industry.

In the brick industry, he is living in a tiny green bricks made room inside the industry with other four fellow workers. The room is connected with electricity but lack of ventilation. He gets fuel woods for cooking, small toilet shares with fellow fireman and water supply. His monthly salary is Rs. 8500 out this salary 800 rupees per week is giving him to carry out his weekly expenditure. Above all Mr. Murmu has a habit of drinking local alcohol. Therefore whatever amount is left after buying food and medicine spends on drinking. Thus at the end of the season, he is going back to home in empty hand.

Box No. VI.2.4 Migrant fireman

Shibu Paharia (Santal: ST) 52 years old brick maker working in the *Astha* Brick Industry located at Hajirpara village (Murshidabad- Jiagang, Murshidabad). He is from Jharkhand recruited by his fellow worker, working in same brick Industry. He is living in kachha house with other six family members lacking in sanitation, water supply and electricity connection. His family member fetches water from the nearby road side taps. He was working daily causal labour in his native. He has little amount of debts. Poverty, debts and seasonality of works in native compel him to migrate in brick industry. He is living with his family in a tiny green bricks made room inside the industry connected with electricity but lack ventilation. Major part of his income spent to buy the food and allied items for his large family. Further, remaining income spent to treat his sickness. In addition to it he has a habit of drinking. Therefore at the end of the season he is going back home bearing the burden with debts.

Box No. VI.2.5 Migrant fireman

Kamal Yadav (OBC), 39 years old brick maker working in the S.M.T (Sani) Brick Industry located at the Hulashpur village, (Murshidabad- Jiaganj, Murshidabad). He is from Bhagalpur, Bihar. He has recruited by his fellow worker, working in the same brick Industry. He has four members in his family and living in semi pucca house lacking in sanitation, electricity connection and water supply tap. The agricultural lean period at his native exactly match with the function of brick industry has pull him from his native to join in the industry. He has further informed that relatively higher daily wage in brick industry attract him to join. He is living with his family in a tiny green bricks made shared room (hall) is connected with electricity. His monthly income is about Rs. 8000-9000. Major portion of his income spent to buy food. Very little amount of money is spending as tuition fees for children's education.

Box No. VI.2.6 Migrant fireman

Bishnu Soreng (Santal: ST), 43 years old brick maker working in the Bharasa7 Brick Industry located at Koltala village, Murshidabad- Jiagang, Murshidabad. He is from Santal dihi district (Jharkhand). He is recruited here by labour contractor belong to Kanaipur village (Birbhum, West Bengal) Mr. Soren is living with six family members comprising three young children and old mother in a kachha house. He and his wife both are bread earners in his family. His family does not have access to the sanitation, water and electricity connection. He is belonging to the village which is lacked in basic facilities like health Centre, safe water supply. He is working coming here from last six years. At the initial he was working as brick transporters. The poor economic condition, limited working opportunity at native force him and his family member to come here and join as makers. In the brick industry, he is living in a tiny pucca brick made shared hall room with his family. His monthly income is above Rs. 9000. His income is relatively high because his wife and old mother together work as the team in the brick industry. But it is important to note that name of his wife and mother does not register as separate workers. He is informed that he is not allowed to leave the work in the middle of the production season. He is bound to work for the whole season as an agreement is made with his contractor before coming to the brick industry.

Mr. Soren and his wife both have a habit to drink. Therefore, a significant portion of their salary spent on drinking and remaining part of their income is spending buying food items. Their little children are staying with them. It has seen that these little children also help their parent at work place by bringing water, food, bidi as we as drying and stocking the dry bricks.

Box No. VI.2.7 Migrant fireman

Laxmi Ram Pahari (Santal: ST), 33 years old brick fireman working in the Smart Brick Industry located at Bhatsala village, Domkal block, Murshidabad. He is from Pakur district (Jharkhand). He is recruited here by the labour contractor from the Pakur town [unwilling to reveal his contractor name and says in his own word – '*me uski nimak khate he- ohamare liye bhagoban ke soman he hum uski nam nehi lenge babuji*']. Mr. Pahari has five family members, comprises three young children and wife living in a kachha house in his native place. He is the only bread earner in his family. He belongs to hilly inaccessible village with lacked in basic facilities like health Centre, safe water supply.

He is use to came here last seven years. Earlier he was working under other contractors in Lalgola block. He is coming here to repay the advance money which was taken from his contractors during agricultural lean period at his native.

He is living in a bricks made shared room hall with his family. His monthly salary is Rs. 8000. He is informed that he has an agreement with the recruiter that he can't leave the industry in the middle of the production season. He is working with a lack of basic equipment like heat resistant shoe and clothes and protective musk etc.

Mr Pahari and his wife have habit of drinking local cholai wine. His little children also suffer from skin disease. Therefore, a significant part of their salary spent on drinking and treatment.

Box No. VI.2.8 Migrant Brick Maker

Ganga Pahari (Santal: ST), 29 years old brick maker working in the N. B. F Brick Industry located at Juginda village, Domkal, Murshidabad. He is from Dumka district of Jharkhand. He is appointed here by a labour contractor from Pakur; Jharkhand (not ready to disclose the Name & Address of contractor) Mr. Ganga is living with five family members comprising three young children (one boy and two girl child) in a kachha house at his native. He and his wife both are bread earners in his family. His family does not have access to sanitation, water and electricity connection.

He informed that earlier he was working as migrant agriculture daily wage labourer (‘*me bidesh me katai buai ka majduri korte the’*) and use to migrate seasonally in Haryana and Punjab during winter cropping season He also informed that (‘*thidar laye he’*) he is introduced by his friend with contractor and who made available this work to him The contractor also made available advance money to him when he was sitting in home without work. The lack of employment opportunity and seasonal agricultural lean period force him to migrate in brick industry.

Inside the industry he is living in a tiny pucca bricks made shared hall room with his family. His monthly income is above Rs. 9000. His income is relatively high because his wife is also working (after finish household) with him as a team in the brick industry. But it is important to note that name of his wife is not registered as separate workers. He is informed that as a part of their agreement he is not allowed to leave the work in the middle of the production season. Mr Ganga is a regular drinker; therefore a significant part of their salary is spending on drinking.

Box No. VI.2.9 Migrant fireman

Murad Ali Sk (OBC), 54 years old brick fireman working in the Power Brick Industry located at Aminabad village, Domkal, Murshidabad. He is from the Birbhum district of West Bengal. He is recruited here by labour contractor belongs to his village of Birbhum district, West Bengal. Mr. Sk belongs to a family of six members comprising two sons, one daughter and old mother. He is living in a semi pucca house with his family at their native. He has access to sanitation facility, water supply and electricity connection. He belongs to a village which is lacked in basic facilities like primary school, health Centre. He and his elder son are bread earner in his family.

He informed that the employment opportunity at his native is total based on cropping season, therefore he always uses to migrate different sectors and different parts of the country in search of employment. Earlier he was use to migrated states like Maharashtra, Tamil Nadu etc in search of employment. Now his physical condition does not permit him to travel such huge distances. As a result he is compelled to come here for earning. The higher daily wage as compare to agriculture sector as well as continuous working opportunity influence him to join in the industry.

He is living in a bricks made shared room inside the industry with other five local firemen. His monthly salary is Rs. 8000. He is working in a dusty hazardous environment with lack of basic protective equipments like heat resistant shoes, clothes and musk etc. He is also informed that a quite good amount of his income spends to buy medicine for his old mother who is suffers from heart problem. Little amount of his income spends on his children education.

VI.2.2.1 Working Environment for workers inside Brick Industries:

So, from the above discussion (data analysis and case study) it is safely stated that whether labourers (brick industrial workers) are coming from local villages or other parts of the country; all are belonging from same economic background. These workers belong to landless, marginal wage labourers who constitute their yearly income from daily wages. As they belong to landless section of rural society, therefore, significant portion of their income spent to buy the food and allied items. Poverty and lack required skills compel them to join in brick kiln industries.

They are working 10- 12 hours daily to earn minimum level of income to support their family. The duration of work varies from worker categories to categories. For makers and pakmill workers it is approximately 10 hours work per day. For brick transporters it is about 8 -9 hours work (combining morning and evening shift) per day. For firemen, mistry and rubbishmen it is approximately 10-12 hours. There is no provision of bonus, pay leave, medical care and work place safety measure. In addition to it the delay or disruption in production due to rain or shortfall in supply of raw materials, no compensation would make for the workers.

The living condition of workers (especially for firemen) inside the industry is very pathetic. They are living in small room with dusty, hazy unhealthy, lack of drainage, open space and exposes to fumes, dust, smoke throughout the night and days. They are deprived from adequate basic facilities like sanitation, water supply.

There is no concept of decent works or decent working facility as mentioned in ILO guideline (ILO 2008; ILO 2013). The ILO (2008) agenda on social justice for fair globalization recommends for the establish of proper indicators to measure the progress in implementation of decent work agenda to reduced the poverty, achieving equity,

inclusive and sustainable development in all sectors labour related works irrespective of formal, informal, public, private or cooperative which provides employment and payment in the form of wage or salary in cash or kind in exchange of labour.

To achieve decent work agenda, the agency formulates the following ten indicators related to works namely: - decent working time; combining working and family time; work should be abolished; stability and security of works; safe working environment; employment opportunity; , equal opportunity and equal treatment in employment; social security; and social dialogue between employers and workers. Let's discuss one by one all the indicators in details and try to find out decency of works in respect to brick industry.

First, decent working time duration defined by the ILO (2013) that it is not more than 48 hours per week. It further mentioned that if the working time in any places increase above 48 hours per week, it may reduce the family time and also increases the risk of health hazard. The decent working time further recommends for incorporating paid annual leave for worker.

Second, indicator of decent work includes the issue of combining working time and family time. Agenda incorporates the issue of parental and maternal leave for the employee to look after their children and family.

Third, decent work agenda also includes abolition of child labour as well as further suggests the provision for prohibits the children from hazardous works. In this regards, Govt of India also passes acts to prevent child labour (The gazetteer of India 2016).

Fourth, stability and security of work agenda includes the job tenure, security of job, free from fair of termination from job, received bonus, pay leave, gratuity etc.

Fifth, safe decent work agenda address the issue of environment includes the safety from occupational injury, accidents, compensation for time and days lost due to injury or accidents at workplace etc.

Sixth, the adequate earning for all agenda defines that each individual should give a chance to earn minimum amount of income to afford their life smoothly and peacefully.

Seven, the employment opportunity agenda define that the employment opportunity should extend for all irrespective of caste, class and regions. Employment should be given all according to their skills and ability.

Eight, equal opportunity and equal treatment in employment define that gender gap should abolished, female participation in all sectors of employment should be encouraged. It further noted that occupational segregation, wage gap by sex for same work should be abolished.

Nine, to promote the social security, the decent work agenda emphasis on the issue of old age pension, health care facility for family and children etc.

Tenth, social dialogue, workers and employers representation agenda includes all the stakeholders comprises of government institutions, employers and employee on the issue of common interest. It also emphasizes on involvement of trade union in the process collective negotiations and bargaining on deciding a wages, working time, leaves, pensions, bonus and others facilities in favour of employees. The provision of decent work inside brick industry is totally absent. They are forced to work throughout the production season without any pay leave. There is no provision of family time (spatially for migrant firemen) once they joins their work. They are not getting any pension, medical care (*only First Aid*), insurance and other economic benefits. The workers are

always left behind during bargaining and negotiation on daily wage, working time, duration of works etc. Here, it is very important to note that the informal nature of operation, exclusion from the factory laws as well as organizational and political influence of owners on local organization and institutions causes of deprivation of brick industrial workers from their due benefits.

VI.3 Brick Kiln Industries and Marginal and Small farmers

VI.3.1 Introduction

The farmers of the study area fall under marginal to small categories and size of holding is very small. The small size of land unable to meet the requirement of household, as a result they are undergoing financial stress though out their life. The coming up of brick industries in the study area offers an opportunity for small and marginal farmers to generate considerable amount of income and meet very important needs by leased out part of their agricultural land for top soil quarrying. Brick industries also extend its daily wage work to these small and marginal when they make free from their agricultural activity. The daily wage helps these farmers to meet significant part of their daily need as well as the money received from the brick industries in exchange of top soil helps these small and marginal farmers to performed important socio economic activities including celebration of social duties; mainly daughter marriage and paid dowry, build small new house, meet the expense of their children's education, buying irrigation systems etc.

VI.3.2 Socio-religion background of the farmers:

Study shows that majority of the farmers belong to Islam religious (70 percent) group followed by Hindu (20 percent) and nature worshipers (10 percent) (Table VI.3.1). Study further shows that, about 30 percent farmers belong to general category. About two third

farmers belong to (60 percent) O.B.C category. Further, study shows that about seven (6.8 percent) farmers belong to SC category and remaining three (3.2 percent) farmers are ST category (Table VI.3.2). Study further demonstrates that about 28.4 percent farmer's family size is small. The share of medium size family are about 48.3 percent, and remaining one fourth farmer's family having more than 7 members (Table VI.3.3).

Table VI.3.1 Religion Background of the Farmers

Religion	Share in percentage
Islam	70
Hindu	20
Nature worshipers	10

Source: *Field work 2016*

Table VI.3.2 Caste Background

Categories	Share in percentage
General	30
O B C	60
SC	6.8
ST	3.2

Source: *Field work 2016*

Table VI.3.3 Family size

Number of member	**Share in percentage**
Upto 4 members	28.4
5- 6 members	48.3
7 and above members	23.3
Total	100

Source: *Field work 2016*

VI.3.3 Social Infrastructure at the Household of the Farmers:

Human being needs very basic items like food, clothes, and medical facilities to sustain. In addition to it sanitation, source of safe of drinking water, source of light in the household also considered as important basic requirement for survive. Study shows that, about one fifth farmers have a pucca house (23.4 percent). Majority of them is still lived in semi pucca (48.3 percent) and in kachha (18.3 percent) houses (Table VI.3.4). In

addition to it about one fifth farmer's household doesn't have any sanitation facility. They are still using bush path or open fields to carry out the same. Study further reveals that about half of the farmer's households have traditional sanitation. The study further demonstrates that only one third farmer's households have improved sanitation. Similarly study shows that, all farmer's have own source (Tubewell) of drinking water at their yard. In addition to it quite significant percentage of farmer's households has electricity connection (Table VI.3.5). Study further illustrates that the significant number of farmer's household has very basic consumer goods. Study reveals that almost all the families have respondents having a bicycle mobile set. Study further demonstrates that quite significant percentage of families have T.V radio sets (Table VI.3.6).

Table VI.3.4 House types among the farmers

House Type	Share in Percentage
Pucca house	23.4
Semi Pucca	58.3
Kachha	18.3
Total	100.0

Table VI.3.5 Availability of sanitation, water supply and light

Items	Types	Share	Total
Sanitation	Traditional	51.5	100
	Improved	30.0	
	No sanitation	19.5	
Water Supply	PHE	10.0	100
	Tube Well	90.0	
Light	Electricity	85.0	100
	Kerosene	15.0	

Table VI.3.6 Family having different type of goods in the house

Items	Yes
Bicycle	100
Radio	24.7
Mobile	98.3
Television	31.7

Source: *(Table (vi.3.4, vi.3.5, vi.3.6) Field work 2016*

VI.3.4 Economic Background of the Farmers

Agriculture is the main economic activity of the study blocks in particular and district in general. Majority people of study blocks lived in villages and involved in agricultural for their earning and livelihood. The size of agricultural land holdings is very small. Study shows that the size of agricultural land holding lies in between less than one hectare to two hectares (VI.3.7). Farmers use their small land extensively to fullfil their basic needs. The study further demonstrates that, major part of their land is devoted in food crops like rice, wheat, maize and remaining parts engaged in potato, onion, brinjal and other seasonal vegetation cultivation. The economic returns from cultivation of land are very small. Lack of market facility and access to credit, storage facilities, and market forces - especially during harvest further reduced the margin of return from the agriculture.

Study further reveals that the famers of the area also keep few animals especially milk cow for milk, draft cow for perform agricultural, few goats and chickens. But the economic return from these domestic animals is very small and insignificant. Use of local breed of milk cow, lack of adequate space for rearing large number of herds, poor economic background and lack of knowledge prevent these people from real benefits from their animals. Therefore, only cultivation remains as main economic activity and source of earning among the farmers of the study area. As a result, these farmers are undergoing financial stress and always remain under economic crisis.

VI.3.4.1 Area and Size Holdings among the Farmers:

The field study reveals that most of the farmers, those who leased out their land for top soil quarrying are belong to marginal (Up to 1 Hectare) and to small (1 to 2 Hectare) farmer categories. About 61.7 percent farmers have up to 5 *Bigha* (0.66 hectares) land. About 26.7 percent farmers have 6 to 10 *Bigha* (0.67 hectares to 1.33

hectares) land. The remaining 11.6 percent farmers have above 10 bigha land (1.33 hectare) (Table VI.3.7):

Table VI.3.7 Size and Share of land holding

Size of Land holds	Share in Percentage
0.66 hectares (**Up to 5 *Bigha)***	61.7
0.67 to 1.33 hectares (**6 *Bigha* to 10 *Bigha***)	26.7
1.33 to 2.00 hectares (***10 to 15 Bigha***)	11.6
Total	100.0

Source: *Field work 2016*

VI.3.4.2 Area of land lease out by the Farmers to Brick Industries

Since the majority of farmers, of the study blocks belong to Marginal and Small (Table VI.3.7) categories; therefore the size of holding is also very small. These small lands unable to fullfil requirement of cash, especially when farmers needed in lump sum to performed any capital intensive activities like daughter marriage, paid children education expense, repay the existing loan, build new house and treat illness. To overcome these problems farmers used to keep their land to other farmers in exchange of money. It is a well known practice across the district of Murshidabad. The coming of brick industries in the study area scenario is steadily changing in the area. Now farmers try to overcome these problems by leased out part of their land for top soil quarrying in exchange of money. The study shows that the amount of land leased out by these farmers are ranging from 0.5 *Bigha* to 2.5 *Bigha* (Table VI.3.8).

The study shows that areas of land leased out and amounts of money received from the brick industry differ from individual to individual. The highest share of land leased out to the brick industry in terms of areas lies in between 0.5 - 1.0 bigha's (40 percent) to 1.0 -1.5 bigha's (34 percent). Study reveals that the average rate for quarrying one bigha of agricultural land top soil by one foot deep is Rs. 20,000. Study further shows that the rate also varies from land to land. The land with rich in clay

received higher rate for per foot of top soil quarrying whereas the land with less amount of clay or rich in sand cost less for per foot of top soil quarrying. The table (VI.3.8) shows that about 14 percent farmers lease out up to 0.5 bigha's land and received up to Rs 20 thousand.

Similarly, 40 percent farmers leased out 0.5- 1.0 bigha's land and received Rs 20- 40 thousand. In addition, about 34 percent farmers leased out 1.0 -1.5 bigha's land and received about Rs 40 - 60 thousand and only 8 percent farmers reported that they leased out 1.5 -2.0 bigha's land and received about Rs 60 -80 thousand rupees. Study further demonstrates that only 4 percent farmers who leased out about 2.0 – 2.5 bigha's land and received above Rs 80 thousand from the brick industry.

Table VI. 3.8 Areas of land and Amounts of Money Received by the Farmers

Land leased out (in Bigha)	Money received (Rs. 000)	Share in percentage
Up to 0.5	Up to 20	14
0.5- 1.0	21 – 40	40
1.0 – 1.5	41 – 60	34
1.5 - 2.0	61 – 80	8.0
2.0 - 2.5	Above 80	4.0

Source: *Field work 2016*

VI.3.5 Utilization of Money by the Farmers

Since the farmers of the study areas belong to marginal to small categories, economic stress and low standard of living are prevailing in their life throughout the year. The money that they get from leased land may help them to come out from such economic stress. Study shows that about 30 percent farmers spent major portion of their leased money to building a new house. Similarly, about 24 percent farmers spent a major share of their leased money to repay the existing loan.

In addition to this, about 18 percent farmers spent their leased money to perform the family's marriage (daughters) ceremonies and another 8 percent respondents spent

their leased money to fulfil the family expenditure. Study further shows that about 6 percent respondents utilized their leased money to treat the illness.

Another 6 percent respondents utilized their money to meet the expense of their children education. Here education expense mainly refers to offspring's B. Ed admission charge, admission and vocational training fees, because it need one time lump sum amount which is very difficult for these farmers to arrange from agriculture earning. About 4 percent respondents utilized their money to buy the new Agriculture machinery. Only 4 percent respondents used their money to buy agriculture land (Table VI.3.9).

Thus, the income from the brick industries for time being helps number of small and marginal farmers to come out of debts, build new house, pay off spring education fee etc.

Table VI. 3.9 Utilization of Land Leased Money by the Farmers

Sectors/Items	**share in percentage**
Build New House	30
Repay the Existing Loan	24
Fulfill Family Expenditure	8.0
Celebrate Family Marriage	18
Treat the Illness	6.0
Buying Agricultural Machinery	4.0
Paying offspring Education Fee	6.0
Buying Land	4.0

Source: *Field work 2016*

Though brick industry offers an opportunity to the landless labourers and small and marginal farmers to generate major share of their annual income for short period of time but industry has brought many changes in socio- economic and political situation in the study area.

VI.4 Further Marginalization of Small and Marginal Farmers:

Brick industry play an important role in further marginalization of already marginalized farmers of the study area. The small and marginalized farmers of the study area lease out their agricultural land or part of their agricultural land to brick industry for top soil quarrying for generating one time lump sum amount to meet the various present needs like build small dwellings, repay the existing loans, fulfill household expenses, treat illness, paying offspring education fee, celebrate marriage and other social functions, etc in the expense of degrading part their land.

The cultivation of small patch of land was unable to meet all these needs at a time because it require lump sum amount at one time which is very difficult for these farmers to arrange from agriculture earning. These Small and Marginal farmers are always going though the economic stress. The brick industries have taken the economic stress of these farmers as an opportunity to trap them (small and marginal farmers) for lease out their land for carrying out the top soil quarrying activity.

The top soil quarrying activity of brick industry on agricultural land severely degraded the land. The degradation of agricultural land means loss of important source of livelihood for the small and marginal farmers. Further, to reclaim the degraded land for agricultural practices require huge capital and human effort. Poverty, economic crisis and lack of financial and technological support from the Government institutions permanently degraded their agricultural land (Blaikie 1989). As a result, these small and marginal farmers suppose to intensively cultivate their remaining or already degraded land to make their livelihood. The intensive use of remaining land resulting in decline of fertility status which is subsequently degraded the remaining source of livelihood (Blaikie 1989).

Thus, already poor farmers steadily put under further marginalization (Blaikie 1989). The Government institutions and establishments and their acts also help the brick industry for further marginalization of small and marginal farmers in the study area. The Government institutions like Department of Land and Land Reforms and Department Environment instead of protecting the small and marginal farmers and their land from exploitation by the brick industries, it further widen the possibility of get exploited of these small and marginal farmers and their land by the brick industry by bending the many functional rules and guidelines on the ground. Thus, nexus works in continuity.

Therefore, the Government Institutions and its policies towards brick industry are also helping in further marginalization of these small and marginal farmers (Herschel 1998). The continuous encroachment of small and marginal farmer's agricultural land by the brick industry for top soil quarrying not only further marginalized the already marginalized farmers but also may depose many small and marginal farmers from their land, or in other words, from their means and make them landless labourers in near future. Study (Chapter III, Table III.3) suggested that the share of cultivators rapidly decline in the study areas whereas share of other categories workers continuously increases in the study area in last three decades. Significant percentage of cultivators deposes from their agricultural land and force to adopt other economic activities. As a result, good number of cultivators may already become free labour in the district in the last three decades. The degradation of small and marginal farmer's agricultural land due to brick industrial top soil quarrying activity may depose few hundred small and marginal farmers by uprooting them from their land and avail them as free labour (Marx 1973; Bonefeld 2011). In this way brick industry play an

important role in further marginalization of small and marginal farmers as well as creation of free labour for the larger capital market (Bonefeld 2011).

VI.5 Land Resource Depletion:

The basic raw materials for manufacture of bricks are top soil and sand. For production of good quality bricks, good loam, loamy sand and loamy clay soil is essential. Ten to fifteen years back, brick industrial owners were avoided the use of agricultural land for top soil. They (brick industrial owners) always prefer to use the available wasteland or the lands which once used for settlement. These wastelands are popularly called as *dihies*[50]. These types of *dihies* were abundant in the study blocks of district Murshidabad. Therefore, in the initial stage of the brick industrial development, industries were established in an around such dihies to make the supply of top soil very easy.

The soil of such dihies was used as raw materials for the production of bricks. The availability of such dihies started vanishing very rapidly due to rapid expansion of existing brick industries as well as emergence of new brick kiln industries in the study area. As a result, all the *dihies* turned into leveled land within a few years.

The shortage of these dihies has put serious challenge in front of the brick industries regarding the supply of raw materials (good quality top soil). On the others, the demand for bricks in construction sector is rising very rapidly within the district and outside the district. The demand of bricks further increases in rural area of the district due to the major part of the district is very much prone to monsoon seasonal flood. Therefore, prime concern of the villagers is to build at least one small Pucca/semi Pucca room to protect their life and goods from the flood as well as improvement of socio- economic status of rural masses further increases the demand for bricks.

[50]Dihies – the land which is relatively higher as compared to the surrounding area.

Hence, to meet the internal as well as external demand for bricks which increased dramatically, brick industrial owners have started targeting the agricultural land located around the production unit in the absence of *dihies.*

To minimize the transport cost of raw materials (soil, sand) industries always preferred to find out soil quarrying land close to the production unit. As the distance of the quarrying field from the industry increases the cost of production is also increased. As a result, the profit margin is automatically dropped. Besides this, to keep the industry in operation throughout the production season (Normally mid-September – last week may), owners have to make sure of the continuous supply of soil. The soil (raw materials) is supplied by land contractors.

These soil suppliers (contractors) are not only making sure about the supply of soil for the current year, but also assured the brick industrial owners for next year too. In this way majority of brick industries dumped the soil to prepare their own dihies to continue production in future in the absence of supply of raw materials. The land contractors removed the top agricultural soil up to a few feet deep. The average depth of the topsoil quarrying land is 3.56 feet's to 5.26 feet's (field observation 2016). The deep top soil quarrying on agricultural land is responsible for changing the natural settings of that particular area.

In addition, the continuous quarrying of top soil is responsible for increasing areas of degraded land in the study blocks. The changing landscape is also responsible for changing the natural slope and direction of that particular area. Further, the brick industry is responsible for generating huge waste materials. These waste materials are generally dumped into the open fields. The dumping of these huge amounts of waste material (broken brick, coal ash and rubbish) on nearby agricultural/open land is responsible for changing the soil chemistry (Gupta & Narayan 2010). Thus, the brick

industry degraded vast areas of agricultural land and depleted land resource in the district of Murshidabad.

VI.7 Resource Transformation:

The land (top soil) and water are brought from the immediate surroundings of the brick industry. It is obvious that industry always meant for modification of material and value addition in the commodity. The brick industries modified the soil (raw material) into bricks. The industries have exploited the lands of the small and marginal farmers and make it as a commodity (soil of their land) in the form of bricks. Thus, the function of brick industry helps in mobilized the fixed resources (top soil/land) in the form of bricks. Further, the mobilization of soil/land also helps in changing ownership of those particular resources. The changing ownership of assets and transfers of ownership of resources ultimately helps to accumulation of capital (Dobb 1963).

The commodification of top soil (land) facilitates the brick industrial owners to accumulate huge amount of capital and become an upper middle class in the district of Murshidabad. The accumulation of capital has made them influential not only within the village, but also able to influence the local political system (at least up to block). Apart from this, the brick industry also consumed a huge amount of water during the preparation of mud from the soil. The utilization of the public resource (water) and commodification of it also helps the owners to generate additional profit and the adverse outcome (reduction of water availability and pollution) from these production processes are shared by the people residing around it. In addition, the brick industry also helps in changing ownership of these resources from the socio-economically marginalized poor farmers to the influential middle-class businessmen. The resource transfers has unique societal dimension with regard to brick industry. It is evident

from the study that very few people (owner, soil contractor, brick businessman) become capitalist within villages by exploiting the land of small and marginal farmers; are now the owner of the vast area of land, once which was taken leased for soil quarrying from the farmers.

Therefore, in real sense very few people are benefited in the study area. The spatial dimension of resource transfer is referred to the regional dimension of resource consumption. The bricks are manufactured in the villages of Murshidabad district, but it is used in the urban centres of district and major cities of West Bengal.

VI.7 Capital Formation for the Owners:

The brick industry plays an important role in capital formation for the owners of brick industry in the district of Murshidabad. The creation of the wealth in any society mainly depends upon the availability of natural resources and partly on the efficiency of the labour force. The role played by the richness of the resource in the creation of wealth is higher in relation to the labour force. In addition, the skill of the labour force and mechanism of production system would help in creation of wealth as well as capital (Dobb 1963; Morris 1995).

But whole wealth does not consider as capital surplus. Only a portion of the wealth which is created as surplus with an addition of extra knowledge, skills, mechanical power, motivated forces and the means of greatest mechanical advantage is considered as Capital (Morris 1995). Therefore, the capital is a portion of the stock of an enterprise, company, countries and a nation which is kept with the view of profits. As a result, profit helps in the continuity of capital accumulation through the process of production and distribution.

The accumulation of capital also influences by the institutional power and facilities. The institutions have the authority to legalize any industry or production units in

respect of wealth creation and capital accumulation. Therefore, institutions offer safeguard/legal support to any production units or industry in surplus production and capital formation. In addition to it the institutions also have the power to allow any production units to employ additional amounts of capitals, labour forces, and technology to increase their production capacity as well as capital accumulation (Jone 1859).

The question is here what are the important sources of capital? How industry and production unit accumulates capital? The simple answer is that enterprises and industry accumulates capital from the profits. Besides profits, rents, wages are other important sources of capital formation. In this regard, land rent in the form of land revenue is an important source of capital. The wages mainly under wage or deprivation from actual wages is another source of savings or capital accumulation.

The wage is the reward all simple personal extractions of all skilled and unskilled labour fees. Therefore, the deprivation from the actual wages helps in capital accumulation. The deprivation form actual wage means a certain portion of bodily works fees is serving the interest of employers. That portion of wages ultimately led to the capital formation for the employers in long run.

This type of deprivation is visible in almost every sector of economy. The intensity of deprivation may be higher in informal sectors due to workers are employed by the labour contractors who have some underlying contact with the enterprise/industries. Above all, the condition and clause of works are always decided by the owners and labour contractors and it's remained within the owners and labour contractors keeping behind the labourers from the decision-making process as well as terms and conditions are also kept in secret between owners and contractors. Under such condition, it is mere fact that labourers are deprived of their actual wages.

Thus deprivation from the actual wages paved the path of capital accumulation for enterprises or industries. Apart from rents and under wages, profit is another important source of capital accumulation. The profit is something; in financial terms - the difference between the earned and the amount spent in operating or producing something. Therefore the cost of selling or market price of a product minus the cost of production of that particular product is profits (Newman 1835).

Here, our question is how brick industry helps in capital formation and which one among these three (land rents, wages and profits) have played important role in regards to capital accumulation. The role of land rents in capital formation in case of brick industry is nil or very limited. The brick industry does not receive any rent in the form of land revenue. Instead of receiving, the brick industry is bound to pay the land rent to the landowners (farmers) to carry out their functions on leased land. Therefore, wages and profits are two important sources of capital accumulation in the brick industry.

The brick industrial labourers in the study area consist of landless, unskilled poor village people. They are recruited by the labour contractors. Their daily wages are decided by the Brick Field Owners Association (BFOA) at the district as well as block level. In the process of bargaining of daily wages (different groups) for the labourers, not a single labour's representative or their views are taken into account. Therefore, it is obvious that whichever daily wages are decided by the BFOA, labourers are bound to work on that wages. It is mere fact that BFOA always tries to protect the interest of owners and trying to keep the wages as low as possible. In addition, it is found that brick industrial owner always request the labour contractors to convince the workers to work on BFOA decided wages. The lack of bargaining body in favour of workers compelled the labourers to work on BFOA decided wages. In such way industries

separated the labourers from the ownership of their own means of production meaning there by their own labour. The separation of labourer from the means of production creates a condition for accumulation (Marx 1967).

Beside the separation, low economic wages still dominates the brick industry, which would help the brick industrial owners to accumulate a lump sum amount of capital. The system of advance payment also helps the owner to keep their influence on the labourers during deciding the wages not only for current year but also for the coming year too. As a result, though the prices of necessary goods are going up day by day in one hand on the other the wages of the labourers remain same. This advance payment system is paved the way to keep the daily wages lower than actual. Therefore, the under wage, followed by the advance payment helps the owner to accumulate a huge amount of capital each year.

The Profit is another important source of capital accumulation in the brick industry. In the brick industry, the major portion of the damage related (green brick damage) risk is put on the shoulder of the brick makers to reduce the production related damage/risk. Therefore, by putting the damage risk on the labourers, brick industrial owners not only reduced the risk of losses, but also trying to avoid the risk of discontinuity in the production process. Thus, brick industrial owners have just only bothered with the finished product. In this way, damage/risk-free production process increases the margin of profits as well as capital accumulation. In addition to it manipulation of government agencies about the exact product or production capacity of the industry and related taxes also help the owners to increase their profit margin. It is important to note that, the owners always preferred to buy the raw materials (soil and sand) from the contractors because it also helps them to manipulate the Land and

Land Reform Office/Officers to fix the amount of land utilization tax. In such way, owners are able to manage to keeps the production cost under their control.

As a result, the profit margin is automatically going high which is ultimately leading to huge capital accumulation. Despite the above facts, the demand for each and every piece of bricks, as well as rubbish, also helps the owner to increase the profit level. For example, the good quality bricks are going to the urban centres and it sells at high prices. The Medium and low-quality bricks are consumed by the rural poor. The broken bricks and rubbish (burn sand) use by the local (village) road contractors to repairing the roads. Therefore, each and every piece of bricks, burns sand and dust, etc. has demand in the market. Nothing is left at the end of the year. The ultimate result is huge profit as well as accumulation of capital for the Owners. Thus, bonded labourer system remains in continuity with modern tools.

VI.8 Emergence of New Socio- Politically influential Class in the Villages:

The brick industry also plays an important role in creation of new classes in the villages of study area. The people those are Owned (Owners of Brick Industry) the industry was a small businessman of the villages. Their position in the society (Villages) was not that much important in decision making. As brick industry help these owners to amass huge amount of capital as well as their increasing relation with political establishments (Political Party and Politicians) and Government Institutions (Dept. of Land and Land Reforms, Pollution Control Board and Dept. of Environment etc.); lifted their social status within the village society. Further, association with political establishment and parties also make them important actors of village politics; mainly in Gram Panchayats Election. As a result, these brick industrial owners are now engaged in grassroots level of politics through their power acumen.

On the other, brick industry changes the socio- economic status of the landless agricultural labourers. These landless labourers were depended on agriculture and allied activities for means of their livelihood. But existence brick industry in the study has changed the nature of means of their respective livelihood. Now these landless labourers are generating major share of their yearly income from the brick industries. In other words, they are now depending on brick industry to make major share as their means of livelihood. Further, by offering an employment in industries, brick industries play a major role in turning these landless agricultural labourers into industrial labourers. Thus, brick industries play an active role in emergence of new economically affluent, socially and politically influential owners on hand and poor, voiceless industrial labour classes in the villages of study area on the other.

Findings and Chapter Summary

After going through the above discussion, it may safely be stated that the majority of the brick industrial labourers belong to the social- economically poor and marginalized section of the rural society. The rapid development of the brick industry has changed the structure of economic activity and production system in the villages in relation to the landless labourers. The division of labourers is very much sharp in the brick industry. The major chunk of these brick industrial labourers belongs to the young and youth age group. Youth and energetic people employs to perform the hard manual works like soil quarrying, moulding, shaping and transporting whereas aged and skilled people are appointed as mistry and firemen. The brick industry has provided 150 -180 days employment to the landless poor agricultural labourers.

The income of these brick industrial labourers ranges from between Rs. 5000- 9000 per month. The majority of brick firemen and makers have monthly income is about Rs 7001- 9000. Similarly, the monthly income of Mistry and Rubbishmen ranges from Rs. 5000- 7000. In addition to it the income of brick transporters varies from

individual to individual because the payment is based upon number of bricks transported/carried by each individual and ranges between Rs 4500- 7000. The income from the brick industry constitutes major part of annual income of these labourers. Study also reveals that major portion of the yearly income was spent to buy food and allied items.

A small part of their income is remained available for spending other sectors like children education and improving sanitation, etc. study further demonstrates that though number of brick industrial labourers has shifted their house from the Kachha to Semi Pucca and semi Pucca to Pucca house but still a significant percent of labourers are living in Kachha houses. The share of semi Pucca and Pucca houses are higher among the brick makers and brick firemen due to relatively good monthly income from industry as compare to other category workers.

Further, study reveals that a considerable percent of brick industrial workers' do not have the access to the improved sanitation facility. They are still depending upon traditional type of sanitation system as well as uses bush path for this. Furthermore, study shows that majority of these workers were depending on agricultural daily wage labour, daily casual wage labour, daily wage from other sectors, and daily wage labour from construction sector before join in brick industries as labourers. The brick industry has changed the production system in the study area in relation to the landless labourers. Earlier these labourers were mainly engaged in agricultural and allied based production system but now major part of their yearly labour devoted to industrial based production process.

Likewise the local landless labourers, considerable number small and marginal farmers of study area are getting an opportunity to lease out part of their land and generate good amount money which for time being may helps to meet many essential

needs like celebration marriage ceremony, paid dowry (mainly for daughter), repay the existing debts, treat illness, meet expense of children education fee, build new house, etc.

Study also reveals that brick industry also employed few migrant labourers coming from the states like Jharkhand, Bihar and (a small percentage) Eastern Uttar Pradesh. Further, study reveals that the majority of these migrant workers recruited by the labour contractors and very few of them come with their fellow workers who are already worked in different brick industries. The study also unfolds that though they are coming different states of India, but so many things are very common among them. First, all of them belong to socio-economically deprived section of society mainly Schedule Caste and Schedule Tribes. Second, either they are working as firemen or brick makers.

In addition to it commonality also found in terms of expenditure. Majority of them are net buyer of food items throughout the year hence significant part of their income spend on buying food items. Moreover, majority of these migrant labourers are still living in Kachha or semi Pucca houses. Almost all of them are deprived of basic facilities like good sanitation, safe drinking water supply, health facility in both the places; inside brick industries as well as at their native villages.

Study also reveals that the labourers exposes number of health hazards related to their task performed inside the brick industry. Majority of brick makers, rubbishmen, and brick transporter suffers from joints related problem whereas mistry and firemen exposes from health problems like suffocation, eye irritation skin burnt, etc. The Works of Singh and Asger (2002), Joshi and Durani (2008) Manga, Singh, Bhardwaj and Singh (2012) also reported similar results on occupational health problems of brick industrial labourers.

The concept of decent work is totally absent in relation to brick industrial workers (local as well as migrant). They are deprived from all type of socio-economic benefits like pay leave, parental leave, bonus, gratuity, medical facility for family and children, old age pension etc. They are left behind from the all social dialogue like negotiation on daily wage, time of work duration of work etc. Lack of awareness about the rights, lack of organizational capacity absence of support from other agencies like trade unions and NGOs prevent them to gets their due benefits. To be precise social consciousness needs an agency for their rightful grievances in the absence of education.

On the other hand development of brick industries in helps in creation new class in the society in the form of capitalist owners in the expenses of land of small and marginal farmers, labour of landless labourers, and voiceless, informal rural industrial labourers. In addition functions of brick industry also play an important role in creation of free labour by disposing hundreds of farmers from their means, by exploiting their agricultural land and helps in supplying labour force for larger capital market.

The function of brick industries also brings number of challenges in relation to environmental degradation and agricultural practices. In the next chapter we will discuss about impact of the brick industries on environment and agriculture practices.

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Chapter VII

Brick Industry, Environment and Agriculture

VII.1 Introduction

As we already discussed about the impact of brick industries on people (labourers, small and marginal farmers, and other social groups) associated with the industries (Chapter VI) in this chapter we mainly deals with the assessment of burning impacts caused by the firing in the brick kiln, on its local environment and related changes in the form of air, soil and water pollution. In addition to it study also assesses the impact of brick industrial top soil quarrying on land degradation. Furthermore, this chapter also tries to examine the impact of top soil quarrying activities on agricultural practices in the study area.

VII.1.1 Brick kiln burning and air pollution:

The brick kiln burnings important industrial source of carbon dioxide and suspended particulate matter in the study area. The open casting, use of traditional method of burning and of low grade coal is responsible for generation of huge quantity of carbon dioxide and suspended particulate matters (Baum 2010). The increasing concentrations of these pollutants are responsible for the hazy weather during winter in the surrounding area of the brick kilns which ultimately affects the quality of the local environment (Joshi and Durani 2008). The release of these pollutants material into the atmosphere is responsible for air pollution and environmental changes.

VII.1.2 Brick Kiln Burning and Carbon dioxide Generation:

The use of low coal is responsible for generation of huge quantity of carbon dioxide. The amount of carbon dioxide produce by the brick industries varied from industry to industry. It mainly depends on the type and size of the kiln. The study (Table VII.1)

shows that the average consumption of coal by each fixed chimney brick industry in a production season is 324 tons in Berhampore, 306 tons in Murshidabad-Jiagang and 324 tons in Domkal. Similarly, the average consumption of coal by the each Hawa or Zig-zag chimney kiln brick industry in a production season is 300 tons in Berhampore, 360 tons in Murshidabad- Jiagang and 330 tons in Domkal block. The average consumption of coal by each movable chimney kiln brick industry in a production season is 308 tons in Berhampore, 264 tons each in Murshidabad- Jiagang and in Domkal.

The average amounts of Co_2 generated and released into the local atmosphere by a Fixed Chimney Kiln in a production season is 1144.8 tons. Further, study shows that a Hawa or Zigzag chimney kiln generated and discharged about 1188.0 tons Co_2 into the local atmosphere in a production year. In addition, a movable chimney kiln produced and discharged about 1002.92 tons Co_2 into the local atmosphere (Figure VII.1).

The average amount of Co_2 generated and released by each fixed chimney kiln industry in the Berhampore block is 1166.4 tons, in the Murshidabad- Jiagang block is 1101.6 tons and in the Domkal block is 1166.4 tons in a production season/year respectively. Similarly, the average amount of Co_2 generates and discharged into the local atmosphere by a Hawa/zig-zag chimney kiln industry in the Berhampore block is 1080 tons, in the Murshidabad- Jiagang block is 1296 tons and in the Domkal block is 1188 tons in a production season.

In addition to this, the average amount of Co_2 generates by a movable chimney kiln industry in the Berhampore block is 1108.8 tons, in the Murshidabad- Jiagang block is 950.4 tons and in the Domkal block is 950.4 tons in a production season/ year (Table VII.1).

Table VII.1 Average Production capacity and amount of coal consumption and Co_2 generation (in tons) per industry per season

Blocks Name	Types of Chimney Kiln/Industry	Production (in lakhs) / Season	Coal used/ lakh brick	Total coal Used (tons)	Coal to Co_2 Conversion	Total Co_2 Generation (tons)	Average Co_2 Generation
Berhampore	Fixed Chimney Kiln	18	18	324	3.6	1166.4	1144.8
M. J block		17		306	3.6	1101.6	
Domkal		18		324	3.6	1166.4	
Berhampore	Hawa Chimney Kiln	20	15	300	3.6	1080.0	1188.0
M. J block		24		360	3.6	1296.0	
Domkal		22		330	3.6	1188.0	
Berhampore	Movable Chimney Kiln	14	22	308	3.6	1108.8	1002.93
M. J Block		12		264	3.6	950.4	
Domkal		12		264	3.6	950.4	

Source: *Compiled by author after field investigation and the information taken from the IPCC (2006) carbon emission factor * carbon to Co_2 conversion factor; Sarraf, M. &Lelia, C. (2012) and U.S. EIA (2013).*

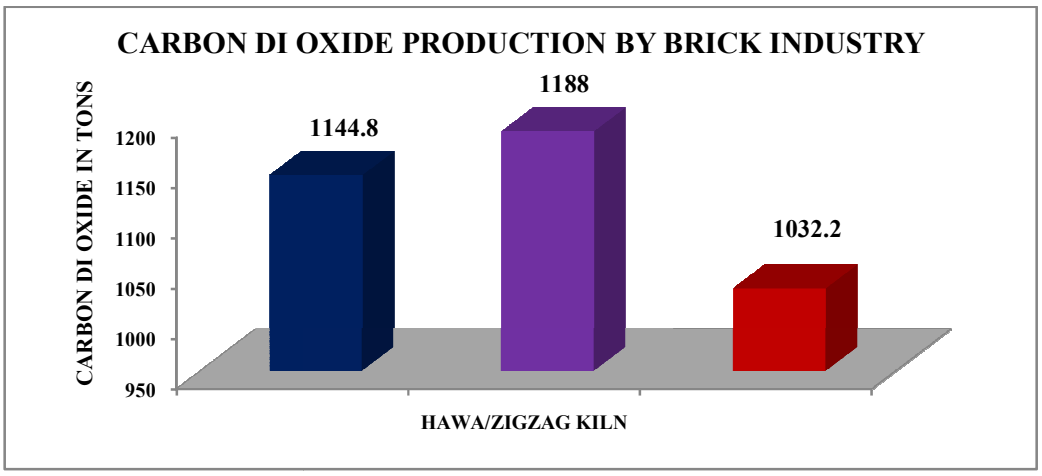

Figure VII.1 *Average amount of Co_2 production by different types of Brick Industry*

VII.1.3 Suspended Particulate Matter Generation:

The suspended particulate matter is another important pollutant generated from the brick industries. The suspended particulate matters (SPM) comprise of dusts, shoots etc. the amount of SPM generation of the brick industry depends on the quality of kilns (Baum 2010). The traditional kilns produce huge amount of SPM as compare to the improve hybrid kilns (Heilrili and Maithel 2008, Baum 2010). In the study area

three categories kilns like traditional, fixed chimney and improve kilns are operated. The study shows that the average amount of SPM generates and discharge into the local environment by a Fixed Chimney Kiln in a production season/year is 3.021 tons. Similarly, a Hawa/Zigzag chimney kiln generates and releases about 1.254 tons SPM into the local atmosphere in the production season. In addition, a movable chimney kiln produced and discharges about 10.209 tons SPM into local environment. The average amounts of SPM generate and releases by each fixed chimney kiln industry in the Berhampore is 3.078 tons, in Murshidabad- Jiagang is 2.907 tons and in the Domkal is 3.078 tons season/year respectively. Similarly, the average amount of SPM generates and ejects into the local atmosphere by a Hawa/zig-zag chimney kiln industry in the Berhampore block is 1.140 tons, in the Murshidabad- Jiagang block is 1.368 tons and in the Domkal block is 12.54 tons in a production season. In addition to this, the average amount of SPM generates and discharges into the local atmosphere by a movable chimney kiln industry in the Berhampore block is 11.284 tons, in the Murshidabad- Jiagang block is 96.72 tons and in the Domkal block is 96.72 tons in a production season/year respectively (Table VII.2).

Table VII.2 Suspended Particulate Matters generates by Brick Industry

Blocks Name	Types Chimney Kiln	Production (lakhs / Season)	SPM generates in Kg/lakh	Amounts of SPM (in tons)	Average amount of SPM (tons)
Berhampore	Fixed Chimney kiln	18	171	3.078	3.021
M. J block		17	171	2.907	
Domkal		18	171	3.078	
Berhampore	Hawa Chimney kiln	20	57	1.140	1.254
M. J block		24	57	1.368	
Domkal		22	57	1.254	
Berhampore	Movable Chimney kiln	14	806	11.284	10.209
M. J Block		12	806	9.672	
Domkal		12	806	9.672	

Source: *Data compiled after taking information from the study of Maithel et al. (2002),Pandit et al (2004), Tuladhur, Acharya and Raut (2006), BUET (2007), Heirli and Maithel (2008) Baum (2010) and World Bank (2011).*

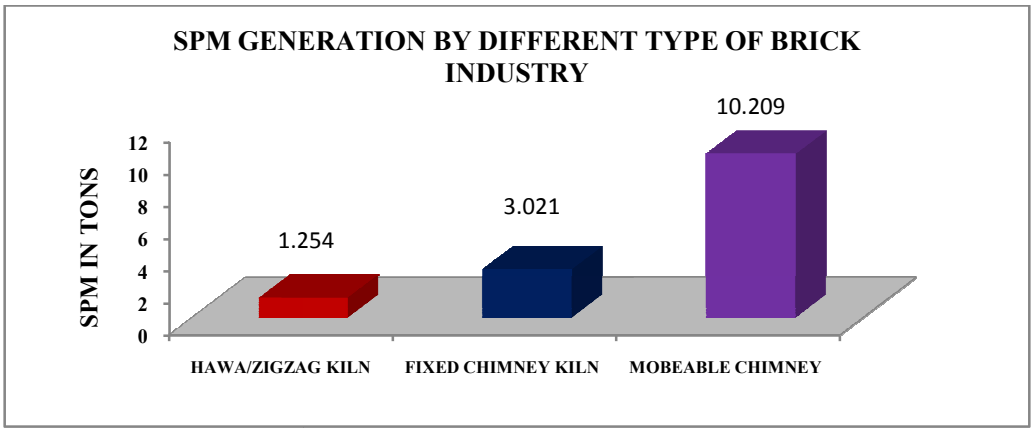

Figure VII.2 *Average amount of SPM generates by different brick industry/Season*

VII.2 Brick Kiln Burning Impact on Surrounding Water Bodies:

The pollutants generate from the function of brick industry travel with air and ultimately fall upon surrounding water bodies and vegetation. Study shows that (data analysis) the releases of the smoke, dust and others suspended materials responsible for the changing water quality of the surface water bodies located close to the brick industry.

The study reveals (Table VII.3) that the water bodies located around 50 -100 meters from any working brick industries have shown the presence of relatively higher level physical properties Like water pH, TDS, EC as well as elements Ca, Mg, Na, P, K and Cl etc. as compared to water bodies located around 150-200 meters away from the any working brick kiln industries.

The average level of the water pH, EC and TDS are higher in the water bodies located around 50-100 meters away from the brick industries (pH 7.63; TDS 493 S/Cm and EC 317.4 Mg/L) as compare to the water bodies located in an around 150- 200 meters away from the working brick kiln industry (pH 7.30; TDS 347.4 S/cm and EC 216.6 Mg/L). Therefore, the study shows that there is variation in the concentration of these physical parameters in the water bodies near and far to the working brick kiln industry.

These physical parameters have higher concentration in the water bodies near to the working brick kilns. Similarly, the average amount of the Na, P, K, Ca, Mg and Cl are higher in the water bodies located 50 -100 meters away from any working brick kiln industry as compared to the water bodies located 150-200 meters away from any working brick kiln industry.

The average amount of the Na, P, K, Ca, Mg and Cl is 28.33 mg/l, 7.59 Mg/L, 8.04 Mg/L, 12.15 Mg/L, 18.25 Mg/L and 12.25 Mg/L in the water bodies located in an around 50-100 meters from any brick kiln industries which is reduced to 23.73 Mg/L, 6.58 Mg/L, 7.16 Mg/L, 10.31 Mg/L, 16.07 Mg/L and 10.96 Mg/L in the water bodies located at 150-200 meters away from any working brick kiln industries.

The average level of change of these parameters with respect to the recorded distances is 4. 82 percent in the pH value, 29.67 percent in the EC, 31.70 percent in the TDS, 16.23 percent in the Na, 13.30 percent in the P, 10.94 percent in the K, 15.14 percent in the Ca, 11.94 percent in the Mg and 10.53 percent in the Cl respectively (Figure VII.3).

Further, the discharge of pollutant materials not only changes the water quality but also affected the aquatic ecosystem (USAID 2003). In addition, the surface clay mining reduced the moisture content in the soil. The excessive pumping of ground water for brick making activities in the indusial site further depleted the ground water level (Santosh, Padmalal, Baijulal and Maya 2012).

Table VII. 3 Changes in Water Quality

WATER SAMPLE COLLECTED FROM 50-100 AWAY FROM THE BRICK INDUSTRIAL BOUNDARY									
SAMPLE	pH	EC(S/cm)	TDS Mg/L	Na Mg/L	P Mg/L	K Mg/L	Ca Mg/L	Mg mg/L	Cl Mg/L
1	7.45	509	320	32.71	5.66	7.85	10.56	20.86	11.64
2	7.55	405	305	30.11	5.38	7.28	10.88	14.40	12.42
3	7.50	556	345	28.34	8.39	8.44	12.72	15.78	12.98
4	7.77	485	298	26.55	9.61	8.76	15.76	21.01	11.47
5	7.67	512	319	23.95	8.92	7.89	10.86	19.22	12.76
MEAN	7.67	493.4	317.4	28.33	7.59	8.04	12.15	18.25	12.25
S. D	0.13	55.66	18.06	3.343	1.942	0.573	2.188	3.012	0.671
SAMPLE COLLECTED FROM 150-200 METER AWAY FROM THE BRICK INDUSTRIAL BOUNDARY									
SAMPLE	pH	EC (S/cm)	TDS Mg/L	Na Mg/L	P Mg/L	K Mg/L	Ca Mg/L	Mg mg/L	Cl Mg/L
1	7.21	359	247	28.71	4.98	7.12	8.22	18.01	10.52
2	7.19	337	152	26.11	5.00	6.98	9.99	12.99	10.75
3	7.31	284	167	22.34	7.93	7.59	10.37	13.87	11.76
4	7.36	381	260	21.55	9.00	7.93	13.87	17.99	11.12
5	7.25	376	257	19.95	6.01	6.21	9.13	17.53	10.67
MEAN	7.30	347.4	216.6	23.73	6.58	7.16	10.31	16.07	10.96
S. D	0.0705	39.399	52.61	3.586	1.806	0.654	2.152	2.444	0.496
Change percent	4.82	29.67	31.7	16.23	13.30	10.94	15.14	11.94	10.53

Source: *Computed by Author 2016*

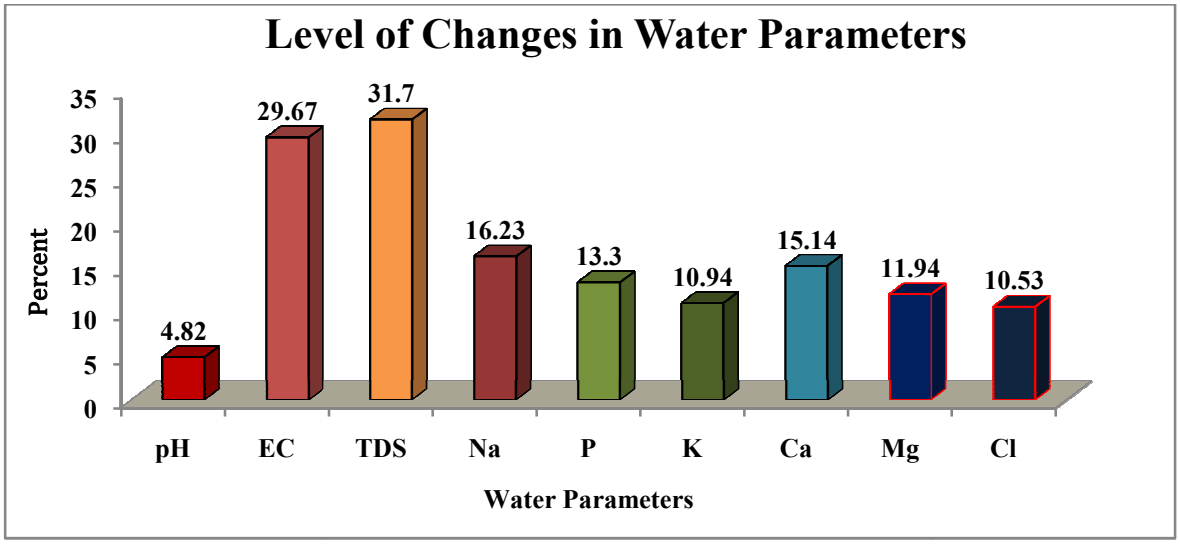

Figure VII.3 *Changes in water parameters with changing distance*

VII.3 Brick industry and its functional impact on Land:

The function of brick industry not only contributes in local air and water pollution but also in soil pollution too. The study shows that the continuous burning of soil in kilns changed the toxic level of soil. The soil of the study area is generally neutral to alkaline in nature (TableVII.4). The brick kiln burnings has changed the characteristics of the soils. The basic and alkaline soils turned into mild toxic or acidic soil. The average pH value of the unburnt soils of Berhampore block is 7.85 which are very near to the neutral soil (pH 7.0). Similarly, the soil of Domkal and Murshidabad – Jiagang is alkaline in nature. The percentage of change in soil toxicity (increase in acid level) due to the kiln burnings differs from block to block.

The maximum change in soil toxic level due to kiln burning is recorded in Murshidabad-Jiagang block (41.34 percent), followed by Domkal block (37.50 percent) and Berhampore block (30.76 percent) respectively

Table VII. 4 Level of Changes in Soil Toxicity

Blocks Name	Mean pH of kiln side/un-burn soil	Mean pH of kiln Burnt Soil	percent of Changes in pH level
Berhampore	7.85	5.45	30.76
M – J block	8.78	5.15	41.34
Domkal	8.56	5.35	37.5

Source: *Data compiled by Author 2016*

VII.3.1 Top soil quarrying effect on the quality of Agricultural Land:

Like kilns burning, brick industrial top soil quarrying activities have significant adverse effect on changing physical and chemical characterstics of the agricultural soil. The removal of surface top layer of agricultural land has changed relative depths of top soil, it is also reduced the total available area of agricultural land. Similarly, the availability of

soil chemical like soil pH, soil Nitrogen, soil Phosphorus and soil Potassium also adversely affected due to top soil quarrying.

VII.3.2 Depth and Areas of Land used for top soil quarrying:

The depth of top soil quarrying land and areas of agricultural land uses by the individual brick industry varies from block to block and industry to industry. The average depths of top soil quarrying land in Berhampore block is about 3.56 feet/108.5cm. Similarly the average depth of top soil quarrying land in Murshidabad-Jiagang block is about 4.46 feet/135.94cm. In addition, the average depth of the top soil quarrying land in the Domkal block is about 5.26 feet/160.32cm (Table VII.5).

The study also shows that the average area of land uses for top soil quarrying by the individual brick industry entirely depends on their average seasonal/annual production capacity. Thus the average amount of land uses by a typical movable kiln chimney brick industry for top soil quarrying ranges from 0.14 hectare to 0.20 hectares. But the highest area of land uses by a typical movable chimney brick kiln is recorded in Berhampore block (0.20 hectare) and the lowest is recorded in Domkal block (0.14 hectare).

Similarly, the average amount of land uses by a fixed kiln chimney brick industry for top soil is ranges from 0.18 hectare to 0.27 hectares. The highest area of land uses by a fixed chimney kiln brick industry is recorded in Berhampore block (0.27 hectare) and the minimum is recorded in Domkal block (0.18 hectare).

In addition, the area of land uses by Hawa/zig-zag kiln industry ranges from 0.23 hectares to 0.34 hectares and the highest area of land uses by a Hawa/Zigzag chimney kiln industry again recorded in Berhampore block (0.34 hectare) and minimum is recorded again in Domkal block (Table VII.5).

Table VII.5 Areas (ha) degraded by the each brick industry/ season

Blocks	Depth of topsoil quarrying land	Industry Type	Production (lakhs)	Land used	
				(Ha)	Acre
Berhampore	3.56feet= 108.5cm (S.D 0.84)	Moveable	12	0.20	0.51
		Fixed	16	0.27	0.68
		Hawa/zigzag	20	0.34	0.85
M. J Block	4.46feet=135.94cm (S.D 0.70)	Moveable	12	0.16	0.41
		Fixed	16	0.22	0.54
		Hawa/zigzag	20	0.27	0.68
Domkal	5.26feet=160.32cm (S.D 0.36)	Moveable	12	0.14	0.34
		Fixed	16	0.18	0.46
		Hawa/zigzag	20	0.23	0.58

Source: *Field Work 2016*

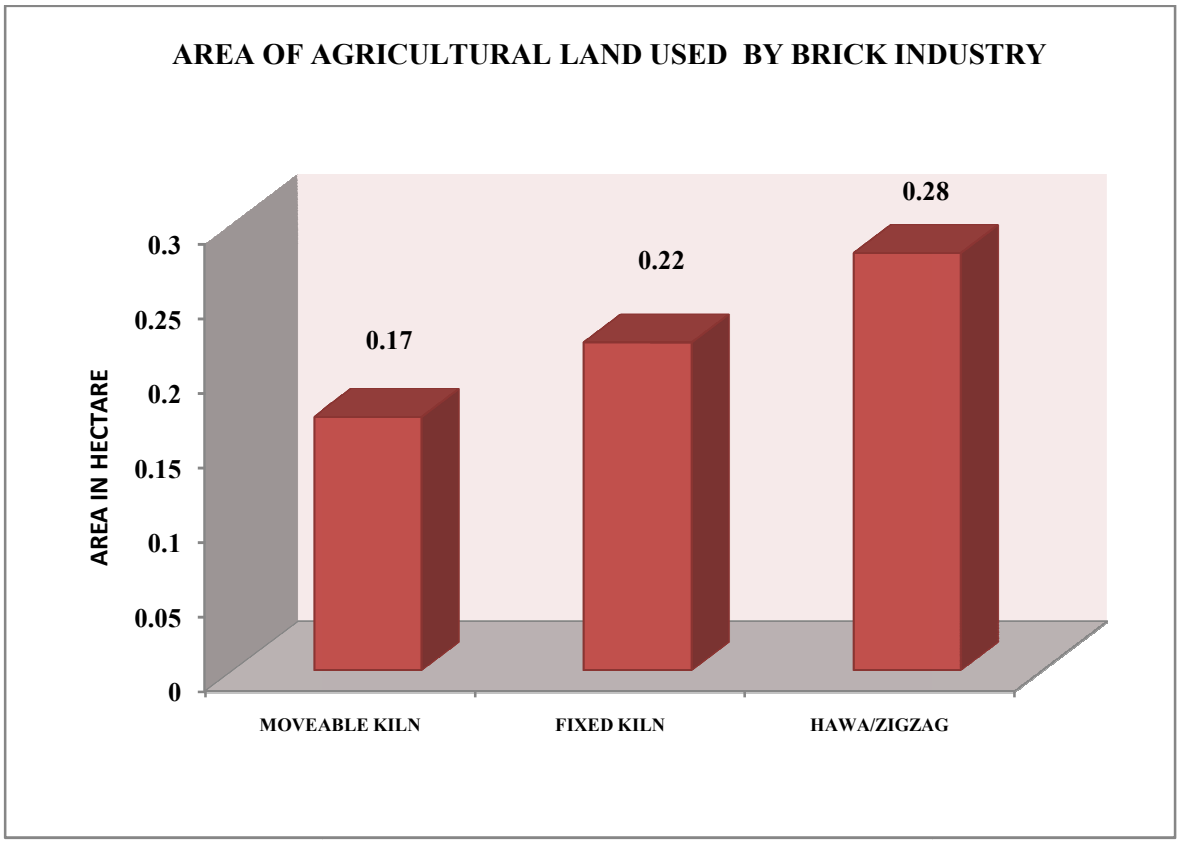

Figure VII.4 *Average amount of land degraded by each type of brick industry*

VII.3.3 Brick Industrial Top Soil Quarrying and Changes in Soil Fertility Status:

The top soil quarrying activity on agricultural land has adversely affected the fertility status of agricultural land in the study area. The important soil elements (fertility determinants) like soil pH, soil Nitrogen, soil Phosphorus and soil potassium are adversely affected in the soil due to top soil quarrying. Therefore, estimation of loss of these elements due to top soil quarrying helps to determine the level of damage has been done by the industry by conducting soil quarrying activity. In this section of study also tries to understand how land characteristics have changed due to top soil quarrying.

VII.3.3.1 Changes in soil pH level in the study area:

Soil pH refers to the presence of hydrogen ions in the soil water system (Jackson 1973). The availability of pH is determined the nature of clay material and natural substance. The soil has a relatively higher amount of clay material represents pH 7.00 and above level (neutral point). Similarly, soil having a little amount of clay and minerals represents less than 7.00 pH level. The availability of pH in soil is determined the fixation of various plant supporting elements like phosphorous, potassium, magnesium, calcium, aluminium, zinc, iron and others. The soil pH would help to determine the nature of the soil, whether it is acidic or basic and also have an impact on the availability of nutrients and plants (Hesse 1994). The study shows that the brick industrial top soil quarrying activities has changed the soil pH to a significant extent. The table (VII.6) shows that the average pH value of the agricultural soil of the study area lies between 7.36 (Berhampore) to 8.20 (Domkal). But pH value has increased on an average up to 9.42 after top soil quarrying land on the same land. Therefore, top soil quarrying activities is responsible for increasing the soil pH value by twenty five percent in the study area.

Similarly, the soil pH level in the study blocks also varies from one another. Average soil pH value in Berhampore is 7.36 which increased to 9.53 after top soil quarrying. In addition, the average soil pH value in Domkal is 8.20 which is increased to 9.53 after top soil quarrying in Domkal block. Further, average soil pH value of agricultural soil in Murshidabad-Jiagang is 7.43 which is increased to 9.67 after top soil quarrying.

Therefore, highest changes in soil pH due to top soil quarrying by brick industries recorded in Murshidabad- Jiagang (M. J block). The minimum changes in soil pH recorded in Domkal block (16.21 percent). Similarly, a moderate change in soil pH value recorded on the top soil quarrying land of Berhampore block (27.98 percent).

Table VII.6 Show the Changes in pH value in the soil of study blocks, District Murshidabad

Block name	Sample Number	Depth of quarrying land (fts)	Agricultural field Soil pH	Quarrying Field Soil pH	Mean of Agri. Field Soil pH value	Mean of Quarrying field soil pH	% of change in pH after top Soil Quarrying
Berhampore	I	3.0	7.55	9.27	7.36 (S.D 0.38)	9.42 (S. D 0.34)	27.98
	II	3.5	7.62	9.37			
	III	3.8	6.70	9.70			
	IV	5.0	7.17	9.77			
	V	2.5	7.77	8.99			
Domkal	I	5.7	8.60	9.99	8.20 (S.D 0.59)	9.53 (S.D 0.63)	16.21
	II	5.2	8.71	9.87			
	III	4.7	8.57	8.92			
	IV	5.3	8.05	9.12			
	V	5.4	7.11	9.78			
Murshidabad-Jiaganj	I	5.0	7.48	9.89	7.43 (S.D 0.17)	9.67 (S. D 0.25)	30.14
	II	4.7	7.59	9.81			
	III	5.0	7.17	9.90			
	IV	4.5	7.37	9.52			
	V	3.1	7.57	9.27			

Source: *Data compiled by Author*

VII.3.3.2 Changes in soil Nitrogen in the study area:

The soil nitrogen is the organic fraction of the soil. The amount of mineral nitrogen is small as compared with the organic fraction. Soil nitrogen is an organic matter come through the complex channels and microorganism activities from the air to plants. Almost all nitrogen is concentrated up to a depth of 20 cm from the top in all soil or in the upper horizon of soil (Stevenson 1994). The life processes of the plants, as well as deficiency of other elements like phosphorous, potash, calcium, and manganese are supplemented with nitrogen (Mongi, Majule and Lyimo 2010). Therefore, nitrogen is an important element of soil which helps in fullfil the deficiency of other plant supporting elements. Such crucial plant supporting element is drastically changed in agricultural soil after top soil quarrying in the study area.

The table (VII.7) shows that the average amount of soil nitrogen in the study area is 120.2 Kg/Ha. But after top soil quarrying it is reduced to 85.2 kg/ha. In addition to it the amount of soil nitrogen also varies from block to block in the study area. The average amount of soil nitrogen in Berhampore block is about 119.7 Kg/Ha. Similarly the average amount of soil nitrogen in Domkal block is about 149.8 Kg/Ha. Further the average amount of soil nitrogen in Murshidabad-Jiagang block is about 118.2 Kg/Ha respectively. But the amounts of Nitrogen significantly dropped after top soil quarrying into 86.0 Kg/Ha in Berhampore, 92.6 Kg/Ha in Domkal and 83.0 Kg/Ha in Murshidabad – Jiagang block respectively. The maximum loss of nitrogen due to brick industrial quarrying is recorded in Domkal block that is (38.16 percent) followed by the Murshidabad- Jiagang (29.78 percent) and Berhampore (28.15 percent) respectively.

Table: VII.7 Changes in Available amount of Soil Nitrogen after Top Soil Quarrying

Block name	Sample Number	Depth of quarrying land (feet's)	Agricultural field Soil Nitrogen (Kg/Ha)	Top Soil Quarrying field Soil Nitrogen (Kg/Ha)	Mean of Agri. Soil Nitrogen (Kg/Ha)	Mean of top soil Quarrying field Nitrogen (Kg/Ha)	% of change in Nitrogen after Top Soil Quarrying
Berhampore	I	3.0	117	92	119.7 (S.D 3.21)	86.0 (S.D 6.41)	28.15
	II	3.5	118.5	84			
	III	3.8	126	80			
	IV	5.0	119	79			
	V	2.5	118	95			
Domkal	I	5.7	130	99	149.8 (S.D 7.93)	92.6 (S.D 3.61)	38.18
	II	5.2	128	90			
	III	4.7	157	89			
	IV	5.3	160	91			
	V	5.4	174	94			
Murshidabad- Jiagang	I	5.0	116	85	118.2 (S.D 2.78)	83.0 (S.D 2.60)	29.78
	II	4.7	115	80			
	III	5.0	117	81			
	IV	4.5	122	82			
	V	3.1	121	87			

Source: *Data computed by Author, October 2016*

VII.3.3.3 Changes in Soil Phosphorus in the study area:

The Phosphorus is another important element of soil. It plays a vital role in determining the soil quality in terms of fertility. Phosphorus plays an important role in the processes of photosynthesis, to synthesis and breakdown of carbohydrates. Finally, it transformed all these into plants as energy. Phosphorus also helps in nutrient uptake and translocation processes in cell transformation and heredity characteristics from plants to plants. Almost half or more soil phosphorus is present in "A horizon" in the form of organic matter (Stevenson 1994). Mainly four forms of Phosphorus namely the soil solution, organic soil constituents, in mineral forms and soil organic matter available in the nature.

The study (Table VII.8) shows that the average amount of soil phosphorus in the study area is 19.57 Kg/Ha. But after top soil quarrying it is reduced to 12.92 kg/ha. In addition, the amount of soil phosphorus also varies from block to block in the study area. The average amount of soil phosphorus in Berhampore block is about 22.40 Kg/Ha. Similarly the average amount of soil phosphorus in Domkal block is about 16.44 Kg/Ha. Further the average amount of soil phosphorus in Murshidabad-Jiagang block is about 20.98 Kg/Ha respectively. But, the amount of phosphorus is significantly dropped after top soil quarrying to 14.22 Kg/Ha in the Berhampore, 11.54 Kg/Ha in Domkal blocks and 13.06 Kg/Ha in Murshidabad – Jiagang block.

Study further shows that average loss of soil phosphorus due to top soil quarrying in study are as whole is 34.06 percent whereas maximum loss of soil phosphorus recorded in Murshidabad- Jiagang block (37.75 percent), followed by Berhampore (36.51 percent) and Domkal (29.56 percent) respectively.

Table VII.8 Changes in the Available amount of Soil Phosphorus after Top Soil Quarrying

Block name	Sample number	Depth of quarrying land (feet's)	Agricultural Soil Phosphorus (Kg/Ha)	Top Soil Quarrying field Soil Phosphorus (Kg/Ha)	Mean of Agri. Soil Phosphorus (Kg/Ha)	Mean of top soil Quarrying field Phosphorus (Kg/Ha)	% of change in Phosphorus after Top Soil Quarrying
Berhampore	I	3.0	21.0	15.0	22.40 (S.D 1.60)	14.22 (S.D 1.18)	36.51
	II	3.5	22.0	14.0			
	III	3.8	25.0	13.5			
	IV	5.0	23.5	12.6			
	V	2.5	20.5	16.0			
Domkal	I	5.7	14.8	10.8	16.44 (S.D 1.16)	11.58 (S.D 0.78)	29.56
	II	5.2	15.8	11.0			
	III	4.7	16.1	11.3			
	IV	5.3	17.5	11.8			
	V	5.4	18.0	13.0			
Murshidabad – Jiagang	I	5.0	20.5	12.7	20.98 (S.D 1.33)	13.06 (S.D 0.68)	37.75
	II	4.7	19.8	13.1			
	III	5.0	23.0	12.0			
	IV	4.5	22.0	13.5			
	V	3.1	19.6	14.0			

Source: *Data compiled by Author,*

VII.3.3.4 Changes in Soil Potassium in the study area:

Potassium is a major component of the earth's crust and important element of plants growth. The earth lithosphere has 1.9 percent potassium, but agricultural soil has 1.2 percent potassium due to weathering (Stevenson 1994). Potassium is necessary for numerous basic physiological functions like cell division, growth of cells and neutralization of organic acids, formation of sugars and starch, protein synthesis. Potassium helps to reduce the effects of adverse weather conditions like drought, cold, and flooding on plants. The deficiency of potassium could results the reduction of crop quality and yields (Hesse 1994).

Such critical plant supporting element is significantly changed in the agricultural soil after top soil quarrying in the study area. Study (Table VII.9) shows that the average amount of soil potassium in the study area is 120.2 Kg/Ha. But after top soil quarrying it is reduced to 85.2 kg/ha. In addition, the amount of soil potassium also varies from block to block in the study area. The average amount of soil potassium in Berhampore block is about 54.38 Kg/Ha.

Similarly the average amount of soil potassium in Domkal block is about 35.28 Kg/Ha. Further the average amount of soil potassium in Murshidabad-Jiagang block is about 51.52 Kg/Ha respectively. But the amounts of potassium significantly falls after top soil quarrying into 30.66 Kg/Ha in Berhampore block, 26.00 Kg/Ha in Domkal block and 33.82 Kg/Ha in Murshidabad – Jiagang block respectively. Study further reveals that the maximum loss of potassium due to brick industrial quarrying is recorded in Berhampore block (43.18 percent), followed by Domkal (36.29 percent) and Murshidabad-Jiagang block (29.56 percent) respectively.

Table VII.9 Changes in the Available amount of Soil Potassium after Top Soil Quarrying

Block name	Sample number	Depth of quarrying land (feet's)	Agricultural field Soil Potassium (Kg/Ha)	Top soil Quarrying field soil Potassium (Kg/Ha)	Mean of Agri. Soil Potassium (Kg/Ha)	Mean of top soil Quarrying field Potassium (Kg/Ha)	%of change in Potassium
Berhampore	I	3.0	48.7	32.0	54.38 (S.D 7.46)	30.66 (S.D 2.74)	43.18
	II	3.5	49.7	31.6			
	III	3.8	69.0	28.5			
	IV	5.0	53.0	26.7			
	V	2.5	51.5	34.5			
Domkal	I	5.7	31.9	25.0	35.28 (S.D 4.22)	26.00 (S.D 0.78)	26.30
	II	5.2	31.7	25.3			
	III	4.7	33.3	25.8			
	IV	5.3	36.5	27.0			
	V	6.0	43.0	26.9			
Murshidabad-Jiagang	I	5.0	49.1	32.5	51.52 (S.D 3.84)	33.82 (S.D 1.59)	36.29
	II	4.7	47.6	33.4			
	III	5.0	57.0	31.9			
	IV	4.5	55.6	35.2			
	V	3.1	48.3	36.1			

Source: *Data compiled by Author*

Findings and Discussion

From the above discussion it is safely stated that the function of brick industries is responsible for generation and discharge of huge amount of carbon dioxide and suspended particulate matters into the local atmosphere every season (Pandey 1997; Joshi and Durani 2008). The quantity of pollution generates form the brick industries are varied from one another. A movable kiln chimney is responsible for highest quantity of pollution and generation and discharge into local atmosphere as compare to fixed chimney and Hawa chimney (Baum 2010). The discharge of such huge quantity of pollution load within small area affects the local water bodies, air and environment. The pollutants in the form of dusts, fumes, shoots etc. travel by air and affects the water bodies located close to industries. The study further shows that the addition of such pollutant materials changed the physical as well as chemical characterstics of surrounding water bodies.

Study further demonstrates that the kiln burning is responsible for significant changes in soil toxic level (Khan, Rahaman, Rouf, Sattar, Oki and Adachi 2007). Maximum changes in soil toxic level due to kilns burning are recorded in Murshidabad- Jiaganj blocks. Like kiln burning, brick industrial top soil quarrying also responsible for degradation of considerable areas of agricultural land as well as depletion of soil pH, soil Nitrogen, phosphorus and soil potassium (Khan, Rahaman, Rouf, Sattar, Oki and Adachi 2007). The top soil quarrying activity changed the physical feature of the agricultural land like depth, altitude and orientation etc. The average depth of the topsoil quarrying land in the study area lies in between 3.0 feet to 6.6 feet. The highest average depth of topsoil quarrying land is recorded in Domkal block that is 5.26 feet.

Study further demonstrated that the top soil quarrying activity responsible for significant changes in soil pH. The study found that the soils of the study area are very much neutral in nature and its value lies in between 7.36 – 8.20. But the top quarrying activity has significantly raised the soil pH level. It is also found that the removal of top soil layer for brick industrial use has turned the soil into basic to strong basic. The study also found that there is a positive relationship existed between the increasing depth of quarrying ground and the availability of soil pH. The deep quarrying of soil on agricultural land is responsible for extreme change of soil pH (beyond 9.0 or above). Highest change in soil pH due to top soil quarrying is recorded in Murshidabad- Jiagang block.

Likewise soil pH the availability of soil nitrogen also depleted in the agricultural land due to top soil quarrying. The average amount of Nitrogen in the soil of the study area is about 129.23 Kg/Ha. But top soil quarrying is responsible to reduce the average amounts of nitrogen to 87.03 Kg/ Ha. The highest loss of Nitrogen recorded in Domkal block (38.16 percent).

Similarly, higher average amount of soil Phosphorus recorded in Berhampore block that 22.40 Kg/Ha, but the highest loss of soil Phosphorus recorded in Murshidabad –Jiagang block (37.75 percent). In addition, the average amount of soil Potassium in the agricultural soil of Berhampore is 54.38 Kg/Ha, followed by Murshidabad-Jiagang 51.52 Kg/Ha and Domkal is 35.28 Kg/Ha. But maximum losses of potassium due to the top soil recorded in Berhampore block (43.18 percent). Therefore, the top soil quarrying adversely affects the availability of important soil elements which is adversely affected the agricultural practices.

VII.4 Brick Industrial Impact on Agricultural Practices

As we found that the function of brick industries is responsible for degrading agricultural land and depleting the agricultural soil fertility in the study area due to top soil quarrying. We had also found that the top soil quarrying activities significantly changed the physical characterstics of agricultural land like depth, relative altitude, orientation etc as well as drastically changed the availability of crop supporting nutrients elements like soil nitrogen, phosphorus and potassium.

The change in soil characterstics; physical and chemical has changed the crops suitability and yields of crops in the study area. To examine the impact of top soil quarrying on changing crops suitability in the study; total number of crops was cultivated by respondents on their agricultural land before top soil quarrying and number of crops cultivates on same land after top soil quarrying use as indicator.

The percentage of change in crops suitability in the study area due to top soil quarrying is calculated by considered the total number of crops cultivated by the respondents minus number of crops cultivates after top soil quarrying, multiplied by hundred. Similarly, the change in crops yields due to top soil quarrying in the study area we have measured the changes in yields of only common crops.

Here we considered rice, wheat and jute as common crops because almost all respondents used to cultivate these crops before top soil quarrying and still cultivates these crops on their land. In addition to determine the change in agricultural land value due to top soil quarrying in the study area; market value per unit of agricultural land in area, and market value per unit of top soil quarrying land in the study area are used.

VII.4.1 Agricultural Background of the Study Area, District Murshidabad

Agriculture is one of the important sector of economy and source of livelihood for the people of district. Above 85 percent district's population lives in village and directly or indirectly involves in agriculture for livelihood (District Statistical Handbook 2012). In addition to it agriculture sector constitutes about 40 percent of Net District Domestic Product (Sau 2009). Total Net Shown Area (NSA) in the district is about 395958 hectares which is about 74.36 percent of total geographical area. Similarly total net shown area in the study blocks are 71.67 percent in Berhampore, 85.11 percent in Domkal and 73.09 percent in Murshidabad – Jiagang respectively. Therefore, share of NSA is quite high in Domkal block as compare to district (Table VII.10).

Table VII.10 Net Shown Area

Name	Total Geographical area (Ha)	Net shown area (Ha)	Share in percentage
Berhampore	32571	23343	71.69
Domkal	30427	25897	85.11
Murshidabad- Jiagang	20700	15129	73.09
Murshidabad	532499	39598	74.36

Source: *Compiled by Author, after taken from District Statistical Abstract (2012) and Directorate of Agriculture, Socio-economic and Evaluation Branch (2012) Government of West Bengal*

VII.4.1.2 Land holding size

The size of land holding is an important determinant of agriculture land use. The size land holding is declining in the state of West Bengal as well as in the district of Murshidabad day by day due to rapid population growth, inherent property laws and successful implementation of Land reforms acts like West Bengal Bargadary rule 1950, the West Bengal landholding Revenue Acts 1979 and the revenue Rules 1980 etc. All these factors singularly or collectively limit the successful utilization of land. It is evident that farmers with large holdings tend to be highly mechanized and commercial whereas

farmers with small landholding tend to be subsistence. Therefore, land ownership, size of land holding and land tenancy are important aspect of agricultural development. The average size of landholding in the district as well as in the study blocks of Berhampore, Domkal and Murshidabad-Jiagang are 0.73, 0.53, 0.80 and 0.74 hectare respectively. Similarly, size of marginal land holding in the district as well as in the study blocks are 0.48, 0.46, 0.56 and 0.52 hectare respectively. In addition, the size small land holding in holding in the district as well as in the study blocks are 1.61, 1.30, 1.49 and 1.29 hectares. Study further shows that the size of semi medium land holding in the district as well as in the study blocks are 4.23, 2.38, 2.46 and 2.59 hectares respectively. Study further demonstrates that the size medium holding in the district as well as in the study blocks are 5.06, 7.34, 4.79 and 5.10 hectares respectively (Table VII.11). The study reveals very interesting fact about the size and share of land holding in the district of Murshidabad as well as study blocks are as follow;

- Share of marginal holds is very high in the district as well as in the study blocks.
- Share of small holds is higher in Domkal and Murshidabad-Jiagang is quite high as compare to district but size of holds in smaller than district average.
- Share and size of holds both are well below in the study blocks as compare to district.
- Share of medium farmers also low in the study blocks but size of holds is higher in Berhampore and Murshidabad – Jiagang compare to the district but share of large holding is absent in the study blocks whereas district has one percent large holds.

Table VII.11 Share and Size of Land holding in the Study Blocks and District

Farmers Categories	Murshidabad		Berhampore		Domkal		Murshidabad - Jiagang	
	Share of holding (%)	Average Size of holding (Ha)	Share of holding (%)	Average Size of holding (Ha)	Share of holding (%)	Average Size of holding (Ha)	Share of holding (%)	Average Size of holding (Ha)
Marginal (Below 1 hectare)	78.58	0.48	93.26	0.46	78.58	0.56	73.55	0.52
Small (1.0< 2.0 hectares)	15.85	1.61	5.24	1.30	19.93	1.49	25.77	1.29
Semi medium (2.0 < 4.0 hectares)	4.23	2.70	1.36	2.38	1.98	2.46	0.64	2.59
Medium (4.0< 10.0 hectares)	0.35	5.06	0.13	7.34	0.23	4.79	0.09	5.10
Large (10< 20 Hectares)	0.9	11.10	0.7	N.A	0.00	N.A	0.00	N. A
Total	100	0.73	100	0.53	100	0.80	100	0.74

Source: *Compiled by Author, taken from Agriculture Census 2011-12, District Statistical Handbook 2012*

VII.4.I.3 Agricultural Cropping Pattern in the Study Area

The cropping pattern refers the proportion of the area under various crops at a point time and it's governed by the law of comparative advantages in the agro climatic conditions (Bhattacharyya 2008). The change in cropping pattern means, changes in the share of area under different crops at a given point of time in a particular area/region. The cropping pattern in any region is mainly influenced by the demands of that particular crop in the market, size of land holding, status of soil fertility, level of irrigation, the market price of that particular crop and the differences among the farmers' perception towards the agricultural practices and the level of technological application/mechanization on the farm. In addition, the cropping pattern of a region is also controlled by the area's geo-climatic, technological advancement and institutional factors (Shafi 2000).

Among the geographic factors; terrain, topography, soil characteristics and slope of the area and climatic factors like; temperature and amount of precipitation are the main determinants to grow certain crops in an area/ region. The technological factors like level of irrigation facilities, Improved Varieties Seeds (IVS), chemical fertilizers, etc. and the institutional factors like size of land holdings, farm mechanisms and credit market facilities are the important determinants of area's cropping pattern.

Besides the above-mentioned factors; geo-climatic characteristics and institutional issues shaped the cropping pattern in the district Murshidabad. The agricultural practices in the district are intensive subsistence in nature. The seasonal variation in the agricultural practices/cropping is/are also very much pronounced in the District. The two main cropping seasons observed round the year in the districts; *Kharif* and *Rabi* seasons. The Kharif seasonal cropping practices are mainly influenced by the *South-West Monsoon*. The paddy, jute maize and monsoonal vegetable like brinjal,

chili, lady finger are the main *Kharif* crops grown in the district of Murshidabad. The Rabi season covers the months of October to the end of March. Wheat, barley, potatoes, pulses, oilseeds and other winter seasonal vegetables like cabbage, cucumber, cauliflower etc. are grown in *Rabi* season.

Besides these two main cropping seasons; there is another short duration summer cropping season also observed in the district Murshidabad which is popularly known as *Zaid* cropping season. Very limited crops grown during *Zaid* season with the help of irrigation. The *Amon Dhan* (Paddy cultivated in Zaid season with the help of irrigation) cucumbers, watermelons, vegetables and fodders grown during the Zaid season in the Murshidabad district.

Like district, study blocks (Berhampore, Domkal and Murshidabad- Jiagang) are the part of the *Bagri* region located in interfluve of the river Bhagirathi and Ganga/Padma. The soil of these blocks are generally light alluvial with recent deposits of the river Ganga/Padma and its tributaries consist of silts, sand and gravels. The annual inundation during floods, soil receives the fresh silt deposit every year. The fresh deposition of silts makes the study block's soil very fertile and suitable for the variety of crop cultivation (Bairagaya 2013). The high population density, lack of industrialization, poor standard of living, the small size of land holding forces the farmers to utilize each and every bit of land. Therefore, intensive subsistence agriculture is witnessed in the study blocks. The major crops cultivated in the study blocks are paddy (two types, i.e. in winter paddy popularly known as *Boro Dhan*[51], Monsoonal paddy is known as *Aush Dhan*[52]), wheat, jute, oilseeds (mustard in winter, til in summer), pulses (*masur*, *khasari*, *gram* in winter *maskalai* in summer), potatoes, onion, chili, brinjal, folders and different types of seasonal vegetables. The paddy,

[51] *Boro Dhan*- Paddy cultivated in the winter season.
[52] *Aush Dhan* –Paddy cultivated in the monsoon.

wheat and jute are intensively cultivated in the study blocks. The jute is the only cash crops cultivated in the study blocks. But, after brick industry came into existence in the study area, industries starts use of agriculture land for top soil quarrying. As a result, the crop suitability as well as yield of crops significantly affected due to its functional activities.

VII.4.2 Changes in Crops Suitability:

Crops suitability is an important component of assessment of changes of crops cultivation under the specific – condition. Here we try to understand the changes in number of crops cultivation on the top soil quarrying lands in the study area. The study (Table VII.12) shows that the crop suitability has substantially reduced on top soil quarrying agriculture land.

The average number of crop cultivated on (samples) agricultural land in the study blocks was 5 crops in all three study blocks. But after top soil quarrying the number crops cultivation of that particular land has reduced to 3 crops in all three study blocks. The overall change in crop suitability due to top soil quarrying in study area is about 40 percent.

Here it is important to note that the brick industrial quarrying activity made the land unfit for the major crops like jute and wheat. Those farmers are cultivating jute and wheat after top soil quarrying the input cost is significantly increased.

As a result profit from the cultivation of these two crops severely decreased. Therefore, it is very clear from the study that the top soil quarrying activity of brick industries responsible for significantly reduced the crop suitability (on the samples agricultural land) in the study area (Table VII.12).

Table VII.12 Changes in the crop suitability

Name of the blocks	Crops cultivated before soil quarrying	Crops cultivate after top soil quarrying
Berhampore	5	3
Murshidabad Jiagang	5	3
Domkal	5	3
Total	5	3

Source: Field Work 2016

VII.4.3.1 Changes in Rice Yields:

Rice is the main staple food crop cultivate in the study area. The study area witness mainly two rice seasons in year namely summer rice (April - September) and winter rice (October – March). There are also few pockets where another rice crop is cultivated with help of irrigation in between the two (summer & winter) rice seasons. The agro climatic condition of the study area is favourable to grow the rice crops by putting less effort. The study (Table VII.13) shows that the average yields of rice in the study area are about approximately eight quintals per bigha. But, the loss of crops supporting top fertile layer due to brick industrial quarrying activity has significant adverse impact on rice yields in the study area. The average yields of rice dropped to approximately six quintals per bigha after top soil quarrying. Similarly, study reveals that the average yield of rice in Berhampore block is about 7.81 quintals per bigha which is reduced to 6.00 quintals per bigha after top soil quarrying. In addition to it study also shows that the average yield of rice in Murshidabad - Jiagang block is about 7.86 quintals per bigha which is decreased to 6.02 quintals due to change in soil characterstics induced by the brick kiln quarrying activity. Study further shows that the average yield of rice in Domkal block before top soil quarrying was about 7.90 quintals per bigha and it is decreased to5.98 quintals per bigha due to loss of top fertile layer. Average loss of rice yields recorded is about 23.58 percent in the study area. The maximum loss of rice yield is recorded in Domkal block (24.24 percent) in Domkal block, followed by Murshidabad- Jiagang (23.34 percent) and Berhampore

block (23.16 percent). Study also reveals in order to makes top soil quarrying land suitable for rice cultivation; the total cost of inputs in the form of fertilizers, manures etc. increases total expenditure whereas the fall of yields significantly reduce the profit margin.

Table VII.13 Changes in Rice yields after top soil Quarrying

Name of the Blocks	Yields before top soil quarrying	Yields after top soil quarrying	Percentage of changes
Berhampore	7.81	6.00	23.16
Murshidabad Jiagang	7.86	6.02	23.34
Domkal	7.90	5.98	24.24
Total	7.85	6.00	23.58

Source: *Data computed by author*

VII.4.3.2 Changes in Wheat Yields:

Like rice, wheat is another important common but second staple food crop cultivated by the farmers of Murshidabad. It is cultivate in winter and known as Rabi crop. The agro climatic condition of the study area is also playing important role to grow the wheat crop. The study shows that the yields of wheat on the top soil quarrying land has decreased significantly and become less profitable. The average yield of wheat in the study area is about 3.74 quintals per bigha. Similarly, the average yield of wheat in Berhampore block is about 3.74 quintals per bigha. In addition to the average yield of wheat in Murshidabad - Jiagang block is 3.81 quintals per bigha. Further, study shows that the average yield of wheat in Domkal block is 3.68 quintals per bigha.

But the yields of wheat significantly decreased to due to top soil quarrying by the brick industries in the study area. The average yield of wheat is dropped to 2.89 quintals per bigha in after top soil quarrying. Similarly, study also shows that the average yield of wheat is dropped to 2.79 quintals per bigha in Berhampore block. In addition to it the average yield of wheat is decreased to 2.92 quintals per bigha in Murshidabad - Jiagang. Further, study reveals that the average yield of wheat dropped

to 2.96 quintals per bigha in Domkal block. Therefore, the top soil quarrying activity is responsible for decreased the yield of wheat about 22.78 percent in the study area. The maximum loss of wheat yield is recorded Berhampore block, followed by Murshidabad – Jiagang and Domkal (Table VII.14).

Table VII.14 Changes in Wheat yields after top soil Quarrying

Name of the blocks	Yields before top soil quarrying	Yields after top soil quarrying	Percentage of change
Berhampore	3.74	2.79	25.40
Murshidabad Jiagang	3.81	2.92	23.22
Domkal	3.68	2.96	21.30
Total	3.74	2.89	22.78

Source: *Data compiled by the author*

VII.4.3.3 Changes in Jute Yields:

Jute is an important crop cultivated in the district of Murshidabad. It is the only cash crop extensively cultivated in the Bagri region of the district. The district is one of the major suppliers of jute fibre for jute mills in the state of West Bengal. The jute fibre popularly called as 'golden thread' for its scenic beauty. It is cultivated in summer monsoon season. But, the cultivation of jute became very challenging task for farmers on top soil quarrying land due to alteration of land characterstics. The change in physical characterstics like altitude, slope and orientation and loss of important soil nutrients like nitrogen, phosphorus and potassium due to brick industrial top soil quarrying adversely affects the yield of jute in the study area. The study shows that (Table VII.15) average yields of jute in the study area is about 3.81 quintals per bigha. Similarly the average yield of jute in Berhampore block is about 3.72 quintals per bigha. In addition to it the average yields of Jute in Murshidabad- Jiagang block is about 3.87 quintals per bigha. Study further noted that the average yields of jute in the Domkal block is 3.85 quintals per bigha

But, loss of soil fertility due to top soil removal badly affects the yield of jute in the study area. The average yields of jute on soil quarrying land reduced to 2.75 quintals per bigha in the study area. Similarly, the average yields of jute on top soil quarrying land in Berhampore block reduced to 2.83 quintals per bigha. In addition to it the average yields of jute on top soil quarrying land in Murshidabad – Jiagang block reduced to 2.78 quintals per bigha. Further, the average yields of jute on the same samples agricultural land in Domkal block reduced to 2.65 quintals per bigha. Therefore, top soil quarrying/removal activity is responsible for reduced the yields of Jute about 27.75 percent in the study area. Maximum loss of jute yields is recorded in Domkal block (31.18 percent) and minimum loss of jute yields recorded in Berhampore block.

Table VII.15 Changes in Jute yields after top soil Quarrying

Name of the Blocks	Yields before top soil quarrying	Yields after top soil quarrying	Percentage of change
Berhampore	3.72	2.83	23.83
Murshidabad Jiagang	3.87	2.78	28.75
Domkal	3.85	2.65	31.18
Total	3.81	2.75	27.75

Source: *Field Work 2016*

VII.4.4 Changes in Agricultural Land Values:

The agricultural land is an important asset for the rural farmers. The agricultural land value is determined by them considering the nature of land. They always consider quality of soil, relative height of land, slope of land and access to irrigation facility to estimates the value of agricultural land. They are also considered the fact whether the land fit for agricultural practices throughout the year irrespective of seasons. Study

reveals that the average agricultural land prices varied from one *mouza*[53] to mouza. The average agricultural land value in the study mauza's (villages) of Berhampore block is 4.60 lakhs per *bigha*. Similarly, the average agricultural land value in the study mauza's (villages) of Murshidabad- Jiagang block is 4.50 lakhs per *bigha*. In addition to it the average agricultural land value in the study mauza's (villages) of Domkal block is 4.75 lakhs per *bigha*.

But, study shows that after top soil quarrying on agricultural land value is significantly dropped to 3.36 lakhs per *Bigha* in Berhampore block. Similarly, top soil quarrying land value is dropped to 3.32 lakhs per Bigha in Murshidabad- Jiagang block. In addition to it the agricultural land value due to top soil quarrying is dropped to 3.37 lakhs per *Bigha* in Domkal block. The study reveals that the agricultural land value is decreased by 27.3 percent in due to loss of top soil. The maximum loss of agricultural land value is recorded in Domkal block Therefore, the top soil quarrying activity is responsible for significantly decreased the agricultural land value in the district of Murshidabad (Table VII.16).

Table VII.16 Changes in Agricultural Land Value after top soil Quarrying

Name of the blocks	Land value before top soil quarrying (lakhs rupees)	Land value after top soil quarrying (lakhs rupees)	Percentage of change
Berhampore	4.60	3.36	26.9
Murshidabad Jiagang	4.50	3.32	26.2
Domkal	4.75	3.37	29.0
Total	4.61	3.35	27.3

Source: *Field work 2016*

[53] **Mouza**- in India, a **mouza** is a type of administrative district, corresponding to a specific land area within which there may be one or more settlements. The term also referred to a revenue collection unit in a pargana or revenue district.

VII.4.5 Brick Industries and other crops practices:

We seen that the top soil quarrying activity has significant influence on changing crop suitability, yields of common crops cultivated on that land, and land value in the study area. Here we discuss about the experience of cultivation on top quarrying land shared by the different farmers during our field investigation. The respondents informed that the agricultural land of the study area is suitable for multiple crop cultivation. They use to cultivate their land throughout the year. The land keeps engaged in summer (kharif) crops, winter (Rabi) crops as well as intermediate (zaid) crops with the help of irrigation. Therefore, farmers always try to engage their small pieces of land for maximum use throughout the year.

But, after leasing out their land for top soil quarrying their land became unsuitable for a number of crops. Among the total respondents, a quite significant number of the respondents informed that the quarrying activities have an impact on monsoonal summer as well as winter paddy cultivation. Approximately 88 percent respondents reported that top soil quarrying activity has adversely decreased rice yields. About 94 percent respondents reported that the top soil quarrying has substantially raised the cost of rice production and 21 percent respondents reported that during monsoonal rain their field crops gets damaged due to water logging on their land.

Similarly, about 85 percent respondents reported that their wheat crop yields significantly affected due to top soil quarrying. About almost every respondent agreed with fact that the rising of the production cost of wheat due to loss of top fertile layer.

For jute, each and every respondent reported that their standing crop affected due to due to changing relative altitude and slope of their land after top soil quarrying. About 66.6 percent respondents reported that their jute crop gets damaged due to water logging during monsoonal rain. About 97 respondents reported that the loss of top

fertile soil has a dramatic negative impact on yield and rising production cost of jute. In addition to it about 76 percent oilseeds, 54.5 percent pulses and 42 percent potato cultivators reported that their crops affected due to top soil quarrying. About 91 percent oilseeds, 48.4 percent pulses and 39.3 percent potato cultivators reported that their crops yield dramatically affected due to loss of fertile top soil.

Every respondent has reported that due to brick industrial quarrying their land became unfit for cultivation of chill in both the seasons' summer as well as in winter. Study further recorded that the crops like onion, brinjal and green vegetable severely affected due to the removal of topsoil by the brick industry. Study further shows that other crops like onion (87.9 percent), brinjal (93.9 percent) and seasonal green vegetables (87.8 percent) yields are decreased significantly one hand on the other hand it increased the inputs cost of production of these crops are rising dramatically. As a result margin of profits equally dropped.

Table VII.17 Farmer's perception about the negative impacts of brick industrial quarrying on agricultural activities

Crops	Total Number of Respondents = 60 Percentage of respondents agreed with the effects of Brick Industrial quarrying on following crops and agricultural practices.				
	Summer season	**Winter season**	**Crops damage**	**Changes in yields**	**production cost increase**
Paddy	81.8	60.6	21.2	87.8	93.9
Wheat	NA	84.8	NA	81.8	100
Jute	100	NA	66.6	96.9	100
Oilseed	NA	75.7	NA	90.9	93.9
Pulses	NA	54.5	NA	48.4	36.6
Potato	NA	42.4	NA	39.3	51.5
Chilly	N.S	N.S	.....	.....	.....
Onion	NA	60.6	NA	87.8	90.9
Brinjal	N.S	78.7	NA	93.9	96.9
Vegetable	N.S	93.9	27.2	87.8	100

NA- not applicable # N.S – Not suitable;
Source: *Field investigation 2016*

Summary of the Chapter

From the above discussion it is very clear that the function of brick industry is an important contributor for the increasing concentration of the Co_2 and the SPM in the local air and atmosphere. The amount of the Co_2 and the SPM generation vary from industry to industry and it depends upon the types and production capacity of the brick industry. The discharge of the huge amounts Suspended Particulate Matter (SPM) and the Co_2 into the local atmosphere increases the concentration of the Co_2 and SPM and reduces the quality of the air in the environment (Pandey 1997; Asger 2004; Joshi and Durani 2008, Baum 2010, Avitia, Antonio & Mora 2012).

The discharge of the Carbon dioxide and the SPM into the local air is responsible for hazy condition at local atmosphere, during the winter season. Such hazy and smoky weather prevent sunlight reach to the ground as well as reflects it back to the space (Asger 2004). The rising level of SPM due to brick kiln activities not only affect the local atmosphere, but also these SPM travels with the wind and affects the distant places, vegetation, standing crops and water bodies (Avitia, Antonio & Mora 2012).

The presence of physical parameters like water pH, EC and TDS as well as chemical elements like Na, P, K, Ca, Mg, and Cl have subsequently increased in the surface water bodies located close to the working brick industry due to mixing of pollutant materials with water. The increasing level of these elements in the water bodies directly affects the local aquatic ecosystem (USAID 2003). In addition to that, the pumping of ground water by the brick industry is responsible for depletion for ground water (Santosh, Padmalal, Baijulal and Maya 2012).

Therefore, the brick kiln burning is responsible for the changing neutral soil into the toxic, raising concentrations of the Co_2 and the SPM in the air and chemical and physical changes in the surface water bodies in the study areas.

In addition to it the brick kiln burning is responsible for the increasing toxic level in the soil adjacent to the industries as well as degraded considerable areas of agricultural and land and depleted the availability of soil Nitrogen, Phosphorus and Potassium (Khan, Rahaman, Rouf, Sattar, Oki and Adachi 2007). The degradation of agricultural land and depletion soil fertility due to reckless quarrying, a considerable area of agricultural land turned into degraded land year after year in the respective study area. The removal of the top layer of soil by the brick industries has not only reduced the availability of agricultural land in the study area, but also responsible for changes in the essential plant supporting elements in the soil like nitrogen, phosphorus, potassium etc (Grewal &Kuhad 2002 & Khan, Rahaman, Rouf, Sattar, Oki and Adachi 2007).

The study reveals that the soil of the study area is neutral and basic in nature. The pH value of all agricultural soil in the study area lies in between 7.43 – 7.71 which is neutral to the basic soil. But quarrying activities significantly raised the pH value and turned the neutral soil into basic to the strong basic soil. It is also observed that the deep quarrying activities changed the soil pH level beyond 9 and above. In case of other nutrients, the topsoil quarrying activity significantly reduced the available amount of Nitrogen, Phosphorus and Potassium. The losses of agricultural land fertility adversely affected the soil quality and agricultural practices in the study areas (Grewal & Kuhad 2002).

The removal of top soil by brick industrial quarrying causes of steep change of slope within the small area. The changes in slope altered the lands orientation in the study area. The farmers (respondents) reported that the changes in relative slope and slope direction have an adverse impact on their land management practices. After top soil quarrying, their land became relatively deeper than that of the land of immediate

farmers. The new orientation of their land forces them either change the source of irrigation or relocate their irrigation sources and systems. Land boundary management becomes a new emerging challenge for the farmers. During the monsoon season these steep slopes accelerates the flow of rainwater to downwards and remove huge amounts of in compact soil and responsible for loss of fertile layer. In addition to it the changing slope and land orientation ultimately forced the farmers to change the agricultural land use practice in the study areas. The land which is normally used to grow vegetables, potato, brinjal, lady fingers, onions, chilly, pulses jute, etc.- is replaced by the paddy due to water stagnation in the agricultural field. The water stagnation is harmful to the standing crops and it damages the natural growth of those standing crops. If there is an early monsoon then the entire crop gets spoiled.

To avoid such risk of economic losses, the farmers are trying to adjust themselves by replacing cash crops by food crops like paddy in summer and wheat in winter. In the case of cultivation of food crops, the amount of investment goes too high and reduced the yields and affects the profit margin due to loss of crop supporting soil nutrition. The losses of crops and lack of top fertile layer soil not only affects the yields of the crops; but also significantly changes the agricultural land value in the study area.

Further, study shows that the water logging is a newly emerging phenomenon in the study area because of appearance of degraded, fragile landscape in the study area. Water logging means the flooding of the lower (quarrying agricultural land) area during the rainy season. The changes in the slope and altitudes of existing high land into low land after top soil quarrying, rain water gets accumulated in the quarrying land. The accumulation of rainwater on quarry lands creates risk levels in cultivation for the farmers. This temporal water logging on their agricultural land frequently goes against the dynamics of natural timings of any crop. Sometimes water logging

situation remains for few month causes of loss of one or more crop. It is also found that standing crops are getting damaged due to sudden rain.

In addition to this, farmers having their land immediate to top soil quarrying land also faces the problem like top soil erosion, boundary damage, loss of irrigation water mostly due to land boundary failure. Sometimes these top soil quarrying lands left in an abandoned condition which have put numerous challenges to the farmers to reclaim such land for further agriculture.

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Chapter VIII

Summary of Findings and Conclusion

In concluding chapter it is important to relocate the findings of the study in short and to summarise contents. Every research has its limitations and strengths as well as a particular perspective. It is important for any research work to go through scrutiny before conclusion.

Urbanization, infrastructure and industrial development has led the rising demand for bricks in the state of West Bengal in particular and in India in general. The study illustrated that for the rising population, country needs to build infrastructure and generate employment. To build such infrastructure, vast quantity of bricks is needed. Likewise, to fulfil the demand of bricks as building materials in the state of West Bengal needs more than 600 crores bricks annually. But state has capacity to produce on an average 300 crores bricks annually. Districts like 24 Paraganas, Medinipur, Hooghly, Howrah, Nadia and Murshidabad are the major producers of bricks in West Bengal.

District of Murshidabad is one of the leading producers of bricks in the state of West Bengal. Majority brick producing units of the district's spread over vast area of agriculture land taking from small and marginal farmers. The emergence of brick industries offer new opportunities to few hundred small and marginal farmers to generates additional income by lease out portion of their agricultural land for top soil quarrying. In addition to that the development of brick industries in the district provides employment to about sixty thousand local landless labourers and made significant contribution in their annual income. However, development of brick industry brought many challenges in the district with respect to agricultural land degradation, environmental pollution; and many more socio-economic challenges.

The rapid increasing demand of bricks as building materials further increases the possibility of degrading more agricultural land and related environmental consequences.

The study on brick industries carried out within and outside India taking into account different environmental and socio- economic aspect of brick industries. Studies on brick industries across the globe (outside India and within India) mainly emphasises on the adverse aspects of the brick industries on society and environment. Their studies have given additional focus on the issues related to the land degradation and environmental pollution.

Particularly, studies conducted by scholars outside India given little attention on socio- economic aspects of the brick industries. The studies confined within the socio-economic issue of the labourers. Their studies simply ignore the class and caste dimension of the labourers of the brick industry. In addition to it their studies also ignored the changing production behaviour of landless labourers in relation to the brick industry in larger context. They can be considered as the legal heir of orientalistic discourse.

On the other hand, studies by Indian scholars tries to highlight the issues of class, caste, gender and little bit political dimension of the brick industry. But their study also failed mentioned about causes of development and changes in social and production relation of the labourers with regard to brick industry. Therefore, existing research on the brick industry either outside India or in India, mainly focuses on the issue like impact/outcomes of the brick industry on the physical aspect of environment like on land, air and water. The existing works also highlighted the health issues of the workers, those who directly involved in the industry and people residing there. Further, studies also highlighted the condition of female, child labour

and migrant labourers. Thus, study on brick industries mainly highlighted the outcomes of the adverse industries.

The basic questions regarding brick industries have not been addressed by any scholars. Their study does not pay any attention to the factors behind the emergence of brick industries or their works that as follows; how the brick industry came into existence? Who are the owners of the industry and why they are interested in brick industry? Which agencies are involved in the emergence of brick industry? How they are interlinked? What are the consequences for the brick industry of the agrarian relation?

In addition to that, how brick industries target new areas for conducting soil quarrying and industrial expansion? Why most of the land givers belong to small and marginal farmers? How industry changes the social fabric of the village society, especially the socio economic condition of the landless labourers? How and to what extend the brick industry influence the livelihood of the people involving in the industry? How agricultural practices and cropping pattern of the area are affected due to industrial expansion? What is the government policy towards brick industry? Therefore, here is the significance lie of present study. The present study have been addressed all these questions in effort to understand the agencies, processes and outcome of brick kiln industry in the Murshidabad District of West Bengal.

The study has been carried out entitle "Human and Environmental dimensions of Brick Industries in District Murshidabad, West Bengal" To identify and critically examined the interactions between agents, and processes involved in the development of the brick industry. It also examined the outcomes of such interactions in the agriculture production system, economy, livelihood, social relations and the environment.

The study reveals that the Murshidabad is one of the densely populated districts in the state of West Bengal. Majority of district population lives in villages and by and large involves in agriculture for livelihood. The workforce structure of the district Murshidabad has gone through significant changes from 1981 to 2011. Study shows that the share of agriculture sector continuously decreases in the district. From the discussion it is very clear that the share of agricultural sectors continuously declined in the district of Murshidabad.

Within agriculture sectors, the share of cultivators is declined in alarming rate in last decades whereas share of manufacturing and other workers is increasing in significant pace. Within others workers; sector like construction, trade, commerce and communication and other services (Real Estate, business and renting, public administration and defence, Financial Intermediation, Public, social security, Health, Education, social and personal services, social work, private household with employed Persons and employment in Extra territorial Organisations and Bodies) shows rising trends in their share in the district in last three decades. Thus, study clearly indicates the major shift in economic activities in the study blocks as well as in the district of Murshidabad. The shift in economic activities recorded from agriculture sector to manufacturing sectors and other working sectors.

This Study examines the spatial and temporal distribution of brick industries in the study area as well as little bit history of brick industries in the district of Murshidabad, its functional mechanism, pattern, nature and also tried to understand to what extent brick kiln industry qualify the status of an industry. The study found that:

1. Very few commercial brick making/manufacturing units were established between 1980- 1990. After 1990s, a steady growth of the brick manufacturing

sector was observed in the various parts of Murshidabad. Real growth of brick industries in the district has taken place after 2000.

2. Almost all brick industries located on agricultural land in *Bagri* region of the district. Within the *Bagri* region blocks like Berhampore, Domkal, Hariharpara, Beldanga I, Lalgola and Jalangi shows maximum concentration of brick industry. The above mention blocks have more fifty brick industries each. In addition to this other seven blocks of *Bagri* region have less than 40 brick industries but above 20 brick industries.
3. Share of unauthorised brick industries is also very high among the blocks like Berhampore, Domkal, Hariharpara, Murshidabad – Jiagang, Beldanga I, Lalgola, Raninagar I & II, Bhagawangola I & II and Jalangi.
4. Brick industries function on the line of division of labour, coordination and under control environment. A strict and strong network is working in brick industries comprises by owners, soil contractors, labour contractors, trucks and tractors owners, etc. Labourers are divided based upon the skills and employed in different section of production process to maximise the output.
5. Further, study also shows that the brick kiln industries developed parallel to the road/highways along the periphery of the urban, city centres and towns.
6. The study further demonstrated that the brick kiln industry has fulfilled almost all the criteria to become an industry. But, the brick kiln industry is still considered a manufacturing unit rather than an industry.

Study critically examined the role played by the different agencies in the development of brick industries in the district of Murshidabad. In this regard, study classified the total agencies into two sub groups namely;

1. Concerned government Official

2. Other stakeholders.

The study revealed that the concerned Government Departmental Officials like Department of Land and Land Reforms Officer, regional office of West Bengal State Pollution Control Board and official, Department of Environment and official, PWD official, Trade Licensing official and Gram Panchayat at village have tried their best to extend their support to the brick industrial owners by ignoring the important facts related to agricultural land use, land conservation and environmental protection. These Government officials just simply ignore the interest of the larger section of the society. They are very much reluctant to protect the interest of brick industries.

The Government authorities ignoring the important facts related to agricultural land use, land conservation and environmental protection. In this way Government official simply ignore the interest of the larger section of the society or very much reluctant to protect the interest of brick industrial owners or unable to take any action against the violators. Thus, elite nexus dominate the whole process.

Further, these political influential brick industrial owners may influence the government authorities, to make the rules flexible at ground in respect of brick industries. Thus it is all about corrupt political culture of the state where financially influential people are able to manage the policy implementing authority at ground in favour of them. The owners of the brick industries wisely exploit the corrupt system to run their industries without obeying the rules and regulation. They are also able to manage a network to take advantage of the financially stressful small and marginal farmers to exploit their land with the help of land contractors. These all factors create an environment of socio - economic oppression.

The supply of cheap landless labourers by the labour contractors added additional advantage to these owners to make the use of them in exploitative

production process. The absence of any form of union with regard to these labourers further expands the scope of production and reproduction by exploiting the labourers. In addition to these government agencies, a considerable number of private agencies or stakeholders like the small, petty businessman, soil (land) and labour contractors as well as trucks and tractors owners played their respective role in the development of the brick industry in the district of Murshidabad. Further, the sympathy of the regulating official, larger market economic interest, owners influence on the officials make the officials to ignore the interest of poor masses even their means of livelihood are getting exploited by the brick industrial owners.

Association of the owners with the ruling political party and active donor of ruling party allow the owners to ignore many functional issues regarding brick industry. In addition to it, making soft target to the people who are really concerned about adverse consequence of industry on people and environment; brick industrial owners and its strong association prevent them to act against the industry. The continuous surveillance on researchers and other people those are working on different aspects of brick industry, prevent them (researchers) to get desire information. If anyhow they are managing to get the desired information, the Brick Field Owners Association request them (researchers) not to use harsh language or not to write harsh reality of brick industries.

On the other hand, they are trying to convincing the researcher to work on the positive side of the brick industry and allow him/her space to become part of that nexus. Therefore, mutual support, coordination among owners, contractors and other stakeholders, co- operation among the agencies, continuous rising demand of bricks, moreover management of opposing agencies through the exploiting political tools;

strong association of brick industrial owners and use local pressure groups to stop the opposing voice led to rapid development of brick industry in the study area.

Study discussed about the contribution of brick industries in socio-economic development of the area. Study shows that, majority of the brick industrial labourers belongs to the social- economically poor and marginalized section of the rural society. The rapid development of the brick industry has changed the structure of economic activities and production system in the villages in relation to the landless labourers from agriculture based production system to industry based production system.

Study noted that the division of labour is very much sharp in the brick industry. The major chunk of these brick industrial labourers belongs to young and youth age group. Youth people employs to perform the hard manual works like soil quarrying, moulding, shaping and transporting of bricks and aged skilled people are appointed as mistry and firemen. Study also revealed that brick industry has provided 150 -180 days employment to these landless poor labourers. The income of these brick industrial labourers ranges between Rs. 5000- 9000 per month. The majority of brick firemen and makers have monthly income is about Rs 7001- 9000 whereas monthly income of *Mistry* and *Rubbishmen* ranges from Rs. 5000- 7000.

In addition to it the income of brick transporters varies from individual to individual because the payment is based on number of bricks transported/carried by each individual and ranges between Rs 4500- 7000. This study further reveals that major portion of the yearly income spent to buy food and allied items. A Little part of their income is remained available for spending other sectors like children education fee and buying necessary household goods.

Study further demonstrated that though good percent of the brick industrial labourers has shifted their houses from the Kachha to Semi Pucca and semi Pucca to

Pucca house. But, a considerable percentage of these labourers are still living in Kachha houses. The share of semi Pucca and Pucca houses are higher among the brick makers and brick firemen due to relatively good monthly income from industry as compare to other category of workers. The study revealed that majority of the respondent depend on Tubewell for drinking water supply but a considerable percent of brick industrial workers' families don't have the access to the improved sanitation facility.

The income from the brick industry constitutes major part of annual income of these labourers. Majority of these workers were depending on agricultural daily wage labour, daily casual wage labour, daily wage from other sectors, and daily wage labour from construction sector before joins brick industries as labourers.

Further, the brick industries have changed the production system in the study area in relation to the landless labourers. Earlier these labourers were mainly involved in agricultural and allied based production system but now major part of their yearly labour force is devoted to industrial based production process. Thus, brick industry gradually shifted the source of income of these landless labourers by making them industrial labour.

Study further observed that, lack of basic work place safety measure, deprived from available protective equipments and lack of awareness exposes the industrial labourers numerous occupational health hazard. The health problems among the labourers are very much related to their task performed inside the brick industry. Majority of brick makers, rubbishmen, and brick transporter suffers from joints related problem whereas mistry and firemen exposes from health problems like suffocation, eye irritation and skin burnt.

Considerable number small and marginal farmers of study area are also benefited from brick industries by getting an opportunity to lease out part of their land and earn lump sum money as royalty. These money may help them to meet many essential needs like celebration marriage ceremony (mainly daughter) or may give relief for time being to repay the existing debts, treat illness, pay offspring education fee, etc.

Study also found that, industries employed few migrant labourers coming from the states like Jharkhand, Bihar and (a small percentage) Eastern Utter Pradesh. Study reveals that majority of these migrant workers are recruited by the labour contractors and very few of them come with their fellow workers who are already working in different brick industries.

In addition to it study demonstrated that though they are coming from different states but so many things are common among them. 1. All of them belong to socio-economically deprived section of society especially from Schedule Caste and Schedule Tribe (ST); 2. Either they are working as firemen or brick makers. 3. All of them are net buyer of food items throughout the year. Majority of these migrant labourers are living in Kachha or semi Pucca houses. They are deprived of basic facilities like sanitation, safe drinking water and health facilities in working place as well as at their native villages.

Study revealed that the concept of decent work is totally absent in relation to brick industrial workers. They are deprived from all type of socio-economic benefits like pay leave, parental leave, bonus, gratuity, medical facility for family and children, old age pension etc. They are deprived from the social dialogue like negotiation on daily wages, time of work, duration of work etc. Here it is important note that the lack of awareness about the rights, lack of organizational capacity and

lack of helps from other agencies like trade unions and NGOs prevent them to gets their due benefits.

It is also found that the informal nature of operation, exclusion of brick kiln industries from the domain of industry and factory laws, organizational and political influence of owners on the institutions and lack of labour union in favour of workers causes of deprivation of these workers and getting their due benefits.

Study unfolded that brick industries play an important role in further marginalization of small and marginal farmers. These small and marginal farmers have lost part of their agricultural land due to top soil quarrying to meet present need. These small and marginal farmers were somehow managing their livelihood by cultivating their small patch of land. The degradation of important source of livelihood may put them in vulnerable situation in near future. The destruction of part of their productive agricultural land to meet the present need may push them under question of food security (Sebesvari, Sehiller and Ortelepp (2015).

Study also unfolded that brick industries help in transfer of ownership of local resources. It also facilitates to transformation of fixed resource (land) into mobile asset by converting it into bricks. The land resource of small and marginal farmers gradually shifted from these farmers to brick industries for making bricks which ultimate exported to urban centre. In such way brick industries helps to transfer the ownership of soil and land resources from socio-economically marginalized poor farmers to brick industrial owners and ultimately facilitates to enter into large market.

Study further disclosed that brick industries play a vital role in capital formation for the owners. The clay rich soil play significant role in creation of wealth and capital by providing an option to develop brick industries. In this regard, the deprivation of the labourers from their actual wages and profits from bricks selling are

the two main source of accumulate the capital owners to. In addition to it, the upper hand of owners in deciding daily wages, lack of bargaining body or voice in favour workers, also helps the owners to amass huge profits which ultimate lead to capital formation.

Study further revealed that the brick industry helps in emergence of new classes in the study area. The village society is very homogenous in nature in term of economy. Majority people of the villages are farmers and agriculture and allied activities are their main source of livelihood. Therefore, disparities in term of economy among these people are very small or minimum. The emergence of brick industry helps in creation of new classes like influential Owners and voiceless marginalized industrial labourers in the study area. These economically affluent owners are now active player of decision making process in the villages in particular and in the study area in general.

Function of brick industries brings many issues with regard to environmental degradation and agricultural practices. The kiln burning of brick industries generates and discharges huge amount of carbon dioxide and suspended particulate matters into the local atmosphere every season. The amount of pollution load generates form the brick industries are varied from one another. A movable kiln chimney is responsible for highest quantity of pollution and generation and discharge into local atmosphere as compare to fixed chimney and Hawa chimney. The discharge of such huge quantity of pollution load within small area affects the local water bodies, air and environment.

These pollutants in the form of dusts, fumes, shoots etc travel by air and affected the water bodies located close to the brick industries. The study further shows that the addition of such pollutant materials changed the physical as well as chemical

characterstics of surrounding water bodies. Study further revealed that the kiln burning is responsible for significant changes in soil toxic level.

Maximum changes in soil toxic level due to kiln burning are recorded in Murshidabad- Jiaganj block. Unlike kiln burning, brick industrial top soil quarrying also responsible degrading considerable amount of agricultural land every year. A typical movable chimney kiln brick industry degrades on an average about 0.17-hectare agricultural land for top soil quarrying per production season. Similarly, a fixed chimney industry degrades about 0.22 hectare land for top soil quarrying per production season, and Hawa kiln brick industry degrades about 0.28 hectares land in a production season.

The top soil quarrying activity has changed the physical feature of the agricultural land like; depth, altitude and orientation. The average depth of the topsoil quarrying land in the study area lies in between 3.0 feet to 6.6 feet. The highest average depth of topsoil quarrying land is recorded in Domkal block that is 5.26 feet.

Study further unveiled the fact that the top soil quarrying activity responsible for significant changes in soil pH, Nitrogen, Phosphorus and soil Potassium. The study found that the soils of the study area are very much neutral in nature and its value lies in between 7.36 – 8.20. But the top quarrying activity has significantly raised the soil pH level. It is also found that the removal of top soil layer for brick industrial use has turned the soil into basic to strong basic. The study also found that there is a positive relationship existed between the increasing depth of quarrying ground and the availability of soil pH.

Likewise soil pH, the availability of soil Nitrogen also depleted in the agricultural land due to top soil quarrying. The average amount of Nitrogen in the soil of the study area is about 129.23 Kg/Ha. But top soil quarrying is responsible for

reducing the average amounts of nitrogen to 87.03 Kg/ Ha. The highest loss of Nitrogen recorded in Domkal block (38.16 percent). Similarly, higher average amount of soil Phosphorus recorded in Berhampore block that 22.40 Kg/Ha, but the highest loss of soil Phosphorus recorded in Murshidabad –Jiagang block (37.75 percent). In addition, the average amount of soil potassium in the agricultural soil of Berhampore is 54.38 Kg/Ha, followed by Murshidabad-Jiagang 51.52 Kg/Ha and Domkal is 35.28 Kg/Ha. But maximum losses of potassium due to the top soil recorded in Berhampore block (43.18 percent).

Therefore, the top soil quarrying adversely affects the availability of important soil elements which directly affects the fertility status of agricultural soil. Study further demonstrated that the cropping suitability is significantly reduced on the top soil quarrying agricultural lands in the study area. The crop suitability has reduced by 40 percent in the study area.

The loss of crop supporting soil nutrients adversely affected the crops yields in the study area. The top soil quarrying and removal activity of brick industries is responsible for reducing the yields of rice about 23.58 percent in the study area. But it varies from block to block. The yields of rice is decreased by 23.16 percent in the Berhampore, 23.34 percent in the M. J block and 24.24 percent in the Domkal block respectively. Similarly, yields of wheat have declined by about 22.78 percent in the study area. Maximum loss of wheat yields recorded in Berhampore (25.40 percent) and minimum loss of wheat yields is recorded in Domkal block (21.30 percent). In addition to it the yields of the Jute also decreased by 27.78 percent in the study area due to top soil quarrying. The average loss jute yields recorded in study blocks are as follows; 23.83 percent in Berhampore, about 28.75 percent in M. J and about 31.18 percent in Domkal respectively. As a result, the cultivation of food crops on top soil

quarrying land increases the amount of investment and reduced the yields and affects the profit margin due to loss of crop supporting soil nutrition.

The loss of crop supporting top fertile layer not only affects the yields of the crops but also significantly changes the agricultural land value in the study area. The agricultural land value is decreasing by 27 percent in the study area due changing of land characterstics. The maximum loss of land values recorded in Domkal block whereas minimum changes in land value is recorded in Murshidabad-Jiagang block. The agricultural land has been dropped by 26.95 percent in the Berhampore, 26.22 percent in Murshidabad - Jiagang and 29.05 percent in the Domkal block.

The removal of top soil by brick industries causes of steep changed of slope within the small area. The changes in slope altered the lands orientation in the study area. The respondents (farmers) reported that the changes in relative slope and direction have an adverse impact on their land management practices. The managing the land boundary becomes a new emerging challenge for farmers of study area. During the rainy monsoon season these steep slopes accelerated the flow of rainwater to downwards and remove huge amounts of in-compact soil and responsible for loss of top fertile layer.

Top soil quarrying on respondents land, makes their land relatively deeper than their neighbour farmers land. As a result of developing of new orientation of their land, forces them either changed the source of irrigation or relocate the source of irrigation. The changing slope and orientation of land ultimately forced the farmers to change the agricultural land use practice in the study area.

The land which was normally used to grow crops like vegetables, potato, Brinjal, lady fingers, onions, chilly, pulses and jute during rainy season now all these crops replaced by paddy due to water stagnation in the field during rainy monsoon.

The water stagnation is harmful for the standing crops and it damages the natural growth of those standing crops. During early monsoon entire crops spoiled or immature crops harvested and it is a matter of economic losses. To avoid such risk and economic losses farmers are trying to adjust themselves by replacing cash crops by food crops like paddy in summer and wheat in winter.

Seasonal water logging is a newly phenomenon in the study area due to the appearance of degraded, fragile landscape due to unchecked quarrying of topsoil in the study areas. Water logging means the flooding of the lower (quarrying agricultural land) area during the rainy season. Due to changes in the slope of the existing low land, rain water get accumulated in the quarrying land. The accumulation of rainwater on quarry pits, make these top soil quarrying pits or land as waterlogged area. Cultivation of crops on such land became a risky task for farmers due to chance of getting suddenly waterlogged.

The temporal water logging on agricultural land frequently delayed the crop sowing time. Sometime farmers lose one or more crops due to water logging situation remain for few months. It is also found that standing crops are getting damaged due to sudden rain. Farmers having their land immediate to top soil quarrying land also faces the problem like top soil erosion, boundary damage, loss of irrigation water mostly due to land boundary failure. Further, very often land contractors left the soil quarrying lands in an abandoned condition which have set numerous challenges for the farmers to reclaim such land for further agriculture.

Thus, the development of the brick industries in the study area are accompanied by the contribution and cooperation of the numerous agencies and groups from the Governments, private and individuals as well as continuous rising demand for building materials among the people within and outside the district.

The function of brick industries provides an opportunity for the thousands of landless labourers to get an employment for a period of 5- 6 months at their doorstep which prevent them from the out-migration for time being. In this way by employing in brick industry, gradually replaced the production relation of these rural landless labourers from agriculture based production to industry based production system.

Though, brick industries provides few thousand employments to the landless and casual daily labourers from the local villages as well as few hundred migrant labourers coming from the nearby district and the states but, industry does not bring any radical change in the life of these labourers due to its exploitative nature. As a result, these labourers are still living with lack of basic facilities and struggling for fulfilling their daily basic needs. The exploitative, captivate and controlling nature of the production process as well as an advance payment system in brick industries are the main hurdle for the labourers to get out of the vicious cycle of poverty.

Brick industries also offered an opportunity to many farmers to generates a quite good amount of money by lease out a portion of their land which helps them to get escape from economic stress and poverty for time being or build a small house or repay the existing debts or celebrate social functions or paid the offspring tuitions fees; but it permanently degraded important source of livelihood which put them under further marginalization by making their agricultural land infertile, fragile, degraded, marginal and unsuitable for many crops but as well as by puts a numerous hurdle in front of them to reclaim their already degraded land. In addition to it the ignorance of the functional guideline regarding soil utilization and exploitation of top agricultural soil by the brick industries further intensifies the adverse impact of brick kiln quarrying on agricultural practices. Thus, brick industry gradually putting these

small and marginal farmers in vulnerable situation with regard to their future livelihood.

On the other hand, the function of brick industry helps in capital formation for the owners of the industries. The under wages and profits are the two important sources of surplus capital generation for the owners. In addition to it, brick industry also helps in transfer of ownership of land resources by exploiting the land of poor farmers in the study area.

Further, function of brick industries help emergence of new classes in the village in the form of capitalist owners and voiceless, poor, unskilled labour class. As a result, social relation of these people is largely getting changed. Now these owners are the main actors of decision making in the villages.

The unchecked growth and the use of traditional technology in the brick kiln burning are responsible for the generation of huge amount smoke, carbon dioxide, SPM and other gases. The discharge of these pollutant materials into the local environment is responsible for changing the quality of the soil, water and the atmosphere. The changing quality of the soil, water and air has an adverse impact on the human health.

Moreover, the uncertain nature of brick industries with regards to function and will create the situation for free labour by adding additional few hundred small and marginal farmers as landless labourers in near future. Therefore, to keep away from the above such possible future adverse outcomes from brick industries in the study area; Government should ensure that the brick industries should avoid the use of agricultural land for top soil quarrying as well as adopt available alternative raw materials based bricks production. In this regard, fly ash based brick manufacturer is an important alternative. It was found that the fly ash brick is relatively cheaper than

the fire clay bricks, yet people prefer to use the fire clay bricks due to prevailing popular notion about the highest longevity of the fire clay bricks as compare to the other available alternative form of bricks including fly ash bricks.

It is due to colonial influence in the mind of the people. The common belief among the people is that the brick with '*Red bright Ring Tune'* is a best building material with high longevity. This perception and notion should be changed.

In this regards, media can play the positive role to change the people's perception by popularizing the utility and benefits of the Fly Ash bricks as well as other alternatives from of building materials which can reduce the pressure on agriculture land for raw materials. On the other hand, switches from the traditional brick kiln burning techniques to the improved Vertical Shaft Brick Kiln (VSBK) technology may reduce the fuel consumption by 40 - 60 percent energy as well as the same amount of pollution load in the form of carbon dioxide which is ultimately reduced the severe environmental implication.

The ill and irregular implementation of Govt. rural employment programmes, political biases towards the village poor by the ruling parties, irregular and long waited payment or payment procedure discourage these landless labourers to join the Government run rural employment scheme. On the other side, regular payment system in the brick industry encourages these landless labourers to work in such hazardous and exploitative Industry. Therefore, proper implementation of Government employment scheme could help these landless labourers to get out the labourers from this exploitative Industry.

In this regard, taking brick industry and its labourers under industrial laws could minimize the level of exploitation as well as help these labourers to get their due benefits. Government should encourage the owners to establish agro based

industries by providing the tax holiday and subsidy to accommodate the rural surplus labour forces. Every one of us needs development; but it is not in the cost of others. Development should be inclusive and sustainable.

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