2015

Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh

Ahmmed, Md. Forhad

University of Rajshahi

Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh

PhD Dissertation

Researcher

Md. Forhad Ahmmed
PhD Fellow
Session: 2008-2009

Institute of Bangladesh Studies (IBS)
Rajshahi University
Rajshahi-6205

January 2015

Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh

PhD Dissertation

Researcher

Md. Forhad Ahmmed
PhD Fellow
Session: 2008-2009

Supervisor

Md. Fakrul Islam PhD
Professor
Department of Social Work
Rajshahi University
Rajshahi-6205
Bangladesh

Institute of Bangladesh Studies
Rajshahi University
Rajshahi-6205

January 2015

Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh

PhD Dissertation

Researcher

Md. Forhad Ahmmed

A Dissertation Submitted to the Institute of Bangladesh Studies (IBS) University of Rajshahi in Fulfilment of the Requirement for the Degree of

Doctor of Philosophy

in

Social Work

Institute of Bangladesh Studies
Rajshahi University
Rajshahi-6205

January 2015

c‡dmi †gvt dLi“j Bmjvg
GgGmGm (XvKv), GgBGmwm (mKev), wcGBPwW (mKev)
mv‡eK mfvcwZ
mgvRKg wefvM
ivRkvnx wekwe`¨vjq
ivRkvnx-6205, evsjv‡`k
†dvbt 880-0721-750041-(3706 evmv, 4158Awdm)
†mj †dvbt 01712-144002

Professor Md. Fakrul Islam
MSS (DU), MESc (Tsukuba), PhD (Tsukuba)
Former Chairman
Department of Social Work
University of Rajshahi
Rajshahi-6205, Bangladesh
Phone: 880-0721-750041-(3706 res., 4158 office)
Cell: 01712-144002
E-mail: fakrul@ru.ac.bd

Certificate

It is my pleasure to certify that the dissertation titled **"Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh"** is an original work done by Mr. Md. Forhad Ahmmed, a Ph.D. Fellow in Social Work of the session 2008-2009 at the Institute of Bangladesh Studies (IBS), University of Rajshahi, Bangladesh. The findings and views expressed in the dissertation are outcomes of both primary and secondary data collected by the researcher. He has prepared this dissertation under my supervision and guidance. As far as I know, the dissertation as whole or in part has not been submitted anywhere else for any purpose e.g. any degree or diploma or publication.

I have gone through the dissertation thoroughly and found it suitable for submission. The dissertation is, therefore recommended and forwarded to the University of Rajshahi through the Institute of Bangladesh Studies for necessary formalities leading to its acceptance in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Social Work.

Md. Fakrul Islam PhD
Professor
Department of Social Work
University of Rajshahi, Rajshahi, Bangladesh
&
Supervisor

Declaration

I, the undersigned, hereby declare that the dissertation titled **"Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh"** has been prepared by me. It is an original work carried out by me under the guidance and supervision of my honorable supervisor. I have not taken any direct help from any book, article or thesis without proper citation. The dissertation or any part of it has not been submitted partially or fully to any academic institution or university at home or abroad for the purpose of any degree or diploma.

Md. Forhad Ahmmed
PhD Fellow
Session: 2008-2009
Institute of Bangladesh Studies
Rajshahi University
Rajshahi-6205
Bangladesh.

Acknowledgement

This dissertation is the outcome of my six years' laborious effort as a PhD fellow at the Institute of Bangladesh Studies, Rajshahi University, Rajshahi, Bangladesh. During this long journey, I have taken help from many persons in many ways. I am very grateful to all of them. At the beginning, I would like to thank the Almighty "Allah" for giving me the strength and opportunity to finish the work.

It is my great pleasure to convey my deep respect, profound gratitude and indebtedness to my revered supervisor Dr. Md. Fakrul Islam, Professor, Department of Social Work, Rajshahi University, Rajshahi, for his cordial supervision, guidance, pragmatic suggestions and continuous encouragement and inspiration during the whole period of my research work, which enabled me to complete my dissertation successfully.

I would like to extend my deep sense of gratitude and profound regards to Professor Dr. Md. Shahidullah, Director, Institute of Bangladesh Studies, Rajshahi University, Rajshahi, for his cordial cooperation, scholastic criticism and all types of institutional support. I am also grateful to Professor Dr. Md. Mahbubur Rahman, Ex-director of Institute of Bangladesh Studies for his valuable advice and assistance during the initial stage of my research work.

I am really indebted to the honorable faculty members of IBS who have helped me to develop my ideas during the course-work. I would like to express my gratitude to Dr. Zainul Abedin, Professor of Economics, Institute of Bangladesh Studies for his constructive criticism and continuous inspiration. I am very much grateful to Dr. Swarochhich Sarker, Professor, Institute of Bangladesh Studies, because I have learned many things about research methodology and report writing from him. His suggestions and guidance enriched me in many ways. I am also grateful to Dr. Md. Mostafa Kamal, Associate Professor of

Institute of Bangladesh Studies, Dr. Jakir Hossain, Associate Professor of Institute of Bangladesh Studies, Dr. Mohammad Nazimul Hoque, Associate Professor of Institute of Bangladesh Studies, and Dr. Md. Kamruzzaman, Assistant Professor of Institute of Bangladesh Studies for their continuous cooperation and guidance.

I would like to offer my sincere thanks and gratitude to the honorable teachers of Social Work Department of Rajshahi University. I want to give special thanks to Professor Dr. Md. Ashrafuzzaman, Professor Dr. Afrina Mamun, Dr. Sheikh Kabir Uddin Hyder, Associate Professor, Dr. Md. Faruk Hossain, Associate Professor, Dr. Shahidur Rahman Chawdhury, Associate Professor, Dr. Aktar Hossain Mozumdar, Associate Professor, Dr. Jamilur Rahman, Assistant Professor, for their cordial cooperation and constructive suggestions.

I want to convey my thanks and gratitude to one of my favorite persons, Dr. Md. Rezaul Karim, Professor and Head, Department of Social Work, Jajannath University. Dhaka, whose inspiration remains with me always. I am also grateful to Dr. Wardatun Akmam, Professor and Chairman, Department of Sociology, Rajshahi University. I got many valuable suggestions from her and she has inspired me to finish this work.

I am very much indebted to the officers and staffs of Institute of Bangladesh Studies, Rajshahi University, who provided me all sorts of administrative supports during my research work.

I would like to convey my thanks and gratitude to my friends, Dr. Kudrat-E-Khuda, Dr. Kazi Muhammad Wazir Hyder, Dr. Al Mamun Sarker for their cooperation and continuous inspiration. I am very grateful to my senior friend Dr. Helal Uddin Ahmed, Joint Secretary of Bangladesh Government and Dr. Hossain Al Mamun, Associate Professor, Department of English, Shahjalal University of Science and Technology for their constructive suggestions and inspiration. I am also grateful to the fellows of Institute of Bangladesh Studies for helping me in different ways.

I am indebted to the respondents of my study area, who provided data and information during interviews without which this research work could not have been finished. I am also indebted to the GO and NGO personnel of Panchagarh district who helped me by providing important data and information.

I am indebted to Mrs. Kaniz Mahmuda Akter, Principal, Siddheswari Girls' College, Dhaka, for her continuous cooperation and inspiration. I would like to convey my gratitude and thanks to my colleagues Mrs. Monwara Begum, Assistant Professor, Mrs. Ripa Sarif, Assistant Professor, Mrs. Eti Rani Shaha, Lecturer and others, who extended their co-operation and inspired me in this regard.

I am expressing my sincere thanks and gratitude to my family members who have given me inspiration for doing PhD and provided all kinds of support. I owe to my mother Begum Ferdousi Khandokar, who is my first teacher and I believe without her prayer and support, I could not reach this stage. I am also indebted to my departed father Khalaquzzaman Khandoker who inspired me to get myself admitted in a PhD program. I am very much indebted to my elder brothers Md. Fizur Rahman Khandokar and Farid Uddin Ahmed Khandokar for their inspiration and support. I am indebted to my elder sister Shahinur Sultana Nahar who helped me in many ways. I am exceedingly indebted to my wife Bornaly Ahmed who inspired me all the times for the advancement of my professional life. She also contributed to data inputting and thesis writing.

Finally, I would like to convey my thanks and gratitude to all my friends and well-wishers who directly or indirectly helped me in my research work.

Md. Forhad Ahmmed
PhD Fellow
IBS, Rajshahi University

Acronyms or Abbreviations

ADB	:	Asian Development Bank
ADP	:	Annual Development Program
BAPA	:	Bangladesh Poribesh Andolon
BBS	:	Bangladesh Bureau of Statistics
BEN	:	Bangladesh Environment Network
CBO	:	Community Based Organization
CDMP	:	Comprehensive Disaster Management Program
CHT	:	Chittagong Hill Tracts
DDM	:	Department of Disaster Management
DM	:	Disaster Management
DMC	:	Disaster Management Committee
FEJB	:	Forum of Environmental Journalists of Bangladesh
ESCAP	:	Economic and Social Council for Asia and the Pacific
FGD	:	Focus Group Discussion
GOB	:	Government of Bangladesh
IAIA	:	International Association for Impact Assessment
IBS	:	Institute of Bangladesh Studies
ICF	:	International Classification of Functioning Disability and Health
ILO	:	International Labour Organization
IPCC	:	Intergovernmental Panel on Climate Change
MDGs	:	Millennium Development Goals

MFDM	:	Ministry of Food and Disaster Management
NCCWPD	:	National Coordination Committee on the Welfare of Persons with Disabilities
NGO	:	Non-governmental Organization
NWMP	:	National Water Management Plan
PRSP	:	Poverty Reduction Strategy Paper
SEMP	:	Sustainable Environment Management Program
SPSS	:	Statistical Package for Social Sciences
UK	:	United Kingdom
UN	:	United Nations
UNDP	:	United Nations Development Program
USA	:	United States of America
WARPO	:	Water Resource Planning Organization
WCED		World Commission on Environment and Development
WHO	:	World Health Organization

Abstract

In most countries of the world, underground mining resources are considered as important contributors to economic development. But quite often these works cause a lot of damage to the environment and put many lives under threat. In the northern part of Bangladesh, there are huge quantities of stones stored beneath the surface in some districts. Local people collect these stones and sell and supply them to different places for construction and development work. There are about 8 crore and 9 lac cubic feet of underground stones in the Panchagarh district of Bangladesh. The local businesspersons give the landowners a nominal amount of money and collect these stones under their own management. They appoint hundreds of labourers in collecting; supplying and transporting stones; as a result many people get the opportunity to work there. Unplanned and unrestricted digging, picking, raising, collection and storage of stones make the local and natural environment vulnerable.

Man in earlier times believed in the ‘nature-nurture’concept. However, during the past fifty years, relation between man and environment have changed considerably. At present, open and competetive ecnomic growth causes environmental ruins that threatens human lives and their existence. Considering the natural environmental loss (loss of cultivable land due to soil digging) eco-social decays (loss of homesteads) and growing social problems (family disorganizations, drugs etc.), the researcher chose this important area of study to measure the socio-economic and environmental impact of underground stone collection at Panchagarh district. The present study is an exploratory one based on sample survey, where the researcher has tried to show the economic, social and environmental impact of underground stone collection by using different methods of data

collection. The study was conducted in the farthest district of Bangladesh-Panchagarh. The researcher chose eight villages using multistage sampling method and the inhabitants of the study villages were considered as the population/universe of the study. The study focused on these priority themes- (i) Assessment of socio-economic impact of underground stone collection; (ii) Tracing the environmental changes that occurred after starting the underground stone collection and its effects; (iii) To know the people's attitude regarding stone collection; (iv) Detecting opportunities for socio-economic and environmental development; and (v) Policy making for underground stone collection. First, multistage sampling method was used to select the study villages. Applying multistage sampling method among the five Upazilas of Panchagarh District; two Upazilas; and two Unions from the two Upazilas; and from the four Unions eight villages were selected for the study. Second, stratified sampling method was used to collect data from different categories of respondent. Following stratified sampling method the researcher was selected four categories of people: (I) Stone labourers; (II) Stone Businessmen; (III) Land Sellers; and (IV) General People. A total of 317 respondents were considered as the sample of the study in accordance with the method of purposive sampling. Moreover, 50 persons were included as the key informants among the local leaders, agricultural officers, UNO, fishery officers, NGO personnel and representatives of local government. Data was collected from the sample through interview schedules. For collecting data, observation method was used along with interview. Data and information were also collected from secondary sources as required along with data and information collected through field survey. The researcher also conducted two FGDs along with field survey and observation. Data, collected through interview, were analyzed with the help of the SPSS and Excel computer programmes.

By analyzing the demographic data of the respondents, it was seen that the lion's share of the respondents (89%) were between the age of 20-59 years and 40.7% of the respondents were illiterate. Most of the respondents (75.8%) were involved in collecting stones or in stone business for 1-10 years. It was revealed from the study that 32.5% of the respondents were involved in agricultural activity before becoming involved in this profession.

After analyzing the socio-economic impact of underground stone collection, it was seen that for 87.7% of the respondents, their income had increased after they had begun to collect stones and family condition of 36.7% of the respondents had improved after switching to this occupation. But, this study showed that the persons involved in collecting stones had to remain unemployed for about half of the year. It was also found from the study that 99.4% of the respondents held the view that the scope for employment increased and both the males and females had the scope of working there regardless of their gender since the beginning of stone collection. However, it was seen from the study that though the females did the works similar to males, they got 121.74 taka less per day than the male labourers on an average. Moreover, it was also seen from the study that a number of child labourers were also involved in stone collection; they were not facing other problems in their work place, but were getting 83.33 taka less per day on an average.

From the study, it was found that average monthly income of the respondents was 9,595.41 Taka and the average monthly expenditure of the family was 7,329.24 Taka. Three quarters of the respondents opined that their social condition had improved since they got involved in collecting stones. The majority (52.1%) of the respondents opined that they got sufficient nutritious food. After the beginning of stone collection in the study area, the roads, housing, scope of business, rate of literacy, health facility, scope of work for the females, standard of living had increased. On the other hand, the researcher observed negative impact in some

sectors such as increase in child labour, decrease in agricultural production etc. Moreover, it was also seen from the study that there had not been any improvement in sectors like electrification, scope of entertainment and sanitation.

It was observed in the study that though due to stone collection the socio-economic condition had developed, it has left some negative impacts on environment. As a result of stone collection, soil erosion, destruction of soil composition and loss of soil fertility had become very common. Moreover, 48.9% of the respondents held the view that the number of trees in the study area had decreased due to underground stone collection. It was observed from the study that stone collection had increased the number of unnecessary water bodies. It was also seen that the lion's share (50.50%) of the respondents thought that air pollution had increased after the beginning of underground stone collection. By analyzing the environmental impact of underground stone collection, it was also found that 57.80% of the respondents had identified the underground stone collection as the main cause of decreasing soil fertility. Besides, the respondents thought that underground stone collection was responsible for river bank erosion, deforestation, sound pollution and so on. Though 91.8% respondents viewed that underground stone collection was the main cause of reduction in cultivable land, a majority of them (84.2%) supported underground stone collection. Among the respondents who had sold their land for stone collection, 64.7% had sold their cultivable land for stone collection and among them 98% respondents could not cultivate their land at the time of the interview.

From the study, it was also seen that 95.2% of the respondents did not take government permission for collecting underground stone. Moreover, it was also observed that among the respondents involved in the stone business, 97.6% did not pay any tax or fee to the government. Among them, 51.2% thought that the government did not get any revenue

from this sector as there was no policy to address the issue. Again, 52.4% of the respondents did not support unplanned stone collection, and 85.2% of the respondents opined that development was possible by using the underground stone of this area.

From the data obtained through observation method, it was found that 93.5% of the land from which stone was collected remained uneven and 71.8% of the land was unfit for cultivation in the present condition. It was also observed that the top soil was destroyed in the land from where the stone had been collected; and the land had also become sandy. Moreover, as underground stone collection destroyed the forests and in some areas the river banks, it might cause river bank erosion as well.

Based on the data obtained in the study, some recommendations have been suggested in the last part of this thesis and most importance has been attached to adapting a government policy for the sector. By implementing the recommendations, the stone resources of the district of Panchagarh can be utilised in developing the area, which will make significant contribution to socio-economic development of the region as well as the country.

Contents

List of Tables

List of Figures

Chapter One
Background of the Study

1.1 Prelude

Many countries resort to various activities to exploit natural resources in order to achieve rapid economic development. One such activity is mining. Consequently, mining is an important economic activity, which has the potential of contributing to the development of areas endowed with the resource. There has been a consistent give and take relationship in the mutual balanced condition gradually built up between the sun, gaseous components of the atmosphere, plant and animal world over the last 450 crore years. Directly or indirectly, there is a fixed and consistent dependable relationship between the elements of the environment. By this, a suitable habitation has been built for the animal world, and on the other hand the animal world itself has changed the environment. Human capability to transform his environment can bring in the benefits of socio-economic development and an opportunity to enhance the quality of life. But the incorrect application of such power can cause incalculable harm to the natural environment, and consequently to human life and society. Man in earlier times believed in 'nature-nurture' concept. However, during the past fifty years, relationship between man and environment has changed considerably.

Human beings have appeared in the natural environment of the earth just 35000 years ago from today. In this short time, human beings learnt to produce crops by cultivating the lands. They have localities for their own habitation, mastered the technique of collecting mineral and energy resources from under the surface and have built industries. They collected resources for building houses for their use and for other economic activities; men have fulfilled their needs by using the environment in different ways.

Physical, inorganic, organic elements of the natural environment work in such a manner that if there is change at a certain time in certain part of the environment; the nature fills it up on its own. This self-controlled system of the natural environment is called homeostatic mechanism. Environmental degradation is the development or loss of the surrounding situation of environment, created for a long time due to many natural or human-made reasons. In the recent world, one of the main causes of environmental degradation is collecting natural resources at an extreme level. Collecting the resources on a massive scale has drawn the natural resources to a very tight limit and they have almost come to the end. Again, the slow growing natural resources like soil are being wasted because of human greed. Such acts of human beings have affected the environment to such an extent that it has become dangerous for the human beings to survive in this degraded environment. As a matter of fact, existence of all the living beings depended on the natural environment. Pure air, clarified water, fertile land, plant and animal, mineral and natural resources etc. are the elements of the environment, which are very important for the maintenance, and development of human society. Economic and technological people have started plundering the natural resources to fulfill the gradually rising needs of society. People's expanded functions like industrialization, urbanization and gradually expanding transport network are having a devastating effect on the environment.

Human beings are affecting the environment through economic functions of different kinds. It is quite complex, because changing a normal condition and process notifies the continuous change of the organic and inorganic structural elements of the environment. Peoples' impacts on the environment fall in two classes, namely: 1. direct impact and 2. indirect impact. Human beings' functions or international impacts are direct or pre-

planned, because they are aware of the negative and positive effects of changing natural environment in order to develop a particular area. Changes in environment caused by humans are seen in a very short time. On the other hand, indirect impacts of human functions on the environment are not pre-planned and these impacts are helpful for economic growth and industrial development. After a long time, these indirect impacts can be understood in a cumulative form.

Unwise activities of human beings are creating environmental degradation and disasters, which reaches a dangerous level and causes irreparable damage to the human society. Human-made environmental disaster is created through deliberate, unintentional and many other functions. Human-made environmental disasters can be divided into three main groups, namely: 1. earthquakes, landslides, erosion etc. which are biological natural disaster; 2. emission of toxic chemical elements, storing toxic chemical elements in open places, unpurified oil leaks in the sea water from nuclear explosion and tanker ships etc.; and population explosion and depletion of nutrition etc. are man-made disasters.

Geologically, Bangladesh occupies a greater part of the *Bengal Basin* and the country is covered by *tertiary* folded sedimentary rocks (12%) in the north, north-eastern and eastern parts; uplifted 'Pleistocene Residuum' (8%) in the north-western, mid-northern and eastern parts; and 'Holocene Deposits' (80%) consisting of unconsolidated *sand, silt* and *clay*[1]. Because of a different geological environment, important mineral deposits of Bangladesh are: Natural Gas, Coal, Limestone, Hardrock, Gravel, Boulder, Glass Sand, Construction Sand, White Clay, Brick Clay, Peat, and Beach Sand Heavy Minerals.

[1] Sirajul Islam ed. *Banglapedia: National Encyclopedia of Bangladesh, vol.9* (Dhaka: Asiatic Society of Bangladesh, 2012), 433.

Hardrock is a term used loosely for igneous and metamorphic rock, as distinguished from sedimentary rock. The hardrocks of Bangladesh are of four types: (i) Maddhyapara sub-surface hardrock, (ii) Bholaganj-Jaflong hardrock concretions, (iii) Tetulia-Patgram-Panchagarh Hardrock Concretions, and (iv) Chittagong-Chittagong Hill Tracts sedimentary concretions[2]. The items (ii), (iii) and (iv) are usually considered as Stone or Gravel deposits.

Wide areas of Northern and Northeastern parts of Bangladesh are covered with underground stone or gravel beds. In the north, the gravels are well-exposed at Dahagram-Angorpota, Patgram, Dalia, Chapani, Kaliganj in greater Rangpur and Tetulia, Vazanpur, Boalmari, etc. in Panchagarh. According to the survey of Korean Development Corporation, the amount of underground stone deposit is about 8 crore cubic feet.[3] These stones are quite large (maximum recorded elongation is 30 cm) and are alternated with very coarse to medium sand. They are quite fresh and wel-rounded, with a smooth surface. The sphericity and roundness of these stones are high and they have quartz, quartzite, granite, gneiss and schist as their dominant lithologies.

Composition of these stones or gravels is identical with that of the Daling series of the Himalayas. These gravel beds are grouped together as the Panchagarh 'Sandy-Gravel' beds belonging to the Upper Pleistocene series. They are overlain by the 'Holocene' series represented by alluvium and sometimes-fine sand, silt and clay.

The geological history and the environment of deposition of the Panchagarh 'Sandy-Gravel' beds are quite interesting. During the last glacial maximum (i.e. 18,000 years BP), the

[2] Sirajul Islam ed. *Banglapedia: National Encyclopedia of Bangladesh,* vol.6 (Dhaka: Asiatic Society of Bangladesh, 2012),459.

[3] *The Daily Ittefaq*, (Dhaka: 22 October 2009), p. 5.

'Himalayas' were quite high and were glaciated. The glaciers extended up to the foothills[4]. Dry climatic conditions prevailed during that time and the melted water was flowing over the Bengal plain through some narrow and deeply incised river systems. At the end of the last glaciation (upper part of Upper Pleistocene), monsoon rainfall was quite prominent and the glacier also started melting. The melt water plus the amplified monsoon water flowed over the Bengal plain. The narrow river systems were over-loaded and surplus water flowed over the *Braind Tract*. During that time, *Barind* initial surfaces were dissected leaving some north-south elongated red bed islands as exhibited by the present morphology of the *Barind Tract*. These enormous water flows carried the gravels up to the Panchagarh-Dahagram-Dalia area and were deposited as some piedmont deposits.

In the district of Panchagarh, stone is collected in two ways, viz. 1. underground collection by removing the upper layer of the soil; 2. collecting the floated away stone with the flow of water from the river by filtering. In the case of collecting underground stone, 10 to 30 feet of the cover of the ground is removed with spade from the upper layer of the soil and then underground stone is collected. It is tested before digging the land whether there exists stone or not. Normally by digging a small well, a long iron rod is inserted into the soil to make sure whether there is stone or not. If stone lies in 10-20 feet below the surface and if the layer of the stone is 8 feet or more, then the stone is collected from that land as collecting stone from this kind of land is profitable. Usually, stone businessmen buy this kind of land from the land owners. The land owners sell this land on condition that after stone collection, the real owner will get back the ownership of land. After buying the land from the land owners, businessmen appoint labourers during dry season and eliminate 10-20 feet soil from the upper layer of the land in order to

[4] Sirajul Islam ed. Banglapedia, *National Encyclopedia of Bangladesh* (Dhaka: Asiatic Society of Bangladesh, 2003), p. 460. Vol.6. flo-has. 2012. Sirajul Islam ed.

collect the stone. In this case, the land is dug in such a manner that later on some part of the land becomes ditch and the rest of the land becomes uneven as the stratification of soil is damaged. This method of stone collection does not rely on machines, rather it relies totally on the manual labour of human beings and through this a lot of people get the opportunity to work. Later on, other businessmen buy these stones; classify them into different grades according to field and then by crashing them with machines they are turned into different sizes which are sold for construction work.

Craving for a pristine environment is present in every culture, every religion and in every individual. The issues, which we designate under the rubric of environment, emerged in the first six decades of the century[5]. Early German ideas about conservation biology sailed through the Atlantic to assume the doctrine of resource conservation, which developed as a very different American tradition of linking the wilderness. In modern times, however, growing human populations and the power of our technology have heightened our concern about what we are doing to our environment.[6]

In the district of Panchagarh, around fifty thousand people got the opportunity of employment because of collecting stones by digging the soil. Besides, stone collection has contributed to create employment for a huge part of the population. Though Panchagarh is one of the poorest districts, because of stone collection for the last 20-25 years, a visible improvement is noted in the economic and social sectors of this area. A lot of people opine that people of this district have developed a lot in the economic and social sectors because of stone collection, and employment opportunities have increased for all classes of people of this area. Though some visible improvements are noted, there are also

[5] Mahbub Ullah, "Economy and Environment", in *Bangladesh Environment Outlook 2001*, edited by Ainun Nishat, Mahfuz Ullah and A. K. Enamul Haque (Dhaka: Centre for Sustainable Development, 2001), 13.

[6] P. William Cunningham and Barbara Woodworth Saigo, *Environmental Science*, 5th ed. (New York: McGraw-Hill Companies, 1999), 5.

some negative impacts of stone collection. Cultivable lands of this area are decreasing because of stone collection, prolific energy of soil is damaged, soil composition is being harmed, there is decreased number of trees or forests etc. These various negative impacts are seen. Besides these visible negative impacts, there is also possibility of many negative impacts of stone collection like landslides, earthquakes, water pollution, soil pollution etc. If these problems occur, the people and the resources of this area are likely to face many damages. The cultivable lands from where stone is collected are not filled properly; as a result, they remain uncultivable. As these lands remain uncultivable, the agricultural production of this area is decreasing for which the owners of the lands are facing long term problems. For this reason, though economic development is done by stone collection it should be considered whether the people of this area will be able to enjoy the benefits in the long run. In the present research, the researcher has tried to find out the ways of solving the economic, social and environmental impacts of stone collection, and how the negative impacts of stone collection can be reduced for the highest benefit.

1.2 Statement of the Problem

Underground Stone collection is very closely linked to the subsistence of the people of ‘Tetulia Upzila’ under ’Panchagarh’ district. Few years ago, the main earning source of people of this area was agriculture. The production was not sufficient against their demand. The agriculture system was not modern, so it filed to fulfill their basic human needs. Under these circumstances, most of the people have to live under poverty line. This dismal situation forced people to shift to alternative subsistence strategy, i.e. stone collection. Introduction of underground stone collection has opened a new door of employment. Thousands of people, both male and female, are working in this sector. The scope for job opportunity is enabling the local people to lead a better life.

Usually underground stone is collected by digging and eliminating the top soil. Sometimes, it is needed to dig the soil from 5 to 80 feet deep. Using this manual digging method, underground stone is collected from cultivable and uncultivated land, homestead, river bank and coppice land. For these reasons, the soil composition of this area is changing continuously which affects the soil fertility, soil microorganism, soil texture etc. The continuous change of soil composition can affect the agricultural production. Irrigation systems may also be affected by this. Moreover, due to digging of river bank, the small rivers are also affected. Forest lands are decreasing due to underground stone collection. All these factors are increasing the vulnerability of human life as well as wildlife.

At present, environmental degradation has been recognized as one of the major problems worldwide. Even fifty years ago from now, the environmental condition of earth was stable. But, unfortunately it is true that along with the growth of population, as many materials for human luxury have come to the doors of man, miserable condition has also expanded throughout the world. Gradually the population explosion and the development of technology have provided the weapons for destroying the ecological balance in the hands of human beings. At present, all the countries of the world in all sectors are engaged in competition for development. The connection of environmental degradation with development activities is very close. Environment and development cannot be viewed differently as both of them are closely connected. Development cannot sustain on decaying environment, whereas development cannot be stopped for the decadence of environment. The ideology of dynamic development by meeting the present demand without thinking about the future generation is the slogan of permanent development activities in the present-day world.

Bangladesh is a small country with a dense population. About 16 crore people live here instead of a 3.5 crore population, which is its capability according to the geographical area. For this reason, excessive pressure remains on all the wealth sectors of this country. The stock of underground stone in Panchagarh district is very limited. It is very important to ensure the collection in a planned way and ensure its proper use. Alongside this, whether any environmental damage is taking place because of stone collection and the possibility of natural disaster in this area should be analyzed immediately. The condition of agricultural land for stone collection and whether this situation would give rise to possibility for the long run loss of inhabitants in this area have to be investigated properly. But almost no noteworthy study has been carried out till now and as a result these things have remained unknown to us. Even whether the socio-economic condition has improved because of stone collection is still unknown. For all of these reasons, analyzing the economic, social and environmental effects of underground stone collection and making the people aware of the consequences as well as drawing the attention of the government is very urgent.

1.3 Study Questions

A few questions were raised critically to reconcile with the research objectives. These questions are narrated as follows:

1. What is the present trend of underground stone collection?
2. Who are being benefited and who are being suffered due to underground stone collection?
3. What socio-environmental problems are being created due to stone collection?
4. Is it helpful for long-term socio-economic development?

5. Is it supported from environmental consideration?
6. What are the views of the people of this area regarding underground stone collection?
7. Is there any alternative way of underground stone collection?

1.4 Objectives of the Study

The principal objective of the study was to know the socio-economic and environmental impact of underground stone collection. There were some specific objectives which as follows:

1. To assess the socio-economic impact of underground stone collection;
    - Here the researcher tried to assess the impact of underground stone collection on income, expenditure, education, health status, food intake, housing, employment etc.
2. To know the environmental changes that occurred after starting underground stone collection as well as their effect ;
    - Here the researcher tried to know the impact of underground stone collection on soil fertility, soil composition, river bank erosion, aquifers of water, plant and animal biodiversity, water body, air pollution etc.
3. To know the people's attitude regarding stone collection ;
    - Here the researcher tried to know the level of knowledge regarding environment, people's perception, desire, initiatives, what the people thought about underground stone collection etc.
4. To explore the opportunities of socio-economic and environmental development;

- Here the researcher tried to explore the opportunities of development by using underground stone and how to maximize the economic and social benefit by minimizing environmental degradation.

5. To help in policy making on underground stone collection;

- Here the researcher tried to give some suggestions and recommendations on the basis of study findings.

1.5 Definition of Key Terms

a) Environment: In general, we know what environment is but a concrete definition is not always available to us. In simple words, environment is 'Where we all live'. The word 'environment' originated from the old French word 'Environs' meaning encircle. The human beings are surrounded by people, animals, plants, air, water, land, soil, solar energy and other physical objects. All these are parts of human environment. Hence a simple and common definition of Environment is 'The sum of all social, biological, physical and chemical components and processes which make up the surroundings of man'. Environment includes: (a) Biophysical components and resources such as soil, water and air, including all layers of atmosphere, fisheries, wetlands, wildlife (biodiversity) as physical and biological factors and processes which support these resources, (b) Social components made up of the human communities and populations that utilize the various resources.[7] In this study, the researcher only assessed the impact of underground stone collection on the physical environment; so the term 'Environment' will be used to refer to the Physical Environment.

[7] Md. Abdul Hamid, *Factors in Environmental Degradation Due to Technological Interventions* (Comilla: BARD, 2004), 13.

b) Underground Stone: Underground stone refers here to the stone or Hardrock collected from 10 to 30 feet depth from the surface of the soil and used for construction. The Underground Stone or Hardrock is also usually considered as gravel deposits in environmental science.

c) Environmental Degradation: Environmental Degradation refers to the process by which the components of environment are being lost and the unbalancing condition affects the living organism of the earth. Here the researcher used the term Environmental Degradation only to refer to those negative effects which are caused by underground stone collection.

d) Natural Hazards: Natural Hazards refer to those natural phenomena which increase the vulnerability of human life as well as the wildlife. In this study, the researcher used the word natural hazard only to refer to those hazards which are directly or indirectly occurring due to collection of underground stone.

e) Land Seller: In the present study, land seller refers to the person who sold his land to the stone businessmen for collecting underground stone. Here land seller does not refer to that person who sold his land for ordinary purpose. Land owners of the study area do not sell their land permanently; they only sell their land for a specific period for collecting underground stone. So, in the study the term 'Land Seller' will be used in such case.

f) Sustainable Development: Sustainable development refers to the development that ensures preservation and enhancement of environmental quality, sound and long term use of resources for economic growth, which meets the needs of the present without compromising the ability of future generations to meet their own need. In real sense, it encompasses economic, environmental and social development and means it must be economically viable, environmentally sound and socially acceptable. If an activity is not

sustainable in any of the above three, development will not be sustainable.[8] According to FAO, "Sustainable development is the management and conservation of natural resources and the orientation of technological and institutional changes in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development in the agriculture, forestry and fisheries sectors conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.'[9]

1.6 Rationale of the Study

1.6.1 Review of Literature

Review of literature is a source of knowledge and provides a deep understanding about the topic or the issue closely related to the study undertaken. It also finds knowledge gap and justify the rationale of the study. For doing so, the researcher went through various relevant books, journals, web-sites, and research reports for finding research gap and making a new contribution in the existing knowledge as well as relevant understanding about the study. Some of them are cited bellow.

Jafaru Adam Musah (2009)[10] carried out a study entitled 'Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining – A Case Study of East Gonja District (Ghana) and Gunnarsholt (Iceland)' to compare sand and gravel mining in the East Gonja District (EGD) of Ghana and the Gunnarsholt area of Iceland'. The main objective of the study was to assess the sociological and ecological impacts of sand and gravel mining in the study areas. He used the interview method for data collection and the focus of

[8] *Ibid*., p.14
[9] *Ibid.*
[10] Jafaru Adam Musah, *Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining – A Case Study of East Gonja District (Ghana) and Gunnarsholt (Iceland),* (Ghana: Environmental Protection Agency, 2009), 75-108.

interviews was on the respondents' perceptions of state regulations on gravel and mining vis-à-vis socio-ecological impacts. The study revealed that all respondents from each of the study areas indicated positive impacts of mining in enhancing infrastructural development, such as road and housing, and providing employment to mine workers, as well as providing income for landowners. He also observed loss or reduction of farmlands as a major impact of gravel mining in the district. Other significant impacts of gravel mining in the area included pits serving as breeding grounds for mosquitoes and spread of other diseases, erosion and loss of vegetation, loss of economically important trees, as well as roots of conflicts. In his study the researcher analyzed the policy and regulations of the study area and put forward some recommendations to mitigate the problem.

Sand and gravel mining activities is also going on in Bangladesh and various problems are faced creating for that. But there have been no such type of in-depth study in this field to assess the social and environmental impact of gravel mining in the context of Bangladesh.

William H. Langer (2001)[11] in his report 'Potential Environmental Impacts of Quarrying Stone in Karst—A Literature Review' discussed about the natural formation karst. He also discussed about the potential environmental impact of hard rock mining. He mentioned that "Modern technology and scientific investigation methods have made it possible to reduce environmental impacts associated with extraction of carbonate rocks and manage impacts at acceptable levels that do not cause significant harm to the environment. Nevertheless, carbonate rock resources cannot be obtained from the

[11] William H. Langer, *Potential Environmental Impacts of Quarrying Stone in Karst—A Literature Review,* (USA: U.S. Department of the Interior, 2001), 1-33.

landscape without causing some environmental impacts"[12]. He mentioned the impact of hard rock mining on water surface, air, sound etc. and water quality and water surface were the vital matters of discussion in his report. He did not analyze the social impact of hard rock mining. Moreover, the report was prepared in the context of USA where technological instrument is being used extensively in the mining sector.

M.S. Steve Blodgett and P.E. James R. Kuipers (2002)[13] in their Technical Report on 'Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impacts' discussed about some underground mining methods and their impact. They stated that "underground mining causes impacts to hydrologic features like lakes, streams, wetlands, and underground aquifers. Modern hard-rock metals mining using large-scale methods like block caving and room-and-pillar mining create large areas of hydrologic and subsidence related impacts". In this report the authors also discussed the hydrologic impact of hard rock mining and also gave some recommendations to mitigate the problems. Moreover, they recommended additional investigative and research efforts to provide a sound basis for scientific, regulatory, industrial and public opinion with regard to subsidence and hydrologic impacts and to invent mitigation techniques for reducing or minimizing the problem.

Afia Akhtar (2000)[14] in her article entitled "Coal and hard rock resources in Bangladesh" discussed about the two potential mineral resources i.e. hard rock and coal of Bangladesh. In her writings she mentioned that Bangladesh economy would be benefited by the two resources. She suggested development of minerals-based industries and ensuring the

---

[12] *Ibid*. p.7.

[13] M.S. Steve Blodgett and P.E. James R. Kuipers, *Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impact (*Bozeman: Center for Science in Public Participation, 2002), 1-44.

[14] Afia Akhtar, "Coal and hard rock resources in Bangladesh,*" Geological Survey of Bangladesh* 23, no. 1 (March 2000): 25-28. under "Settings," http://episodes.co.in/www/backissues/231/25-28 Akhtar.pdf. [accessed May 3, 2010].

proper use of resources. She also opined that those resources would create new opportunities for employment and eradicate poverty, but she did not examine the impact of hard rock and coal mining.

Murad Khan et. al. (2012)[15] in their study titled "Effects of Stone Dust Exposure on Some Liver and Kidney Related Serum Parameters of Stone Crush Plant Workers" tried to explore the effects of stone dust exposure on liver and kidney-related serum parameters. They studied the workers of stone crush plants in various localities of Swat and Dir (L) districts of Khyber Pakhtunkhwa, Pakistan. They found that the level of serum SGPT of stone crush workers was significantly higher as compared to persons not exposed to stone dust ($P<0.05$). The serum level of creatinine was also studied, which was significantly higher in stone crush workers as compared to the persons not exposed to stone dust. The significantly higher level of serum creatinine represents adverse effect of stone dust exposure on the kidneys of stone crush workers. In their conclusion, the researchers opined that continuous exposure to stone dust in stone crushing plants resulted in the increased levels of serum GPT, ALP, bilirubin and creatinine. In Panchagarh district, the underground stone is crashed by using machines after collecting it. Many labourers were working in this sector and they might face the same problem. So, the study would help the researchers to assess the impact of underground stone collection on health.

M. K. Hasan and A. K. M. Ashraful Alam (2006)[16] in their article "Land Degradation Situation in Bangladesh and Role of Agroforestry" discussed Land degradation as one of the major ecological issues of the world. They elaborated on the extent and causes of land

---

[15] Murad Khan et al., "Effects of Stone Dust Exposure on Some Liver and Kidney Related Serum Parameters of Stone Crush Plant Workers" *Journal of Biology and Life Science* 3, no. 1. (2012): under "Settings," http://macrothink.org/journal/index.php/jbls/article/view/1961/ [accessed July28, 2013].

[16] M. K. Hasan and A. K. M. Ashraful Alam "Land Degradation Situation in Bangladesh and Role of Agroforestry" *Journal of Agriculture & Rural Development* vol.4, no:1 (2006). Pp.19-25. Under "Settings," http:// banglajol.info/index.php/JARD/article/view/763 [accessed June 25 2011].

degradation in Bangladesh. They mentioned river bank erosion, water logging, water erosion, deforestation etc. as the major causes of land degradation in Bangladesh but they did not mention one of the major causes of land degradation, which is coal and hard rock mining. Again, they suggested agro-forestry to minimize the loss of land degradation. Agro-forestry may also apply in Panchagarh district to control land degradation.

M. Feroze Ahmed (2002)[17] in his article "Environment and Sustainable Development: A Conceptual Model" presented the scenario of sustainable development in the context of Bangladesh. He stated that "the most components of the environment in Bangladesh is in the state of dynamic change to sustain its high population growth. The fast growing population is consuming, manipulating, and restructuring the natural environment, which is a source of material, energy and services for sustenance and a receptor of human impact."[18] According to the author, the country is largely affected by environmental degradation and depletion of land resources. Principal environmental concerns are degradation of land resources, wetlands and coastal environment, fast depletion of forest, declining groundwater table, unplanned urbanization, shrinking bio-diversity and uncontrolled environmental pollution. Moreover, he presented a conceptual model of sustainable development and suggested to use environmentally clean and efficient technology for development. This model can be used to ensure sustainable development in Panchagarh district.

M. Reazuddin and Mahiuddin Ahmed (2001)[19] in their article "State of Land Degradation in Bangladesh" stated the causes and characteristics of land degradation in Bangladesh. They also discussed the consequences of land degradation in Bangladesh.

---

[17] M. Feroze Ahmed, "Environment and Sustainable Development: A Conceptual Model" in *Bangladesh Environment 2002,vol.2,* eds. M. Feroze Ahmed, Saleh A Tanvir and A. B. M. Badruzzaman (Dhaka: BAPA, 2002), 1048-1061.

[18] *Ibid.* p. 1049.

[19] M. Reazuddin and Mahiuddin Ahmed, "State of Land Degradation in Bangladesh," in *State of Environment Report 2001,* ed. Quamrul Islam Chowdhury (Dhaka: FEJB, 2001), 257-264.

But in their article they did not mention anything about the ways of combating land degradation in the mining sector.

Maunuddin *et. al.* (2007)[20] in their study Stakeholders' "Information Needs for Planning and Management of Natural Resources in the CHT" have shown how Government initiatives can develop the livelihoods of the population of CHT. Their study focused on how the people of CHT were surviving by using their surrounding natural resources, like land, water, forest, wild animals and so on. They also tried to explore the pressure on natural resources and factors contributing to the problems of degradation of natural resources.

Brent and Hietkamp (2006)[21] published an article titled "The Impact of Mineral Resource Depletion" in 'International Journal of Life Cycle Assessment.' Here they tried to explain various mineral resources management. Mineral resources are so scarce, they claim that, we have to use mineral resources by examining the socio-economic needs on the basis of their reserve. All mineral resource depletions have their separate and individual impact on environment. Therefore, it is argued that environmental and economic aspects cannot be separated; the complex relationships between increasing scarcity and human livelihood consequences could form the basis for comparison between different mineral resources. So, they suggested using mineral/natural resources in a well-planned way.

---

[20] Maunuddin, *et al.*, *Stakeholders' Information Needs for Planning and Management of Natural Resources in the CHT* (Dhaka: CHARMP Project, Project report 5, 2007), 1-27.

[21] Alan C. Brent and Sibbele Hietkamp, "The Impact of Mineral Resource Depletion," *International Journal of Life Cycle* 11, no. 5 (2006): 361-362. Under "Settings," http://researchspace.csir.co.za/dspace/handle/10204/1957 [accessed September 21, 2011].

Habibur Rahman Khan (1996)[22] published an article titled "Environment and Sustainable Development in Bangladesh" in BIISS Journal. The article found out the linkage between society, economy and environment. The article also highlighted how the environment of Bangladesh was degrading. In this article, there was no discussion on mineral resource mining and its linkage with development.

Nazrul Islam (1997)[23] in his article "Income-environment Relationship: How Different in Asia" showed that there was no rule that the environment has first deteriorate with economic development. There was no absolute, invariant income-environment relationship to imply such a rule. But in his discussion, the issue of how environment was degrading due to collection of underground resources was overlooked.

Savindra Singh (2000)[24] in his book titled "Environmental Geography" examined various facts of the environment, so that the interactions between technologically advanced 'Economic Man', the environment, the process leading to environmental degradation and pollution are properly understood. Finally, some methods and approaches to environmental planning and management together with examples of a few typical programs and projects were discussed in this book. The writer showed the relations between environment and man and suggested some projects in this context.

M. Naveen Saviour (2012)[25] in his article "Environmental Impact of Soil and Sand Mining: A Review" showed how sand mining affected water and air quality, soil quality,

---

[22] Habibur Rahman Khan, "Environment and Sustainable Development in Bangladesh," *BIISS Journal* 17, no. 2 [1996]: 259-284.

[23] Nazrul Islam, "Income-Environment Relationship: How Different in Asia", *Asian Development Review* 15, no. 1 (1997): 18-51.

[24] Savindra Singh, *Environmental Geography* (Allahabad: Prayag Pustak Bhwan, 2000), preface.

[25] M. Naveen Saviour "Environmental Impact of Soil and Sand Mining: A Review," *International Journal of Science, Environment and Technology* 1, no 3 (2012): 125-134.

flora and fauna. He also opined that soil and sand mining caused negative impacts on the environment because of poor handling of resources. The scenario is also present in our country. Due to the poor handling of resources, the mineral resources of Bangladesh are not being used properly and the government did not get revenue from mining.

Besides, some others books and articles related to Bangladesh environment, society and environment, were also reviewed. Among the researchers, Mahbuba Nasreen, A. Z. M. Shoeb and Abdul Baqee may be mentioned here.

A critical assessment of the literature review showed that much of the negative environmental and health effects of mining activities have been documented. However, there were scanty suggestions about policy directives needed to redress hazardous effects of underground stone collection. In addition, most of the reviewed literature was focused mainly on either environmental impact or economic impact of mining. Hence, the present study aimed to relate the socio-economic and environmental impact of underground stone collection. This research work therefore intended to undertake a thorough and broader investigation into the environmental and social implications of mining on surrounding communities, both negative and positive, and recommend policy directives to improve the already instituted policies, as well as reduce the rate of negative effects of underground stone collection.

1.6.2 Justification of the Study

There is no doubt that environmental degradation may cause huge loss to human lives and the country's economy. It can slow down overall development activities. It hampers social and economic progress and washes out all development efforts. It is also a threat for biodiversity conservation. People are getting money by selling stone and operating development activities, but development will not be sustained until and unless

environmental degradation is minimized. So, it is a crying need to justify the impact of underground stone collection. It appears that studies so far done on environmental issues in Bangladesh are limited to a specific area. In this perspective, this study is a pioneering work in this field. So, it can be said that this study will be fruitful in the context of Bangladesh.

1.7 Scope and Limitation

This study is comparatively a new field of environment-related research in Bangladesh. The study seeks to explore the socio-economic and environmental impact of underground stone collection. In this regard, the researcher tried to find out both positive and negative impacts of underground stone collection. Besides, he tried to find out ways of minimizing the negative impact.

There were also some limitations of this study. The sample size was not sufficient in relation to its population. Moreover, additional efforts were required on the environmental aspect and some tools and techniques of natural science had to be applied. The researcher failed to do it because he was a student of social science. He had to present the environmental scenario superficially. The researcher faced problem in this regard and had to rely on existing literature. Though, literature regarding underground stone collection is available in the global context, literature in this regard on Bangladesh is very few. As there was no other study regarding this issue in the study area, the researcher failed to make comparisons with others.

1.8 Conclusion

Underground Stone mining has been one of the serious environmental problems around the globe in recent years. This often resulted in land degradation, loss of agricultural lands and biodiversity, as well as decreased agricultural production. Despite widespread

occurrence and potential impact on the environment and agricultural lands, underground stone collection has received little attention. Even though some studies have enhanced our consciousness regarding the impacts, attention usually seems to be focused on mining and economic impact is seldom considered in the context of environmental threat. This study sought to assess the socio-economic and environmental impacts of underground stone collection with particular reference to the Panchagarh District of Bangladesh.

Chapter Two
Methodology

2.1 Introduction

Research methodology refers the procedure of solving the research problem systematically. It may be understood as a science of studying how research is done scientifically.[1] In it various steps such as formulation of the research problem, selection of method, selection of the study area, determination of the sample size and sampling techniques, methods of data collection, techniques of analyzing data etc. are usually adopted by a researcher in studying his research problem along with the logic behind them. Methodological aspects of the present study have been discussed in this chapter.

2.2 Selection of a Method

The present study was carried out using an exploratory social survey. It is exploratory in the sense that the present study tried to explore the social, economic and environmental impact of underground stone collection.

2.2.1 Sources of Data

Basically, the present study was based on primary data. Data had also been collected in required fields from secondary sources. Both qualitative and quantitative data were used in the present study. The sources of data are given below.

2.2.1.1 Primary Sources

Primary data were collected from the people of the study area through interview, Focus Group Discussion (FGD) and Observation. Primary data were also collected from the Persons who are not directly related to stone collection and stone business.

---

[1] C. R. Kothari, *Research Methodology: Methods & Techniques,* 2nd ed. (New Delhi: New Age International Publishers, 2006), 8.

2.2.1.2 Secondary Sources

The secondary sources of data used in the study included publications of Bangladesh Bureau of Statistics (BBS), census reports, Bangladesh Economic Review, concerned government offices and non-government organizations, web-sites, thesis papers etc. Published documents and research articles from different national and international research organizations and universities were also consulted for developing idea and writing the thesis.

2.2.2 Selection of the Study Area

The present study was carried out in Panchagarh district of northern Bangladesh. The researcher selected the area because it was one of the large sources of underground stone in Bangladesh. Underground stone are collected here manually by removing soil from the land. It is being collected for a long time compared to other parts of northern Bangladesh. Panchagarh district is adjacent to the Himalayas Mountain. For this reason, there is a large deposit of underground stone in this area. Collecting the underground stone without considering the environmental impact may cause great harm for the people of this area. The researcher chose the area because he wanted to explore the impact of underground stone collection. Moreover, the researcher was well acquainted with the geography, life-style and the culture of the people of the study area as his father was an employee there.

2.2.3 Study Population/Universe and Unit of Analysis

The researcher has selected eight villages of Panchagarh district for the study. Among the people of the study villages, 870 persons were involved with underground stone collection. All the people of the study villages who were engaged in underground stone collection were considered as the population of the research and each respondent was considered as the unit of analysis.

2.2.4 Sample Size and Sampling Procedure

Sampling is the procedure of selecting the representative part from the population. As it was an exploratory research and the area of study was very large, so the researcher used sampling procedure for conducting the study conveniently. He used multistage sampling method and stratified sampling method for selecting representative sample from the universe. First, multistage sampling method was used to select the study villages. Applying multistage sampling method among the five Upazilas of Panchagarh District; two Upazilas; and two Unions from the two Upazilas; and from the four Unions eight villages were selected for the study. Second, stratified sampling method was used to collect data from different categories of respondent. Following stratified sampling method the researcher was selected four categories of people: (I) Stone labourers; (II) Stone Businessmen; (III) Land Sellers; and (IV) General People. A total of 317 respondents were considered as the sample of the study in accordance with the method of purposive sampling. Among the 317 respondents, 267 were directly involved with underground stone collection activities. The researcher had conducted a pre-survey in the study villages to determine the number of people directly involved in underground stone collection. He found that there were 870 people directly involved in underground stone collection in the study villages (eight villages). Although tables could provide a useful guide for determining the sample size, it was needed to calculate the necessary sample size for a different combination of levels of precision, confidence, and variability. The researcher used Cochran's formula to yield a representative sample for proportions. The following formula was used for determining the sample size:

$$n_0 = \frac{Z^2 pq}{e^2}$$

Which is valid where n_0 is the sample size, Z^2 is the abscissa of the normal curve that cuts off an area α at the tails (1 - α equals the desired confidence level, e.g., 95%), e is the desired level of precision, p is the estimated proportion of an attribute that is present in the population, and q is 1-p. The value for Z is found in statistical tables which contain the area under the normal curve.

For selecting the sample from a known study population the following formula has been used:

$$n_0 = \frac{Z^2 pq}{e^2}$$

$$n_0 = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2} = 384$$

Where, n_0 =sample size

Z=1.96(confidence level of 95 %)

P=0.5(estimated population proportion)

q=(1-p)=0.5

e= 0.05(error limit)

If the population is small then the sample size can be reduced slightly[2]. This is because a given sample size provides proportionately more information for a small population than for a large population. The sample size (n_0) was adjusted using the following formula.

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} = \frac{384}{1 + \frac{384 - 1}{870}} = 267$$

Where, N=Size of Population=870

n=Adjusted Sample Size

Moreover, 50 persons were included as the key informants from the local leaders, agricultural officers, UNO, fishery officers, NGO personnel and representatives of local government. The sample-frame is presented below through a table.

[2] http://www.edis.ifas.ufl.edu/pd006 [accessed December 10, 2010]

Table 2.1
Sample Frame and Sample Size

Category of Respondents	Number of Respondents Included in the Sample	Sampling Procedure
Stone Labourer	153	Multistage and Purposive
Stone Businessmen	84	Multistage and Purposive
Land Owners	30	Multistage and Purposive
Total Sample Size (Directly Involved)	**267**	
General People	50	Multistage and Purposive
Key Informants (GO- NGO Personnel and Local Leaders)	50	Purposive
Grand Total (Directly Involved + General People + Key Informants)	**(267+50+50)=367**	

2.2.5 Variables and Indicators

Various indicators and variables were used to assess the socio-economic and environmental impact of underground stone collection. Respondents' income, expenditure, education, health status, food intake, housing type, employment opportunity, soil condition, land degradation, river bank erosion, plant and animal biodiversity, number of water body, people's perception, people's desire, people's initiatives etc., were taken as the variables and indicators for the present study.

2.2.6 Data Collection Techniques

The researcher used several methods for data collection, which are stated below:

2.2.6.1 Interview

The interview method of collecting data involves presentation of oral-verbal stimuli and replies in terms of oral-verbal responses.[3] This method can be used through face to face interview. Most of the primary data for the present study were collected from the respondents

[3] Ibid. p. 97.

through face to face interview. Interview schedule was used for conducting interviews with different categories of respondents. Two different Interview schedules were used for primary data collection, where both open-ended and close-ended questions were incorporated. The questionnaire was pre-tested. The researcher appointed four field investigators for collecting data from the field level who were experienced in this field. They were trained by the researcher and worked under the close supervision of the researcher. The researcher himself collected data from the key informants by using another interview schedule where only open ended questions were incorporated. The researcher applied triangulation techniques of data collection to face the validity threats and to ensure the reliability of findings. It is a powerful technique that facilitates validation of data through cross-verification from more than two sources. In particular, it refers to the application and combination of several research methodologies in the study of the same phenomenon.[4] Field investigation was carried out during the period April 2010 to October 2010.

2.2.6.2 Observation

Observation is also a commonly used method of data collection in social research. Observation may be defined as systematic viewing, coupled with consideration of the seen phenomena.[5] Under the observation method, the information is sought by way of investigator's own direct observation without asking from the respondent.[6] In the present study, the researcher used non-participant observation technique for collecting information. The researcher used the method to observe the impact of underground stone collection on the

---

[4] R. C. Bogdan and S. K. Biklen, *Qualitative research in (validation) and qualitative (inquiry) studies* under "Settings" http://www.wikipedia.org/wiki/Triangulation_(social_science) [accessed January 07, 2009].

[5] Pauline. V. Young, *Scientific Surveys and Research* (New Delhi: Prentice Hall of India, 1977), 22.

[6] C. R. Kothari, *Research Methodology: Methods & Techniques,* 2nd ed. (New Delhi: New Age International Publishers, 2006), 96.

physical environment of the study area. A checklist was been followed by the investigators for observation, which has been attached at the end of the thesis.

2.2.6.3 Focus Group Discussion

Focus Group Discussion as a qualitative research method with a definite goal is essentially a group discussion taking place between people of more-or-less identical age, socio-economic status, sex and other common characteristics[7]. It is a method of data collection where a group of people is brought together to talk about a particular issue through open discussion. The researcher conducted two Focus group discussion sessions to collect in-depth data regarding stone collection and its impact. There was another reason for conducting FGD, which was to cross-cheek the data which were collected through interview and observation method.

2.3 Analysis and Interpretation of Data

After collecting data, design for analysis and tabulation was developed by the researcher himself. Data were inputted by the researcher in computer. The researcher himself analyzed and interpreted the data. SPSS and MS-Excel software were used for analyzing data and making comparison. Several statistical tools and tests like averages, percentages, summation, median, mode, correlation, regression, chi-square test, t-test, F-test etc. Qualitative method was applied to analyze the data collected from the key informants and the outcomes from the key informant interviews were presented along with the discussion in tables and charts.

---

[7] Achintya Das Gupta, *The Qualitative Approach to Social Research* (Dhaka: Worldview International Foundation, 1989), 15.

2.4 Logical Framework Matrix

Principal Objective		**Assumed Result**			
To know the socio-economic and environmental impact of underground stone collection.		Apparently Socio-Economic development was occurring but environment was affected			
Specific Objectives	Verifiable Indicators	Analytical approach	Data Sources	Assumed Result	Outcomes of the Study
To know the socio-economic impact of underground stone collection.	Income, expenditure, education, health status, food intake, sanitation, road transportation system, housing, employment etc.	Qualitative and Quantitative	Field Survey, FGD, Observation.	A positive change has taken place in this area.	Positive Change Noticed
To know the environmental change that occurred after starting underground stone collection and its impact.	River bank erosion, aquifer of water, soil fertility, soil composition, plant and animal biodiversity, water body, Air pollution.	Qualitative and Quantitative	Field Survey, Observation, Geographical record of this area, Newspaper reports.	Stone collection is affecting negatively the physical environment of this area.	Negative Impact Noticed
To know the people's attitude regarding stone collection.	Level of knowledge regarding environment, people's perception, people's desire, people's initiatives.	Qualitative and Quantitative	Field Survey, Observation, FGD.	People think that it is necessary to take initiatives to reduce environmental degradation.	Assumption is not fully correct
To propose some policies regarding underground stone collection.	Suggestions, Recommendations	Qualitative and Quantitative	Publications, Seminar, Discussion on research paper.	Government will make policy regarding this issue.	Suggestion Recommended
To explore the opportunities of socio-economic and environmental development.	Suggestions, Recommendations, Government Reports,	Qualitative and Quantitative	Reports of various departments, Observation, Public Opinion,	A new way of development will be opened.	It is possible

2.5 A Brief Introduction of the Study Area

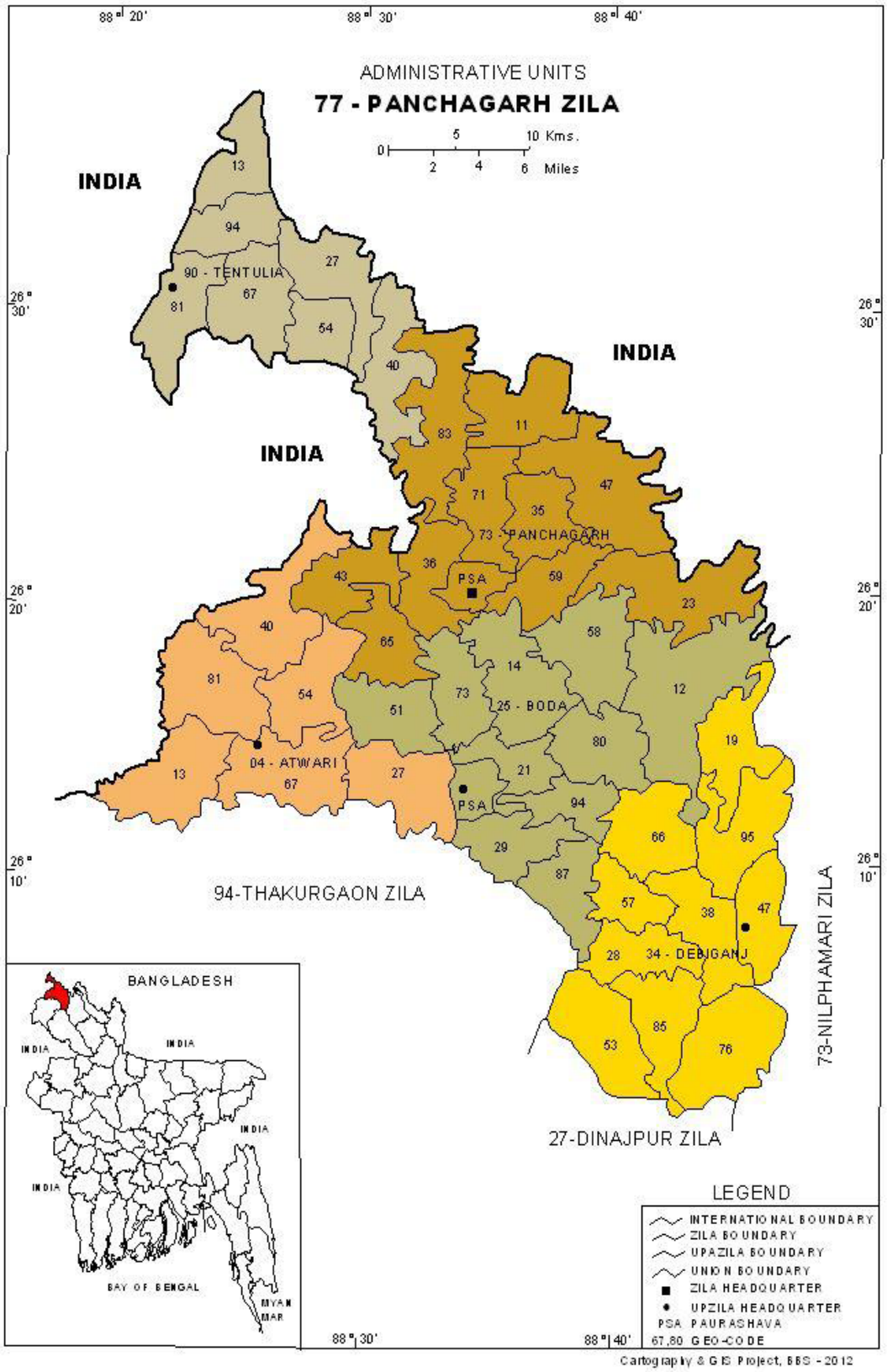
The physical environments like, topography, climatic and underground water condition, soils, minerals, cropping systems, rivers etc. influence the socio-economic condition of an area. However, all the parameters mentioned above are generally inconvenient to incorporate in this type of study. The essential parameters and the most relevant issues and points were taken into account in conducting the study. Moreover, in many cases non-availability of requisite data from the study area in this study was also considered. The best possible and easily available ones are presented in the following sections.

2.5.1 Location and Area

Panchagarh is a district of Rangpur division in the extreme northern part of Bangladesh. It is bounded on three sides by 288 km long Indian border, having Darjeeling district on the north, Jalpaiguri and Kuchbihar districts on the north-east, West Dinajpur and Purnea districts on the west, Dinajpur and Thakurgaon districts on the south, Nilphamari district on the east. Panchagarh was a *Thana* under Jalpaiguri district of West Bengal during the British rule. It was under Dinajpur district at the time of the partition of 1947. In the year 1980, Panchagarh became a sub-division and was upgraded to a district in 1984. It is generally believed that there were Panch (means five) Garhs (means Jungles) namely Mir garh, Hossen garh, Daben garh, Coat Vojonir garh and Vitar garh in the present location of the district, in consequence of which it was named Panchagarh.[8] It lies between 26º00' and 26º38' north latitudes and between 88º19' and 88º49' east longitudes. The total land area of the district is 1404.62 sq. km. (542.00 sq. miles).

[8] Bangladesh Bureau of Statistics, *Population Census-2011*(GOB: Planning Division, Ministry of Planning, 2012).

Map 2.1
Map of Panchagarh District



2.5.2 Administration

Panchagarh was turned into a subdivision in 1980, consisting of Atwari, Tetulia, Panchagarh Sadar, Boda and Debiganj upazilas. Panchagarh was elevated to a district in 01.02.1984. It consists of 5 upazilas, 43 Union parishads, 825 villages, 419 mauza, 2 municipalities, 18 municipality wards and 64 Paura Mahalla[9].

2.5.3 Population

The total population of Panchagarh is 987644; among them, number of males are 496725 & females are 490919. The density of population is 703 per sq. km.[10] and the average size of households is 4.31. Only 9.63 percent people of the total population live in the urban areas. Literacy rate of the study area is 51.8 percent, according to the population census 2011.

2.5.4 Soil Composition

Top Soil of the study area is deep sandy loam to clay sandy loam, alluvial and bears close affinity with the soil of the old Himalayan basin. Water preservation capacity of most of the land is very low; for this reason a large portion of the total land is not suitable for crop production. The pH of the soils ranged from 5.4 to 6.26. The organic matter contents as well as total nitrogen of these soils were, in general, low.[11] Total agricultural land of the study area is 107785 hectare, where crops are grown at once in a year in 13024 hectare, twice a year in 72245 hectare and thrice a year in 22516 hectare. Among the total land area, 46.5 percent is high, 42.5 percent is slightly high, 3.5 percent is slightly low and only .05% is low land.[12] The cropping intensity in Panchagarh district is about 209%.

---

[9] Bangladesh Bureau of Statistics, *Population Census-2011*(GOB: Planning Division, Ministry of Planning, 2012).

[10] *Ibid.*

[11] M. J. Udin et. Al. "Study of Some Soils of the Himalayan Piedmont Plain of Bangladesh," *Journal of the Asiatic Society of Bangladesh, Science* 38, vol. 2 (December 2012): 199-206. under "Settings," http://www.banglajol.info/index.php/JASBS/user/register [accessed November 11, 2010].

[12] Leaflet of Agriculture Department, Panchagarh District, 2014.

2.5.5 Major Crops

The major crops grown in this area are paddy, jute, wheat, potato, tomato, sugarcane, *kaun*, etc. At present, tea and orange is being cultivated in the study area. The land climate of the area is very much suitable for tea and orange cultivation. Therefore, it has become an important area for tea and orange cultivation.

2.5.6 Rivers

Panchagarh has 23 rivers. Among them, the main rivers are Karatoa, Atrai, Teesta, Nagor, Mahananda, Tangon, Dahuk, Pathraj, Bhulli, Talma, Chawai, Kurum, Versa, Tirnoi, and Chilka[13].

2.5.7 Climate

The climate of the study area is a little bit different to that of the major areas of the country. The yearly average rainfall is 2700-3000mm which is evenly distributed nearly for six months of the year[14]. High relative humidity is always found in Panchagarh district. The average annual temperature of Panchagarh district is 25.5-33.1°c and maximum temperature is 30.2°C, while the minimum temperature is 10.1°C. The winter is comparatively long in comparison to other parts of Bangladesh.

2.6 Conclusion

In fine, it can be said that mixed methods and techniques of data collection were used in the present study. The researcher used questionnaire survey, observation, key informant interviews and FGDs for data collection and applied both qualitative and quantitative methods for analyzing and presenting data. All the efforts were made to make the study fruitful and to increase its reliability.

---

[13] Sirajul Islam ed. *Banglapedia: National Encyclopedia of Bangladesh,* vol.11 (Dhaka: Asiatic Society of Bangladesh, 2012), 85.

[14] M.A. Khan et.al. "Prospects of Sweet (Citrus sinensis) and Mandarian (Citrus reticulata) Orange Cultavitation at Panchagarh District of Bangladesh," *Pakistan Journal of Biological Sciences 4*, vol.12 (2001): 1499. under "Settings" http://scialert.net/abstract/?doi=pjbs.2001.1498.1499 [accessed June 9, 2010].

Chapter Three
Theoretical Background of the Study

3.1 Introduction

In this chapter, a brief discussion has been made on the concepts, theoretical basis and various models of environmental impact assessment, social impact assessment, and sustainable development, which were important in conducting this study. The concepts of sustainable development and environmental impact assessment can be applied in the basic conceptual design for such type of research. However, the researcher has also discussed on some economic and labour welfare-related theories which have helped the researcher to understand the economic aspects linked to underground stone collection.

3.2 Environmental Impact Assessment

An Environmental Impact Assessment (EIA) is an assessment of the possible impacts that a proposed project may have on the environment, consisting of the environmental, social and economic aspects.[1]

Every country is trying to increase economic growth to improve the living standard of their people, and on the other hand, environmental problems are becoming complicated due to excessive use of resources. The purpose of the assessment is to ensure that decision-makers consider the environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made.[2]" EIAs are unique in that they do not require observance to a determined environmental

[1] www.wikipedia//Environmental impact assessment [accessed May 12, 2011].

[2] International Association for Impact Assessment, *Principle of Environmental Impact Assessment Best Practice* (UK: IAIA, 1999), 2 under "Srttings" http://www.iaia.org/publicdocuments/special-publications/Principles%20of%20IA_web.pdf [accessed March 3, 2010].

outcome, but rather they involve decision makers to account for environmental values in their decisions and to justify those decisions in the light of comprehensive environmental studies and public comments on the likely environmental impacts.

Environmental impact assessments commenced in the 1960s, as part of increasing environmental awareness. EIAs involved a technical evaluation intended to contribute to more objective decision making. The number of "Environmental Assessments" filed every year "has hugely left behind the number of more rigorous Environmental Impact Statements (EIS)." An Environmental Assessment is a "mini-EIS designed to provide sufficient information to allow the agency to decide whether the preparation of a full-blown Environmental Impact Statement (EIS) is necessary."[3]

3.2.1 Methods of EIA

Methods of EIA are cited below-

- **Industrial products** - Product environmental life cycle analysis (LCA) is used for identifying and measuring the impact of industrial products on the environment. These EIAs consider activities related to extraction of raw materials, ancillary materials, equipment; production, use, disposal and ancillary equipment[4].

- **Genetically modified plants -** Specific methods available to perform EIAs of genetically modified organisms include GMP-RAM and INOVA[5].

---

[3] Ronald J. Rychlak and David W. Case, *Environmental Law: Oceana's Legal Almanac Series* (New York: Oxford University Press, 2010), 111–120.

[4] S. Daniel. et al. "Aggregating and evaluating the results of different Environmental Impact Assessment methods Ecological Indicators," Ecological Indicators 4, (January 2004), under "Settings," http://www.researchgate.net/Aggreg [accessed May 19, 2010].

[5] K. Hitzschky, & J. Silviera, " A proposed impact assessment method for genetically modified plants (As-GMP method)," *Environmental Impact Assessment Review* 29, no.6 (2009), under "Setting," http://www.sciencedirect.com/science/article/pii/S0195925509000444 [accessed December 17, 2012].

- **Fuzzy logic**- EIA methods need measurement data to estimate values of impact indicators. However, many of the environment impacts cannot be quantified, e.g. landscape quality, lifestyle quality and social acceptance. Instead, information from similar EIAs, expert judgment and community sentiment are employed. Approximate reasoning methods known as fuzzy logic can be used[6].

Environmental Impact Assessment (EIA) assesses the possible environmental, social and economic aspects of a certain project. However, many of the environment impacts cannot be quantified, e.g. landscape quality, lifestyle quality and social acceptance. Instead, information from similar EIAs, expert judgment and community sentiment are considered in this study.

3.3 Social Impact Assessment

Social impact assessment originated from the environmental impact assessment model, which first emerged in the 1970s in the United States, as a way to assess the impacts on society of definite development systems and projects before they go ahead— for example, new roads, industrial facilities, mines, dams, ports, airports, and other infrastructure projects. It has been amalgamated since into the formal planning and approval procedures in several countries, in order to classify and assess how major developments may affect populations, groups, and settlements. SIA is often carried out as part of, or in addition to, environmental impact assessment, but it has not yet been as widely adopted as EIA in formal planning systems, often playing a minor role in combined environmental and social assessments[7].

[6] R. Peche & E. Rodriguez, "Environmental impact assessment procedure: A new approach based on Fuzzy logic," *Environmental Impact Assessment Review* 29, no.5 (2009), under "Setting," http://www.sciencedirect.com/science/article/pii/S0195925509000444 [accessed December 17, 2012].

[7] www.wikipedia//Social impact assessment [accessed March 3, 2011].

According to the International Association for Impact Assessment, "Social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment."[8]

The goal of social impact assessment is to drive improvements that increase the value of programs to the people they serve. Social impact assessment helps organizations to plan better, implement more effectively, and successfully bring initiatives to scale. Assessment also facilitates accountability, supports stakeholder communication, and helps guide the allocation of scarce resources.

A considerable academic literature has developed around the techniques and application of SIA, and it is broadly taught and practiced. Major consultancy firms offer SIA expertise. They, and individual skilled practitioners and academics are often called upon to produce SIA reports, mainly in progress of recommended new organizational projects. The academic backgrounds of SIA practitioners are diverse, but may include applied sociology, anthropology, geography, development studies, and planning.

SIA overlaps significantly with the contemporary interest in monitoring and evaluation (M&E). M&E is carried out after a project or development has gone ahead, to assess impacts and to see how well its goals were met. Evaluation is particularly important in the following areas[9]:

---

[8] www.iaia.org [accessed September 20, 2011].
[9] www.wikipedia//Social impact assessment [accessed March 19, 2011].

1. Public policy;
2. Health and education initiatives; and
3. International development projects more generally, whether conducted by governments, international donors, or NGOs.

There is a great deal of debate on how to measure social impact, due in large part to the difficult nature of assessing social change. It takes money, time, imagination and creativity.

SIA is often carried out as part of, or in addition to, environmental impact assessment, but it has not yet been as widely adopted as EIA in formal planning systems, often playing a minor role in combined environmental and social assessments. There is a great deal of debate on how to measure social impact, due in large part to the difficult nature of assessing social change. It takes money, time, keen imagination and creativity. The researcher has tried to avoid separate assessment procedures based on EIA or SIA and instead using a social survey method for clarifying various socio-economic and environmental dimensions such as:

a) Protect the local indigenous nature;
b) Nurture the soil, plant and all kinds biotic animals;
c) Reduce all kinds of negative impact on human health; and
d) Try to ensure an environment-friendly family and social life in the study area.

3.4 Sustainable Development

Sustainable development is neither a doctrine nor a theory, much less a synthesis between economics and ecology. It is a pragmatic approach to implement economic tools for planet management. Sustainable development is a new term for an old idea. There is close link between environment and sustainable development, which is used in the broad

perspective and overall development of human beings without any distinction. The World Conservation Strategy initiated by the United Nations Environment Program (UNEP), the world wide Fund for Nature (WWF) and international Union for Conservation of Nature (IUCN), provided the platform for international debate on sustainability[10]. The most remarkable step towards sustainable development is the publication of an international report titled "Our Common Future" by the World Commission on Environment (WCED) in 1987. WCED (Brundtland Commission, 1987) defined sustainable development as 'The development that ensures preservation and enhancement of environmental quality, sound and sustainable use of natural resources, thereby providing for economic growth, which meets the needs of the present without compromising the ability of future generations to meet their own need'.[11]

The major objective of development should be to ensure the satisfaction of human needs and purposes of a material kind. It highlighted the fact that over-misuse of resources may compel human societies to compromise their capacity to meet the vital needs of their people in future. Settled agriculture, the diversion of waterways, the extraction of minerals, the emission of heat and harmful gases into the atmosphere, commercial forests, and genetic manipulation, were all stated in the report as examples of human intervention in natural system during the course of development. It called upon all countries to adopt the objective of sustainable development as the dominant goal and test of national policy and international cooperation.

---

[10] Abdul Ghafoor Awan, "Relationship Between Environment and Sustainable Economic Development: A Theoretical Approach to Environmental Problems," *International Journal of Asian Social Science 3*, no.3 (2013): 741.

[11] M. Feroze Ahmed, "Environment and Sustainable Development: A Conceptual Model," *Bangladesh Environment, 2002,vol.2,* eds. M. Feroze Ahmed, Saleh A Tanvir and A. B. M. Badruzzaman (Dhaka: BAPA, 2002), 1058.

3.4.1 Different Dimensions of Sustainable Development

Sustainable development has many dimensions. Some of them are briefly described in the following paragraphs.

Social Dimension

a) Workers' health, safety and security.
b) Impact on local communities, quality of life.
c) Benefits to disadvantaged groups, for example, the disabled, the aged etc.

Economic Dimension

a) Creation of new markets and opportunities for sales growth.
b) Cost reduction through efficiency improvements and reduced energy and raw material inputs.
c) Creation of additional value.

Environmental Dimension

e) Reduced waste, effluent generation, emissions into environment.
f) Reduced impact on human health.
g) Use of renewable raw materials.
h) Elimination of toxic substances.

The Environmentalists all over the world has emphasized the need for maintaining environmental quality through sustainable use of resources. All human activities designed and implemented for the economic growth of a country and its social needs would have direct or indirect impact on environment. The qualitative and in some cases quantitative changes in water, land and other resources have the same effect across the world. Unlike social and economic sectors, environmental concerns are similar in both developed and developing countries, as the citizens of all countries must have access to clean water, air, safe drinking water and sufficient supplies of clean renewable energy. Furthermore, all industrial and agricultural activities depend on common environmental resources like land, soil, forests, ocean, rivers, mineral deposits, etc., which are highly localized,

whereas some others are cross-regional and some are global. As the researcher made an attempt to find a sustainable way for development in the study area, so he examined the models of sustainable development.

3.5 Theories of Wages

As a major part of the respondents were stone labourers, labour welfare-related issues were vital concerns of the study. The researcher has presented some theories here which are directly or indirectly related to labour and labour welfare.

3.5.1 Subsistence Theory of Wages

Subsistence theory is one of the popular theories of wages. According to this theory, the wage in the long run tends to be equal to the level of subsistence. Minimum level of subsistence means the amount which is just sufficient to meet the basic necessities of life of the workers and their families. It is argued that if wages exceed the subsistence level, the labourer will marry and produce children. If the supply of labour increases then its demand and money wages will fall to the level of subsistence. If wages remain below the subsistence level, the labourers will not be able to maintain their families. The death rate will increase due to hunger and the supply of labour will fall compared its demand. Again wages will rise to the subsistence level.

Though subsistence theory is one of the popular theories of wages, it is not beyond criticism. It is incorrect to say that when the money income of a person increases above the subsistence level, he marries and increases the birth rate. When income increases, people improve their standard of living instead of taking recourse to marriage. Again, this theory attaches more importance to the supply side and ignores the demand-side of labour for the determination of wages; and it fails to explain why wages differ from occupation to occupation and from person to person.

3.5.2 The Wages Fund Theory

This theory is associated with Adam Smith and J.S. Mill. Wage fund is that amount of floating capital which is set apart by employer for paying wages to the labourers. The average wage rate is determined by dividing the wages fund by the total number of workers employed.

That is, Wage rate = Wage Fund / Total no. of workers.

For example, if capital of fund is 10,000 and number of workers are 100, then rate of wages will be 10,000/100 = 100

If we want to increase the rate of wages, there are two methods. We should increase the fund or we should decrease the supply of labour. We can't increase the fund quickly, because the savings increase slowly. Further, if any group of labour succeeds in getting higher wages, the result will be that other workers would get less.

There are also some critics of this theory. According to this theory, all the workers receive equal wages while infected wages differ from worker to worker. Again, in this theory supply of labour was given much importance while the demand factor was ignored. According to this theory, there is a separate fund for the payment of wages, while in reality there is no special fund which is particularly meant for the payment of wages to the workers.

3.5.3 Residual Claimant Theory

According to this theory, labour receives what remains after the payment of rent, profits, taxes and interest out of the national income. This theory is offered by American economist Walker. He says, "Wages equal the whole product minus rent interest and profit." Jevon says, "The wages of working man are ultimately coincident with what he produces, after the deduction of rent, taxes and the interest on capital."

This theory ignores the influence of supply side in the determination of wages. It fails to explain as to how the trade unions raise their wages. Moreover, residual claimant is the right of entrepreneur and not the labour. The labour receives its share during the process of production.

3.5.4 Demand and Supply Theory

Just as the price of commodity is determined by the interaction of the forces of demand and supply, the rate of wages can also be determined in the same way with help of demand and supply forces.

Supply of Labour: Supply of labour depends upon the following factors.

1. **Size of Population:** If the size of population is greater, then the supply of labour will also be greater.
2. **Mobility of labour:** The supply of labour also depends on the mobility of labour because if supply of labor decreases in any occupation or country it can be increased.
3. **Social Structure:** Supply of labour also depends on the social set-up of a country. If any society allows the women to work, then the supply of labour will be greater.

The wages will be determined at the point where demand and supply are both equal to each other. According to the demand curve (DD) and supply curve (SS), both cut each other at the point "T". So it is an equilibrium point. The OF wages will be determined in the market. In this theory, it is assumed that there is perfect competition in the market while perfect competition is absent in the market of labour and goods.

3.6 Conclusion

In the study, the knowledge of sustainable development was very important to find out the ways of reducing the negative impact caused by the activities for economic development Based on the knowledge of sustainable development the researcher had found ways to reduce environmental damages. Again, the researcher found certain ways to develop the workers socio-economic condition and to enhance their productivity based on subsistence theory of wages. These theories helped the researcher in many ways in his research.

Chapter Four
Socio-economic Impact of Underground Stone Collection

4.1 Introduction

One of the main objectives of the present study is to analyze the socio-economic impact of underground stone collection. To analyze the socio-economic impact, the researcher at first gave a description of the socio-economic condition of the respondents of the study area. Since there is no previous study-based record on the socio-economic condition of the study population, the researcher had to depend on the opinions to evaluate the impact of underground stone collection. To explore the socio-economic impact of underground stone collection, the researcher made comparison among different categories of respondents and did some statistical tests to present the facts.

4.1.1 Demographic Characteristics of the Respondents

In every research work, the socio-economic and demographic information of the respondents are very important. According to the population census of 2011, the population of Panchagarh is 987,644 and 51.8% of the total population is educated.[1] Analyzing the demographic information of the present research work, it is seen that men and women of different professions and ages were included in this research.

[1] Bangladesh Bureau of Statistics, *Population Census-2011*(GOB: Planning Division, Ministry of Planning, 2012).

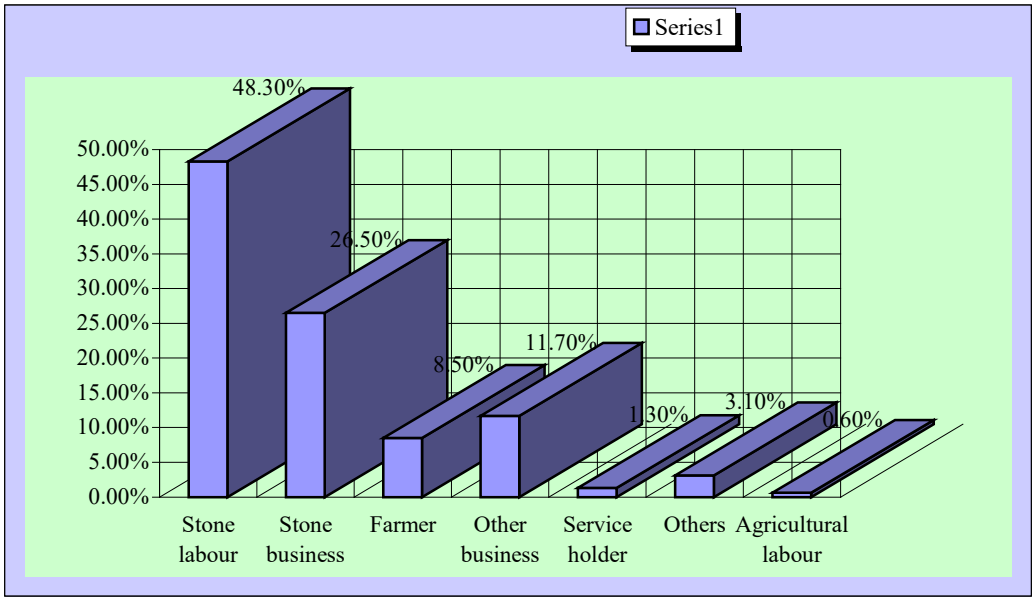
Table 4.1
Demographic Characteristics of the Respondents

Variables		Count	Column N %	Total	Mean (when applicable)
Category of the respondents	Stone labour	153	48.3%	100%	
	Stone businessman	84	26.5%		
	Land seller	30	9.5%		
	Mass people	50	15.8%		
Occupation of the respondents	Stone labour	153	48.3%	100%	
	Stone business	84	26.5%		
	Farmer	27	8.5%		
	Other business	37	11.7%		
	Service holder	4	1.3%		
	Others	10	3.1%		
	Agricultural labour	2	.6%		
Sex of the respondents	Male	288	90.9%	100%	
	Female	29	9.1%		
Age category of the respondents	10-19	16	5.0%	100%	
	20-29	89	28.1%		
	30-39	101	31.9%		
	40-49	60	18.9%		
	50-59	32	10.1%		
	60-69	16	5.0%		
	70+	3	.9%		
Highest education level	No education	129	40.7%	100%	
	Literate	31	9.8%		
	Primary	84	26.5%		
	Secondary	55	17.4%		
	Higher	18	5.7%		
Size of the family	Small (<5)	226	71.3%	100%	4.15
	Medium (5-7)	84	26.5%		
	Large (>7)	7	2.2%		

- Literate = completed less than five years of education
- Primary = completed five years of education
- Secondary = completed ten years of education
- Higher = completed minimum twelve years of education

From the table 4.1 it is seen that among the respondents 48.3% were stone labourers, 26.5% were stone businessmen, 8.5% were farmers and others were involved in different professions. From this table, it is also seen that among the respondents 90.9% were male and 9.1% were female. From the above table, it is seen that, the age of 31.9% of the respondents was in the range of 30 to 39 years, whereas for 28.1% it was 40 to 49 years. Here it was also seen that, 16% of the respondents were above 50 years. Analyzing the educational data of the respondents, it was seen that a major part of the respondents were uneducated (40.7%), rest of them (61.3%) were educated. Among the educated respondents, 26.5% completed primary education, 17.4% completed secondary education and only 5.7% of the respondents completed higher education. The percentages for stone-businessmen, land-sellers and general people were 26.5%, 9.5% and 15.8% respectively.

Figure 4.1
Occupation of the Respondents



Among these general people, there were farmers (8.5% of the sample), service holders (1.3%of the sample), stone businessmen (26.5% of the sample), other businessmen (11.7% of the sample), agricultural labourers (.6% of the sample), and people from other

occupations (3.1% of the sample). In the whole sample, there were 90.0% male and 10% female. Most of the respondents were of 20-40 years of age (28.1% were aged 20-29 and 31.9% were aged 30-39). A major portion of the respondents (40.7%) were un-educated, 26.5% completed their primary education, 17.4% completed their secondary education and only 5.7% completed higher secondary and higher education. Most of the respondents (71.3%) had small families with a mean of 4.15 members per family.

4.1.2 Residential Status and Living Facilities of the Respondents

Since the ancient times the houses of the inhabitants in this area were made of bamboo, straw, wood, tin and so on. At present by analyzing the data of the respondents, it was seen that 47% respondents lived in the bamboo and straw-made houses, 33.1% lived in tin and wooden houses, 14.5% respondents lived in the *semi-pucca* structures and only 5.4% lived in the buildings. Among the respondents, 92.4% lived in their own houses and only 1.3% lived in rented houses.

Table 4.2
Residential Status and Living Facilities of the Respondents

Variables		Count	Column N %	Total
Housing type of the respondents	Pucca	17	5.4%	100%
	Semi pucca	46	14.5%	
	Tin and wooden made	105	33.1%	
	Bamboo and straw	149	47.0%	
Ownership of the house	Own house	293	92.4%	100%
	Own house but others' land	18	5.7%	
	Khas land	2	.6%	
	Rented house	4	1.3%	
Type of latrine	Kancha	116	36.6%	100%
	Water cell	86	27.1%	
	Sanitary	93	29.3%	
	No latrine	22	6.9%	

Source of drinking water	Tube well	310	97.8%	100%
	Pond	0	0.0%	
	River	0	0.0%	
	Supply	0	0.0%	
	Well	7	2.2%	
Whether electricity facility available	No	258	81.4%	100%
	Yes	48	15.1%	
	Solar panel	11	3.5%	
Residential status	Outsider	9	2.8%	100%
	Local	308	97.2%	
Have recreational facilities	No	211	66.6%	100%
	Yes	106	33.4%	

From the above table, it is observed that 36.6% respondents used *kancha* latrine, 27.1% respondents used water cell latrine, 29.3% used sanitary latrine and 6.9% had no latrine. It is notable that according to Bangladesh Economic Review 2012, 51.5% people use sanitary latrine in Bangladesh[2]. That means, the rate of people using sanitary latrine in this area was lower than the national ratio. From the above table, it is seen that 97.8% people drank water from the tube-well and 2.2% drank water from well. A Lion's share of the respondents (81.4%) had no electricity connection and only 15.1% people had the electricity connection whereas 3.5% respondents used solar panel for electricity. Here it can be mentioned that though according to Bangladesh Economic Review, 53% people enjoyed the electricity facility[3], the rate was 18.6% in this area was very frustrating. Among the respondents 66% thought that they had no opportunity for recreation and only 34% opined that they had enough recreational facility.

[2] Ministry of Finance, *Bangladesh Economic Review 2012*[GOB: Finance Division, Ministry of Finance, 2012], xvi.

[3] Ministry of Finance, *Bangladesh Economic Review 2012* [GOB: Finance Division, Ministry of Finance, 2012], 153.

4.1.3 Bivariate Analysis of Background and Household Possessions of Different Categories of Respondents

There were lots of differences among the four categories of respondents in respect of their education, household possessions, residential facilities etc. Among the stone labourers most of the respondents (35.9%) were between 30-39 years, 26.8% respondents were aged from 20 to 29 and 7.8% of the respondents were from 10 to 19. Among the stone businessmen, 33.3% of the respondents aged from 30 to 39 years, and 32.1% of the respondents were from 20 to 29. Among the land sellers, 26.7% of the respondents were from 20 to 29 years, 26.7%, respondents were aged from 30 to 39 and 23.3% respondents were aged from 40 to 49 years. On the other hand, among the general people, 26% of the respondents were aged from 20 to 29 years and 20% of the respondent were 30-39 years.

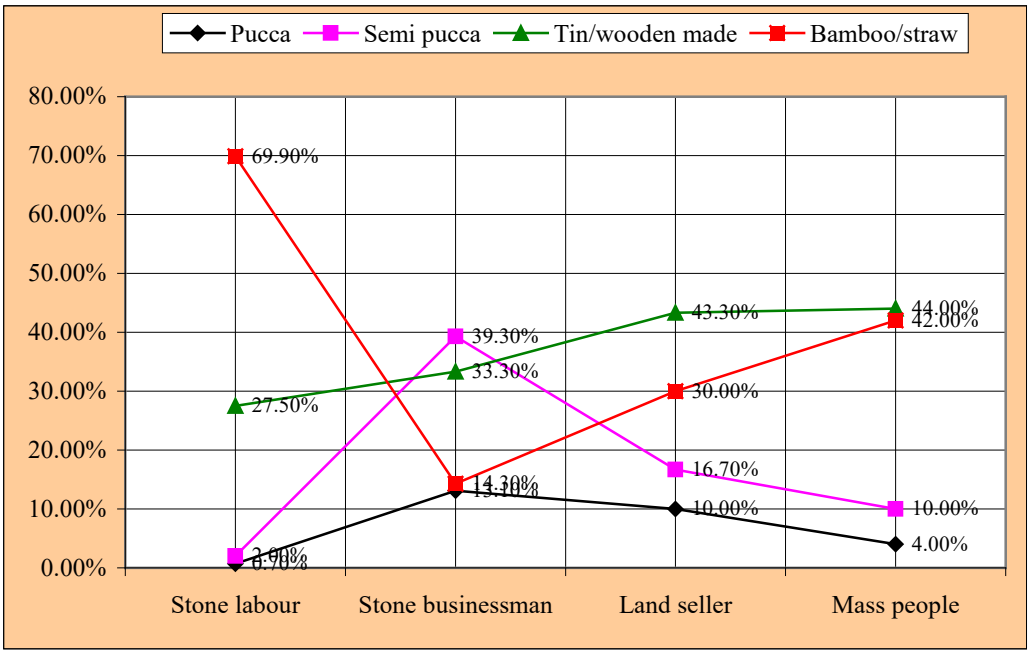
Table 4.3
Background and Household Possessions of Different Groups of People in the Sample

Variables		Category of the respondent			
		Stone labour	Stone businessman	Land seller	Mass people
Age category of the respondents	10-19	7.8%	1.2%	3.3%	4.0%
	20-29	26.8%	32.1%	26.7%	26.0%
	30-39	35.9%	33.3%	26.7%	20.0%
	40-49	19.6%	16.7%	23.3%	18.0%
	50-59	6.5%	13.1%	10.0%	16.0%
	60-69	2.0%	2.4%	10.0%	16.0%
	70+	1.3%	1.2%	0.0%	0.0%
Highest education level	No education	56.9%	16.7%	40.0%	32.0%
	Literate	9.8%	4.8%	10.0%	18.0%
	Primary	28.1%	26.2%	30.0%	20.0%
	Secondary	5.2%	36.9%	16.7%	22.0%
	Higher	0.0%	15.5%	3.3%	8.0%
Housing type of the respondents	*Pucca*	.7%	13.1%	10.0%	4.0%
	Semi *pucca*	2.0%	39.3%	16.7%	10.0%
	Tin/wooden made	27.5%	33.3%	43.3%	44.0%
	Bamboo/straw	69.9%	14.3%	30.0%	42.0%

Ownership of the house	Own house	89.5%	96.4%	96.7%	92.0%
	Own house but others land	9.2%	1.2%	3.3%	4.0%
	Khas land	.7%	0.0%	0.0%	2.0%
	Rented house	.7%	2.4%	0.0%	2.0%
Type of latrine	*Kancha*	45.8%	19.0%	33.3%	40.0%
	Water cell	34.0%	17.9%	16.7%	28.0%
	Sanitary	7.8%	63.1%	50.0%	26.0%
	No latrine	12.4%	0.0%	0.0%	6.0%
Source of drinking water	Tube well	96.1%	98.8%	100.0%	100.0%
	Pond	0.0%	0.0%	0.0%	0.0%
	River	0.0%	0.0%	0.0%	0.0%
	Supply	0.0%	0.0%	0.0%	0.0%
	Well	3.9%	1.2%	0.0%	0.0%
Whether electricity facility available	No	96.7%	53.6%	86.7%	78.0%
	Yes	3.3%	34.5%	10.0%	22.0%
	Solar panel	0.0%	11.9%	3.3%	0.0%
Residential status	Outsider	2.0%	4.8%	3.3%	2.0%
	Local	98.0%	95.2%	96.7%	98.0%
Size of the family	Small (<5)	72.5%	64.3%	80.0%	74.0%
	Medium (5-7)	24.8%	32.1%	20.0%	26.0%
	Large (>7)	2.6%	3.6%	0.0%	0.0%
Have recreational facilities	No	82.4%	42.9%	66.7%	58.0%
	Yes	17.6%	57.1%	33.3%	42.0%

Analyzing the respondents' educational qualification according to their category, it is seen that, a lion's share of the stone labourers (56.9%) were illiterate, and the rest of the stone workers were literate, among whom 28.1% of the respondents had finished primary education. Among the stone businessmen 16.7% were illiterate and the rest of them were literate, of whom 36.95% of the respondents had finished secondary education. Among the land sellers, 40% of the respondents were illiterate and rest 60% were literate, where 30% of the land sellers had completed primary education. Among the common people, 32.05 of the respondents were illiterate and the remaining was literate, of whom 22% of the respondents had completed secondary education.

Figure 4.2
Category and Housing Pattern of the Respondents



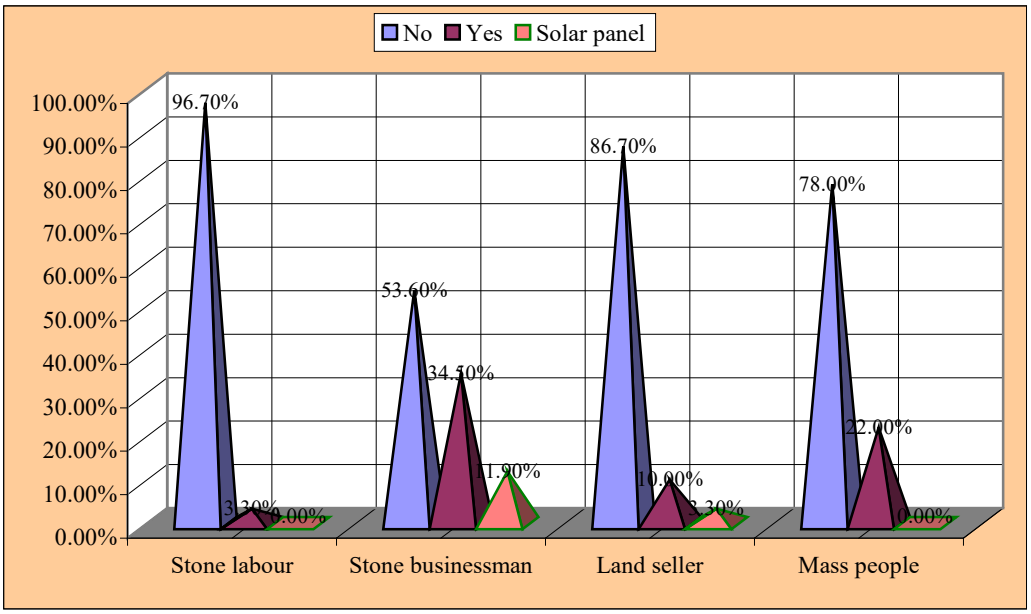
Analyzing the housing related data of the respondents, it was also seen that, most of the stone workers lived in the houses made with bamboo and straw (69.9%) and 27.5% of the stone workers lived in houses made with wood and tin. Among the stone businessmen, 13.1% respondents' houses were *pucca*, 39.3% respondents' houses were *semi-pucca* and 33.3% respondents' houses were made with tin or wood. Among the land sellers, 10% of the respondents' houses were *pucca,* 16.7% houses were *semi-pucca*, 43.3% houses were made with wood and tin, and 30% of the houses were made with bamboo and straw. Among the general people, 44% respondents' houses were made with wood and tin, and 42.0% respondents' houses were made with bamboo and straw.

From the Table 4.3(a), it is also seen that among the stone workers, 12.4% of the respondents did not have any latrine and 45% of the respondents had latrine though it was *semi-pucca* latrine. Among the stone businessmen 63.1% of the respondents had sanitary latrine but in this class 19% of the respondents used *semi-pucca* latrine. Most of the land sellers (50%) had sanitary latrine, but among them 33.3% of the respondents used *semi-*

pucca latrine. 6% of the common people did not have any latrine at all and 40% of the respondents used *semi-pucca* latrine.

Through comparative analysis of different classes of respondents, it is seen that 96.7% of the workers did not have electric facility and only 3.3% of the respondents had electric facility. Among the businessmen, even though 53% of the respondents did not have electric facility, rest of them had electric connection; of them 11.9% of the respondents used solar panel power. Among the land sellers, 86.7% of the respondents did not have electric facility in their houses and among the general people 78% of the respondents did not have electric facility.

Figure 4.3
Electricity Facility and Category of the Respondents



So, from the above table it is seen that in all the groups, most of the people were aged 20-39 years. Among stone labourers, land sellers and other general people, most of the respondents were non-educated and a good number of respondents were primary educated. Among stone businessmen, most of the respondents had completed their secondary education and a good number of them completed primary education. Among these four groups of respondents, we had few female respondents who were stone labourer or mass people.

4.1.4 Chai-square (χ^2) Test for Different Categories of Respondents

The following table (Table 4.4) shows the results of χ^2 test of association for "categories of the respondents" with variables -"Highest education level", "Type of latrine", "Whether electricity facility available", "Have recreational facilities", "Balance of income and expenditure", "Increase of income due to stone collection", "Children of 6-18 goes to school", "Whether health care service available", "Where they go for treatment", and "Do you and your family members get sufficient nutritious food."

Table 4.4
Chai-square (χ^2) Test for Different Categories of Respondents

	χ^2			Uncertainty coefficient	
	Value	df	p-value	Value	p-value
Highest education level	85.140	12	.000*	.103	.000*
Type of latrine	93.229	9	.000*	.128	.000*
Whether electricity facility available	74.016	6	.000*	.211	.000*
Have recreational facilities	39.995	3	.000*	.100	.000*
Balance of income and expenditure	56.587	6	.000*	.081	.000*
Increase of income due to stone collection	84.385	3	.000*	.299	.000*
Children of 6-18 goes to school	3.767	3	.288	.043	.218
Whether healthcare service available	16.396	3	.001*	.039	.001*
Where they go for treatment	38.167	18	.004*	.069	.001*
Do you and your family member get sufficient nutritious food	70.452	3	.000*	.174	.000*

*=significant at 5%

All these variables except "Children of 6-18 goes to school" showed significant associations with "categories of the respondents". This implies that, except "Children of 6-18 goes to school", all other variables vary significantly among the four categories of the respondents.

4.1.5 Income and Expenditure of the Respondents

In the following table, income and expenditure-related statistics such as average income, average family expense, range of income, family savings, family loans etc. were analyzed. In analyzing income and expenditure-related data comparison was made among different groups.

Table 4.5
Income and Expenditure of the Respondents

Variables		Count	Column N %	Mean (when applicable)
Time spent in the first occupation (in hours per day)	=<6	53	16.8%	8.91
	7-8	124	39.2%	
	9-10	66	20.9%	
	11-12	64	20.3%	
	>12	9	2.8%	
Respondent's income from 1st occupation (in tk.)	=<5,000	94	29.7%	8771.84
	5,001-10,000	168	53.2%	
	10,001-20,000	35	11.1%	
	>20,000	19	6.0%	
Total monthly income of the respondent (in tk.)	=<5,000	80	25.3%	9595.41
	5,001-10,000	163	51.6%	
	10,001-20,000	48	15.2%	
	>20,000	25	7.9%	
Total monthly family income (in tk.)	=<5,000	54	17.0%	10806.15
	5,001-10,000	172	54.3%	
	10,001-20,000	61	19.2%	
	>20,000	30	9.5%	
Balance of income and expenditure	Surplus	98	30.9%	
	No surplus, no deficit	136	42.9%	
	Deficit	83	26.2%	
How deficit covered	Striving	9	10.7%	
	Govt. Assistance	0	0.0%	
	NGO assistance	50	59.5%	
	Help of relatives	10	11.9%	
	Borrowing money from others	15	17.9%	
Family savings	No savings	181	57.1%	
	Have savings	134	42.3%	
	Savings as investment	2	.6%	
Amount of savings (in tk)	=<10,000	78	59.1%	58364.39
	10,001-50,000	26	19.7%	
	50,001-2,00,000	19	14.4%	
	> 2,00,000	9	6.8%	
Family loans	No loans	135	42.6%	
	Have loans	182	57.4%	
Amount of loan (in tk.)	=<10,000	86	47.0%	44488.80
	10,001-50,000	67	36.6%	
	50,001-2,00,000	18	9.8%	
	> 2,00,000	12	6.6%	

Table 4.5 shows that most of the respondents (39.2%) worked 7-8 hours a day in their first (main) occupation and only 2.8% respondents worked more than 12 hours a day in their first occupation. Lions' share of the respondents (53.2%) earned 5,001-10,000 Taka per month and a number of them (29.7%) had earning of less than or equal to 5,000 Taka per month. In a similar way, most of the respondents' (53.2%) total monthly income remained within 5,001-10,000 Taka and a good number (25.3%) of them had a total monthly income below or equal to 5,000 Taka. In terms of combined family income, again most of these respondents' families had monthly incomes of Taka 5,001-10,000. A good number of them (19.2%) had monthly family income of Taka 10,001-20,000. 17% of these families had a total monthly income below or equal to 5,000 Taka. Nearly half of the respondents (42.9%) informed that the amount of money they earned were just enough for their family expenditure, i.e. they had no surplus or no deficit in the balance of income and expenditure. But, there were also a good number of respondents who had some surplus over their expenditure (30.9%) and also some respondents who fell into deficit on their monthly expenditure (26.2%). Most of these respondents, who fell into deficit, covered their deficit by taking assistance from local NGOs, where 10.7% of them succeeded. Lions' share of the respondents (57.1%) had no family savings, whereas rest of them had family savings. The reverse situation was seen in family loans, where lions' share of the respondents (57.4%) had family loans and the rest of them did not have. Most of the respondents had family savings (59.1%) of or below 10,000 Taka. Most of the respondents having family loans had family loans of or below 10,000 Taka and 36.6% of them had loans of Taka 10,001-50,000.

4.1.6 Comparative Analysis of Income, Debit and Credit of the Respondents

Analyzing the debit and credit of the respondents, it is seen that there is a huge difference in debit and credit of different categories of respondents. Lions' share of the respondents (60.10%) among stone labourers earned 5001-10000 Taka from their main occupation and 39.20% of the respondents' income was below five thousand taka. But among the

businessmen, 38.10% earned 5001-10000 Taka from their main profession, 33.3% of the respondents' income was 10001-20000 Taka and 22.6% of the respondents' income was above 20000 Taka. Among the general people, 53.1% respondents earned 5001-10000 taka from their first occupation.

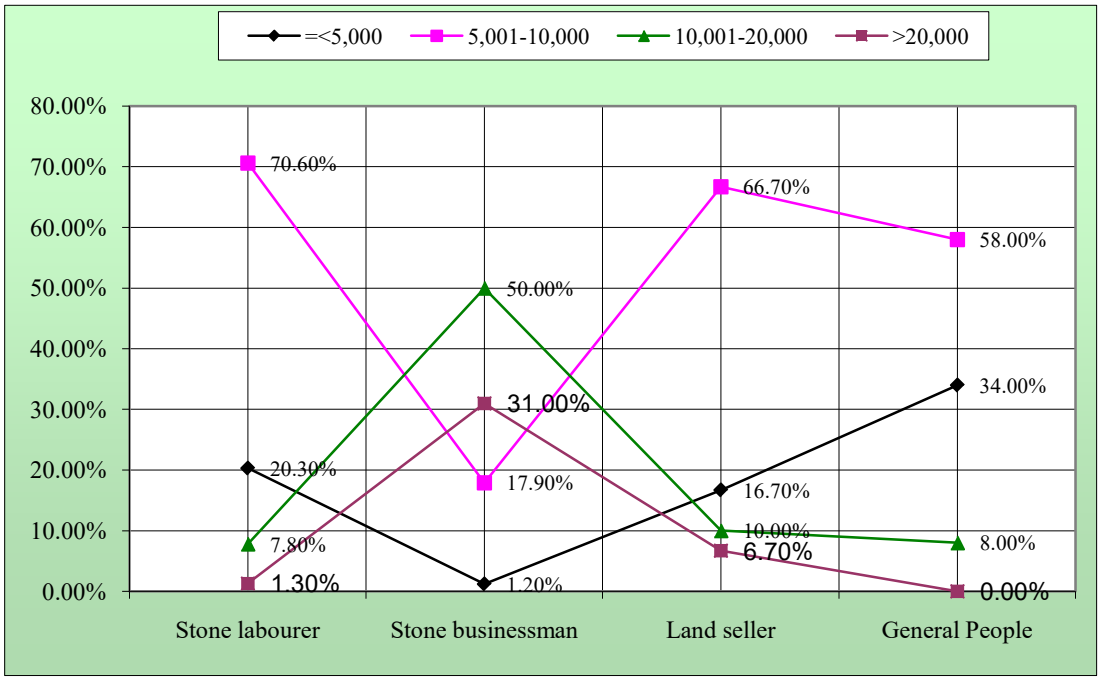
Table 4.6
Comparative Analysis of Income, Debit and Credit of the Respondents

		Category of the respondent			
		Stone labourer	Stone businessman	Land seller	General People
Respondent's income from 1st occupation	=<5,000	39.20%	6.00%	26.70%	42.90%
	5,001-10,000	60.10%	38.10%	60.00%	53.10%
	10,001-20,000	0.70%	33.30%	13.30%	4.10%
	>20,000	0.00%	22.60%	0.00%	0.00%
Total monthly income of the respondent	=<5,000	34.00%	1.20%	23.30%	40.80%
	5,001-10,000	62.70%	25.00%	63.30%	55.10%
	10,001-20,000	3.30%	44.00%	13.30%	4.10%
	>20,000	0.00%	29.80%	0.00%	0.00%
Total monthly family income	=<5,000	20.30%	1.20%	16.70%	34.00%
	5,001-10,000	70.60%	17.90%	66.70%	58.00%
	10,001-20,000	7.80%	50.00%	10.00%	8.00%
	>20,000	1.30%	31.00%	6.70%	0.00%
Balance of income and expenditure	Surplus	15.7%	61.9%	23.3%	30.0%
	No surplus, no deficit	53.6%	21.4%	53.3%	40.0%
	Deficit	30.7%	16.7%	23.3%	30.0%
Family savings	No savings	68.0%	35.7%	50.0%	64.0%
	Have savings	32.0%	61.9%	50.0%	36.0%
	Savings as investment	0.0%	2.4%	0.0%	0.0%
Amount of savings	=<10,000	85.10%	28.80%	73.30%	66.70%
	10,001-50,000	14.90%	25.00%	13.30%	22.20%
	50,001-2,00,000	0.00%	28.80%	13.30%	11.10%
	> 2,00,000	0.00%	17.30%	0.00%	0.00%
Family loans	No loans	54.9%	40.5%	20.0%	22.0%
	Have loans	45.1%	59.5%	80.0%	78.0%
Amount of loans	<10,000	63.80%	22.00%	54.20%	45.00%
	10,001-50,000	34.80%	40.00%	33.30%	37.50%
	50,001-2,00,000	1.40%	18.00%	4.20%	17.50%
	> 2,00,000	0.00%	20.00%	8.30%	0.00%

Analyzing the data of the total monthly income, it was seen that lions' share (62.74%) of the stone labourers earned 5001-10000 Taka in a month, 34% earned less than five thousand taka. Analyzing the total monthly income of the stone businessmen, it was seen that among the respondents 25% earned 5001-10000 Taka, 44% earned 10001-20000 Taka and 29.80% earned more than 20000 Taka. From the table, it is observed that majority of the land sellers (63.3%) earned 5001-10000 Taka. The same rate went with the general people, among whom 55.1% had the monthly income of 5001-10000 Taka.

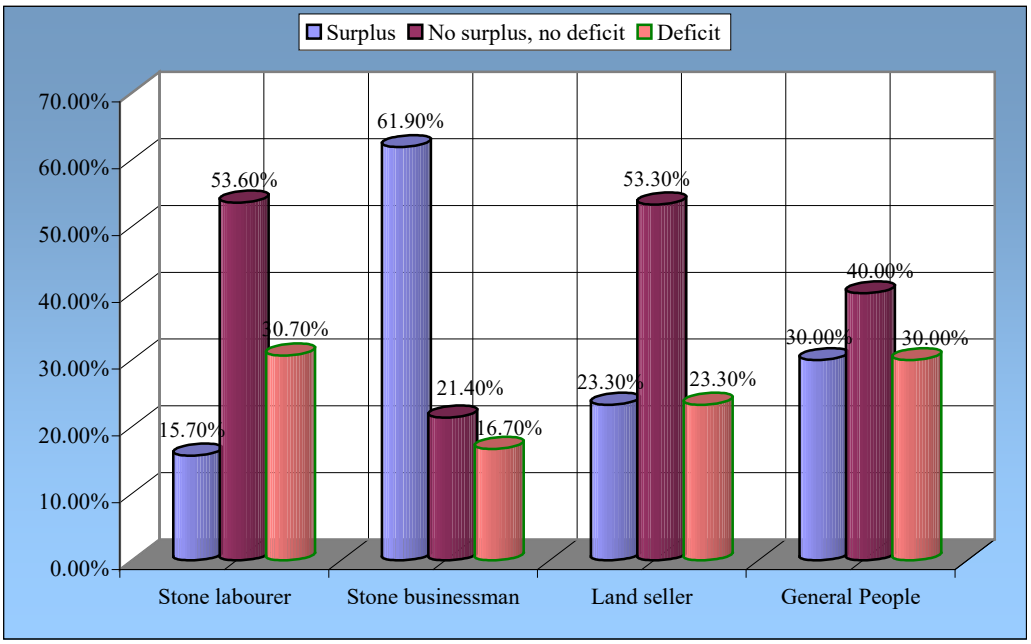
Analyzing the total monthly income of the family, it was seen that, 70.65 stone labourers had monthly family income of 5001-10000 Taka and 20% stone labourers maintained family income below 5000 Taka. Among the stone businessmen, 50% respondents had the monthly family income of 10001-20000 Taka and 31% maintained more than 20000 Taka. Lions' share of the land sellers (66.70%) and general people (58%) had monthly family income of 5001-10000 Taka.

Figure 4.4
Category Based Total Monthly Income



Observing the debit and credit balance of the respondents, it was found that 30.7% of the stone labourers could not maintain their family with their income and 53.65 respondents passed their days without any surplus or savings. But among the stone businessmen lions' share of the respondents (61.9%) had surplus after their family expenditure. Among the land sellers, 53.3% passed their days without any surplus or savings and 23.3% had surplus. On the other hand, among the general people, 30% had surplus, 40% ran on strict balance and 30% earned less than their expenditure.

Figure 4.5
Respondents Category and Balance of Income and Expenditure



Comparative analysis of the savings of the respondents show that 68% stone labourers had no savings while the rest 32% had savings, of whom 55.1% had less than 10000 Taka as savings. Among the stone businessmen, 61.9% respondents had savings and 35.7% had no savings. Among those who had savings among the businessmen, 28.8% respondents' savings were less than 10000 Taka and 25% had savings between 10001-50000 Taka,

while the rest of the respondents had savings of more than 50000 Taka. Among the land sellers, 50% had family savings, among whom 73.3% had savings of less than Taka 10000. Among the general people, 64% had the savings, among whom 66.7% had savings of less than 10000 Taka and 22.2% had savings between 10001-50000 Taka. So it can be concluded that as the number of stone businessman having savings was more, the amount of savings was also higher.

Comparative analysis of the data regarding taking loan shows that 45.10% of the stone labourers, 59.5% of stone businessmen, 80% land sellers and 78% general people had the burden of loan. Among the stone labourers, 63.80% had loan of less than 10000 Taka, but among the stone businessmen the percentage was 22%, 40% had taken 10001-50000 Taka, 18% had taken 50001-200000 Taka and 20% had loan of more than 200000 Taka. Among the land sellers, majority of the loan takers (54.2%) had taken loan of less than 10000 Taka; among the general people, the percentage was 45%. So it was seen that among different categories of people, land sellers and the general people had the highest number of loan takers; the number of loan takers was also high among the stone businessmen.

Table 4.7 shows the quantitative features of the time spent in work, income-expenditure and other economic attributes of the respondents. Respondents worked a minimum of 4 hours to a maximum 15 hours in a day, with an average of 8.91 hours. Incomes from the first occupation varied from 2,000 taka to 50,000 taka per month, with an average of 8,771.84 Taka.

Table 4.7
Quantitative Measures of Income and Expenditure of the Respondents

Variables	Mean	Median	Mode	Range	Minimum	Maximum
Time spent for the first occupation	8.91	8.00	8.00	11.00	4.00	15.00
Respondents income from first occupation	8771.84	6000.00	6000.00	48000.00	2000.00	50000.00
Time spent for the second occupation	3.39	3.00	2.00	7.00	1.00	8.00
Respondents income from the second occupation	2576.73	1500.00	1000.00	29850.00	150.00	30000.00
Total monthly income of the respondents	9595.41	7000.00	6000.00	56000.00	2000.00	58000.00
Total family members	4.15	4.00	4.00	8.00	2.00	10.00
Monthly family income	10806.15	7500.00	6000.00	71100.00	2400.00	73500.00
Monthly family expenditure	7319.24	6000.00	6000.00	28000.00	2000.00	30000.00
Amount of savings	58364.39	6000.00	2000.00	699800.00	200.00	700000.00
Amount of loan	44488.80	12000.00	10000.00	499500.00	500.00	500000.00

Most of the respondents had monthly income of Taka 6,000, as indicated by modal income value. Respondents who had a second occupation, worked 1 to 8 hours in a day, with a mean of 3.39 hours and had income from 150 Taka to 30,000 Taka with an average of 2,576.73 Taka. Respondents' total monthly income varied from 2,000 Taka to 58,000 Taka, with an average of around 10,000 taka per month. The size of the families varied from a minimum of 2 members to a maximum of 10 members per family, with an average of 4.15 and a mode of 4 members in a family. Monthly family income varied from 2,400 Taka to 73,500 Taka per month with an average of 10,806.15 Taka; and monthly family expenditure varied from 2,000 taka to 30,000 taka per month with an average expenditure of Taka 7,319.24. In both these criteria, the modal value was 6,000 Taka, again indicating that the income was just enough for the expenditure for many of these families. The

minimum amount of savings, among those who had savings, was 200 taka and the maximum is 700,000 Taka. The minimum amount of family loans, among those who had loans, was 500 Taka and the maximum was 500,000 Taka.

Table 4.8 shows a comparative view of the economic variables, those discussed above, in terms of the age and category of respondents. People of all age groups (except 70+) worked on an average around 9 hours a day in their first occupation and had an average income of around 8,500 Taka. People under the age 20 and over the age 70 did not have any second occupation. Those who had a second occupation worked around 3.5 hours a day and earned around 2,000 Taka, except the 50-59 aged-group people. Among the respondents' major categories, stone labourers had lowest (5,581 taka on average) and stone businessmen had highest (16,661 taka on average) monthly income from the 1st occupation. The amount of savings and the amount of loans were highest for stone businessmen (averages of 128,692.31 taka, and 106,640 taka on respectively), and lowest for the stone labourers (5,627.66 taka, and 11,544.93 taka respectively).

Table 4.8
Income and Expenditures by Age and Category of the Respondents

Variables		Time spent for the first occupation	Respondents' income from first occupation	Time spent for the second occupation	Respondents' income from the second occupation	Total monthly income of the respondents	Amount of savings	Amount of loans
		Mean	Mean	Mean	Mean	Mean	Mean	Mean
Age category of the respondents	10-19	9.5	8263	-	-	8262.50	11333.33	32666.67
	20-29	8.5	8651	3.34	2354.41	9550.00	70388.10	62182.98
	30-39	9.0	8939	3.55	2363.64	9718.50	77930.56	33722.32
	40-49	8.9	9055	3.19	2214.29	9863.33	35876.00	37780.49
	50-59	9.4	8311	3.75	5712.50	9676.56	43242.86	65535.00
	60-69	9.3	8125	3.00	2000.00	8750.00	9000.00	22058.33
	70+	10.7	12233	-	-	12233.33	154500.00	10000.00
Category of the respondents	Stone labourers	8.3	5581	3.07	1568.18	6144.77	5627.66	11544.93
	Stone businessmen	9.5	16661	3.82	4621.21	18476.19	128692.31	106640.00

	Land sellers	9.7	7267	3.50	1833.33	7633.33	27066.67	35747.92
	Mass people	9.3	6133	3.71	1500.00	6346.94	18977.78	28872.50

In the Table 4.8, it is seen that the respondents spent 8.91 hours on an average for their first occupation and earned 8771.84 Taka on an average. Again, the respondents spent 3.39 hours on average for their second occupation and earned 2576.73 Taka. Analyzing the family income and cost of the respondents, it was seen that their family income was 10806.15 Taka and their family expense was 7319.24 Taka.

4.1.7 Differences among Respondents in Terms of Income, Savings and Loans

In this section, the differences in terms of time spent by respondent for first occupation, the income, earnings, savings, loans etc. of the four categories of respondents have been analyzed.

Table 4.9
Differences among Respondents in terms of Income, Savings and Loans

		N	Mean	Std. Deviation	Std. Error
Time spent for the first occupation	Stone labourer	153	8.33	2.05	0.17
	Stone businessman	84	9.45	2.28	0.25
	Land seller	30	9.73	2.45	0.45
	Mass people	49	9.33	2.28	0.33
Respondents' income from first Occupation	Stone labourer	153	5581.05	1733.02	140.11
	Stone businessman	84	16660.71	10423.32	1137.28
	Land seller	30	7266.67	3768.59	688.05
	Mass people	49	6132.65	2322.39	331.77
Earnings per hour in a month	Stone labourer	153	721.28	304.22	24.59
	Stone businessman	84	1782.08	1172.35	127.91
	Land seller	30	748.05	319.41	58.32
	Mass people	49	698.85	314.97	45.00
Amount of savings	Stone labourer	47	5627.66	6660.06	971.47
	Stone businessman	52	128692.31	171277.76	23751.95
	Land seller	15	27066.67	59343.09	15322.32
	Mass people	18	18977.78	37089.63	8742.11
Amount of loans	Stone labourer	69	11544.93	12138.48	1461.30
	Stone businessman	50	106640.00	140406.23	19856.44
	Land seller	24	35747.92	69204.20	14126.25
	Mass people	40	28872.50	39487.86	6243.58

The above table shows that, there were differences among four major categories of the sample in terms of "Time spent for the first occupation", "Respondents' income from first occupation", "Earnings per hour", "Amount of savings", and "Amount of loan". ANOVA F-test was applied to test whether these differences were significant.

The ANOVA table shows that, the four groups of respondents differed significantly at 5% level of significance in terms of all the five continuous variables mentioned above.

Table 4.10
ANOVA Table

		Sum of Squares	df	Mean Square	F	p-value
Time Spent for the First Occupation	Between Groups	105.581	3	35.194	7.364	0.000*
	Within Groups	1491.112	312	4.779		
	Total	1596.693	315			
Respondents' Income from First Occupation	Between Groups	7194669524	3	2.4E+09	73.756	0.000*
	Within Groups	10144844812	312	32515528		
	Total	17339514335	315			
Earnings per hour	Between Groups	69610518.65	3	23203506	53.285	0.000*
	Within Groups	135864324.8	312	435462.6		
	Total	205474843.4	315			
Amount of Savings	Between Groups	4.30524E+11	3	1.44E+11	11.694	0.000*
	Within Groups	1.57087E+12	128	1.23E+10		
	Total	2.00139E+12	131			
Amount of Loans	Between Groups	2.79613E+11	3	9.32E+10	14.546	0.000*
	Within Groups	1.14697E+12	179	6.41E+09		
	Total	1.42658E+12	182			

*=significant at 5%

4.1.8 Test of Homogeneity of Variances

Table 4.11 provides Levene's test of homogeneity of variances to check whether the variances of these four groups were homogeneous or not, in terms of the above five variables.

Table 4.11
Test of Homogeneity of Variances

	Levene Statistic	df1	df2	p-value
Time spent for the first occupation	2.695	3	312	0.046*
Respondents' income from first occupation	73.494	3	312	0.000*
Earnings per hour	30.864	3	312	0.000*
Amount of savings	23.459	3	128	0.000*
Amount of loans	30.162	3	179	0.000*

Tests show that for all the five variables, the group variances are not homogeneous. So, for those variables, where those four groups differed significantly, multiple comparison was done assuming non-homogeneous variances. Considering this perspective, Tamhane t^2 multiple comparison for non-homogeneous variances test procedure was adopted.

4.1.9 Multiple Comparisons among Four Categories of Respondents

The following multiple comparison table shows that, in terms of "Time spent for the first occupation", stone labourers differed significantly from the other three categories. Stone labourers worked on an average 1.13 hours less than the stone businessmen, 1.41 hours less than land sellers, and 1 hour less than the mass people.

Table 4.12
Multiple Comparisons among Four Categories of Respondents

Tamhane t^2 multiple comparison tests for non-homogeneous variances					
Dependent Variable	(I) Category of the respondents	(J) Category of the respondents	Mean Difference (I-J)	Std. Error	p-value
Time spent for	Stone	Stone	-1.126	0.299	0.001*

the first occupation	labourer	businessman			
		Land seller	-1.406	0.477	0.032*
		Mass people	-.9997	0.365	0.045*
	Stone businessman	Stone labourer	1.126	0.299	0.001*
		Land seller	-0.281	0.512	0.995
		Mass people	0.126	0.409	1.000
	Land seller	Stone labourer	1.407	0.477	0.032*
		Stone businessman	0.281	0.512	0.995
		Mass people	0.407	0.553	0.976
	Mass people	Stone labourer	.9997	0.365	0.045*
		Stone businessman	-0.126	0.409	1.000
		Land seller	-0.407	0.553	0.976
Respondents income from first occupation	Stone labourer	Stone businessman	-11079.67	1145.875	0.000*
		Land seller	-1685.62	702.168	0.127
		Mass people	-551.61	360.140	0.568
	Stone businessman	Stone labourer	11079.67	1145.875	0.000*
		Land seller	9394.05	1329.214	0.000*
		Mass people	10528.06	1184.682	0.000*
	Land seller	Stone labourer	1685.62	702.168	0.127
		Stone businessman	-9394.05	1329.214	0.000*
		Mass people	1134.01	763.859	0.609
	Mass people	Stone labourer	551.61	360.140	0.568
		Stone businessman	-10528.06	1184.682	0.000*
		Land seller	-1134.01	763.859	0.609
Earnings per hour	Stone labourer	Stone businessman	-1060.80	130.257	0.000*
		Land seller	-26.77	63.291	0.999
		Mass people	22.44	51.279	0.999
	Stone businessman	Stone labourer	1060.80	130.257	0.000*
		Land seller	1034.02	140.580	0.000*
		Mass people	1083.23	135.597	0.000*
	Land seller	Stone labourer	26.77	63.291	0.999
		Stone	-1034.02	140.580	0.000*

		businessman			
		Mass people	49.21	73.658	0.986
	Mass people	Stone labourer	-22.44	51.279	0.999
		Stone businessman	-1083.23	135.597	0.000*
		Land seller	-49.2086	73.658	0.986
Amount of savings	Stone labourer	Stone businessman	-123064.65	23771.810	0.000*
		Land seller	-21439	15353.086	0.705
		Mass people	-13350.1	8795.921	0.615
	Stone businessman	Stone labourer	123064.65	23771.810	0.000*
		Land seller	101625.64	28265.327	0.004*
		Mass people	109714.53	25309.676	0.000*
	Land seller	Stone labourer	21439.01	15353.086	0.705
		Stone businessman	-101625.64	28265.327	0.004*
		Mass people	8088.89	17640.804	0.998
	Mass people	Stone labourer	13350.12	8795.921	0.615
		Stone businessman	-109714.53	25309.676	0.000*
		Land seller	-8088.89	17640.804	0.998
Amount of loans	Stone labourer	Stone businessman	-95095.07	19910.137	0.000*
		Land seller	-24203	14201.629	0.474
		Mass people	-17327.6	6412.306	0.057
	Stone businessman	Stone labourer	95095.07	19910.137	0.000*
		Land seller	70892.08	24368.608	0.029*
		Mass people	77767.50	20814.909	0.003*
	Land seller	Stone labourer	24202.99	14201.629	0.474
		Stone businessman	-70892.08	24368.608	0.029*
		Mass people	6875.417	15444.518	0.998
	Mass people	Stone labourer	17327.57	6412.306	0.057
		Stone businessman	-77767.5	20814.909	0.003*
		Land seller	-6875.42	15444.518	0.998

*=significant at 5%

In terms of "income from first occupation", stone businessmen differed significantly from other three categories. Stone businessmen earned on average 11,079.67 Taka more than stone labourers, 9,394.05 Taka more than land sellers, and 10,528.06 Taka more than the general people. In terms of "Earnings per hour", stone businessmen differed significantly from other three categories. Stone businessmen earned on an average 1,060.80 Taka more than stone labourers, 1,034.02 Taka more than land sellers, and 1,083.23 Taka more than the general people. In terms of "Amount of savings", stone businessmen differed significantly from the other three categories. Stone businessmen earned on an average 123,064.65 Taka more than stone labourers, 101,625.64 Taka more than the land sellers, and 109,714.53 Taka more than the general people. In terms of "Amount of loans", stone businessmen differed significantly from the other three categories. Stone businessmen earned on an average 95,095.07 Taka more than stone labourers, 70,892.08 Taka more than land sellers, and 77767.50 Taka more than the general people.

4.1.9.1 Regression Analysis of Income

Table 4.13 shows the parameter estimates and test results of the regression model of "Income of the respondents from first occupation (Y)" on "Age of the respondents (X_1)", "Time spent for the first occupation (X_2)", "Sex of the respondents (X_3)", and "Educational status of the respondents (X_4)".

Table 4.13
Regression Analysis of Income of the Respondents from First Occupation

Model	Coefficients		t	p-value	95% Confidence Interval for B	
	B	Std. Error			Lower Bound	Upper Bound
(Constant)	-6060.95	2211.98	-2.74	.006*	-10413.29	-1708.614
Age of the respondents	33.51	30.98	1.08	.280	-27.45	94.48
Time spent for the first occupation	862.06	165.2	5.22	.000*	537.01	1187.10
Sex of the respondents (male)	3598.85	1337.02	2.69	.007*	968.11	6229.59

Educational status of the respondents	602.63	86.75	6.95	.000*	431.94	773.32

F-statistic: 23.564 with 4 and 311 df p-value: 0.000*
Coefficient of determinants, R^2 : 0 .233

*= significant 5%

[Dependent variable: Income of the respondents from first occupation]

From the p-values of the t-tests of individual parameters, it can be seen that all the parameters except that of the "Age of the respondents (X_1)" were significant at 5% level. The estimated model was thus,

$$Y= \beta_o+\beta_2X_2+\beta_3X_3+\beta_4X_4 = -66060.95+ 862.06\ X_2+ 3598.85\ X_3+602.63\ X_4$$

These significant model parameters can be interpreted as-

- Value of $\beta_2= 862.06$ means that, one hour increase in time spent for the first occupation would increase income by 862.06, on an average.
- $\beta_3= 3598.85$ means that, *a* male had a 3598.85 Taka higher income, on an average, than a female.
- $\beta_4= 602.63$ means that, one class increase in educational status of the respondents, would increase income by Taka 602.63, on an average.

The p-value of the F-statistic shows a significant value, indicating that all the model parameters were not equal or zero and the model was significant. Value of R^2 was 0.233, indicating 23.3% of variation in "Income of the respondents from first occupation (Y)" can be explained by the estimated model with independent variables "Time spent for the first occupation (X_2)", "Sex of the respondents (X_3)", and "Educational status of the respondents (X_4)".

4.1.10 Comparative Analysis of Income and Expenditure

The respondents of the present study were divided into four categories—stone workers, stone businessmen, land sellers and general people. If the income and expenditure of these four classes were analyzed, significant difference would be found in their income and expenses.

Table 4.8 shows that among the respondents whose were between 40-49 years earned 9863.33 Taka monthly on an average and minimum monthly income of 8262.50 Taka on an average. Again, among the four categories, monthly income of the stone businessmen was more than the other groups, which was 6144.77 Taka. The stone businessmen spent 9.5 hours daily on an average from their main occupation and stone labourers spent 8.3 hours daily on average.

These comparisons of economic criteria with the major categories of respondents have been graphically presented below-

Figure 4.6
Time Spent for the First Occupation and Category of the Respondents

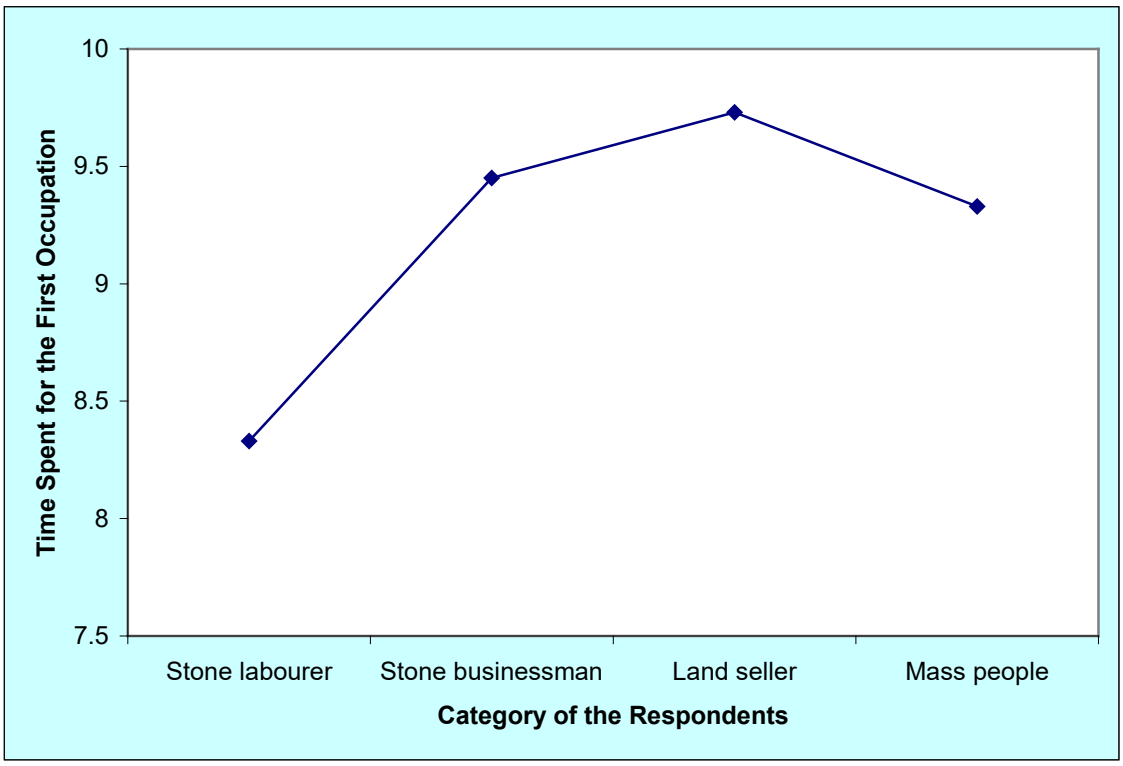


Figure 4.7
Respondents Income from the First Occupation by Categories

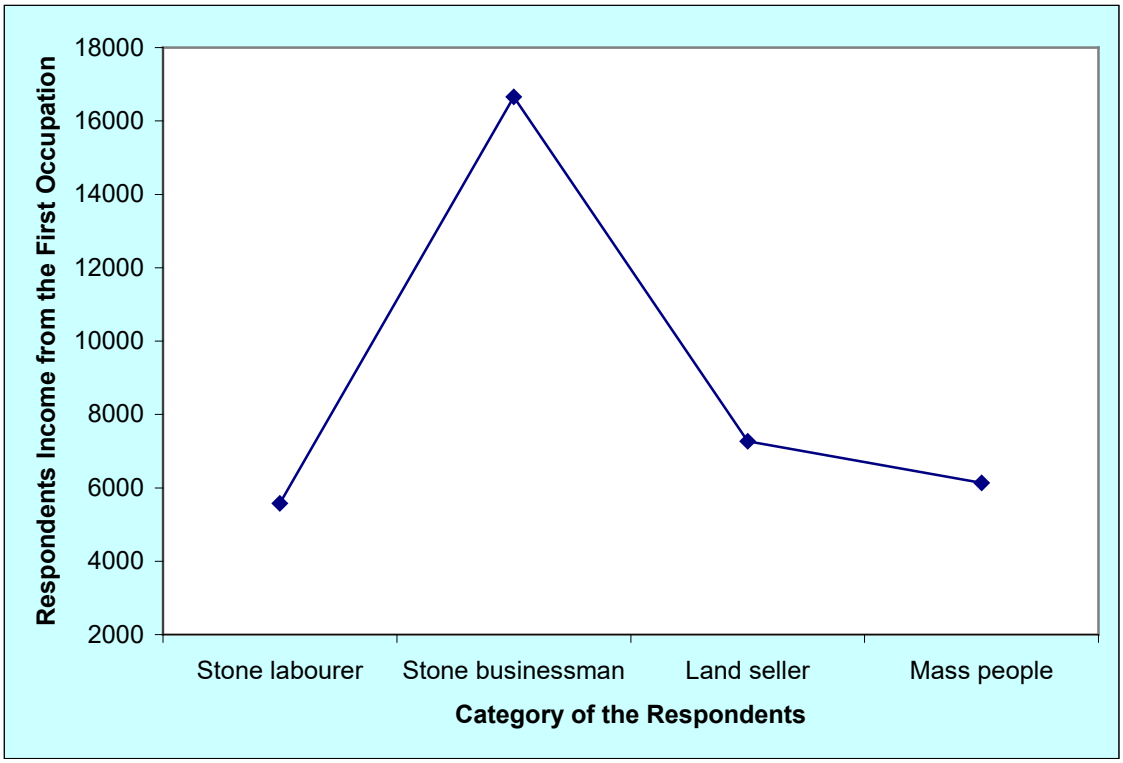
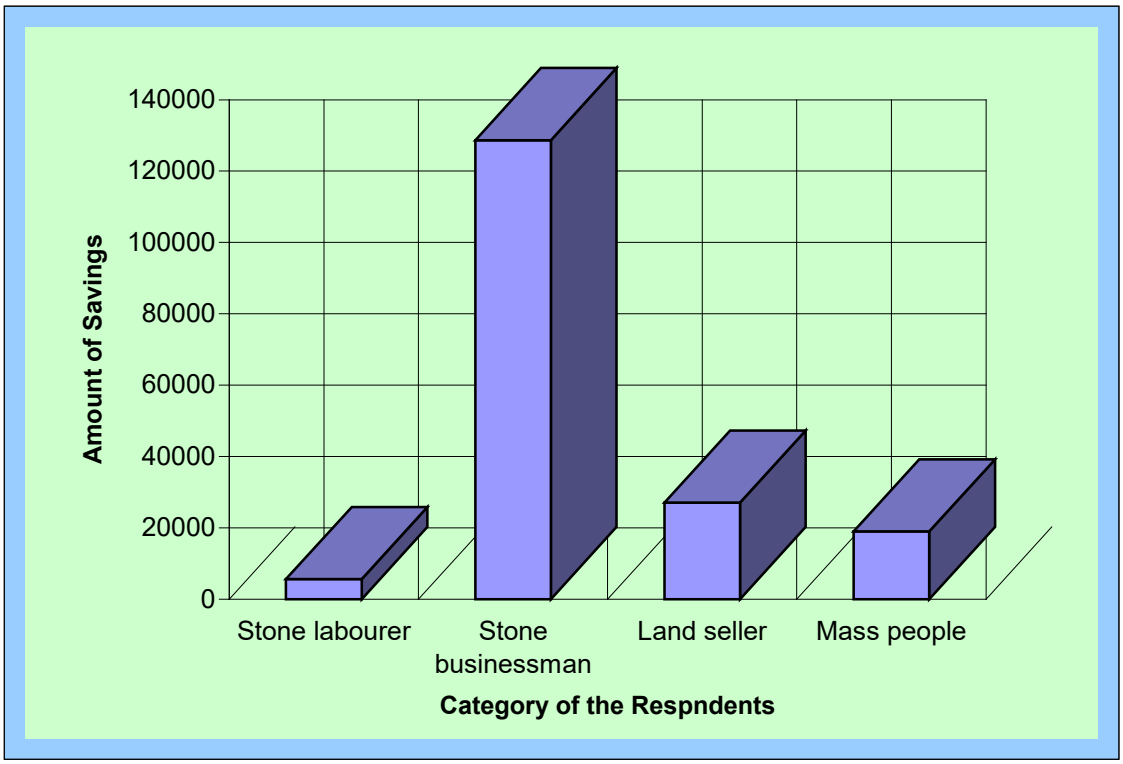


Figure 4.8
Amount of Savings by Categories of the Respondents



4.1.11 Economic Impact of Underground Stone Collection

In this part, the economic impact of underground stone collection has been analyzed from various perspectives. The economic condition of the people of this district situated in the most remote north of Bangladesh is not so good in comparison to other parts of Bangladesh. Employment opportunity is very limited here. There are not many industries in this area, for which the people move to different parts of the country for earning income. Due to underground stone collection, a new gateway of employment was developed for the people of this region. Though it does not happen all the year round, they can employ themselves in collecting stone in the stone quarries and earn money through which a major part of their annual expenses can be met.

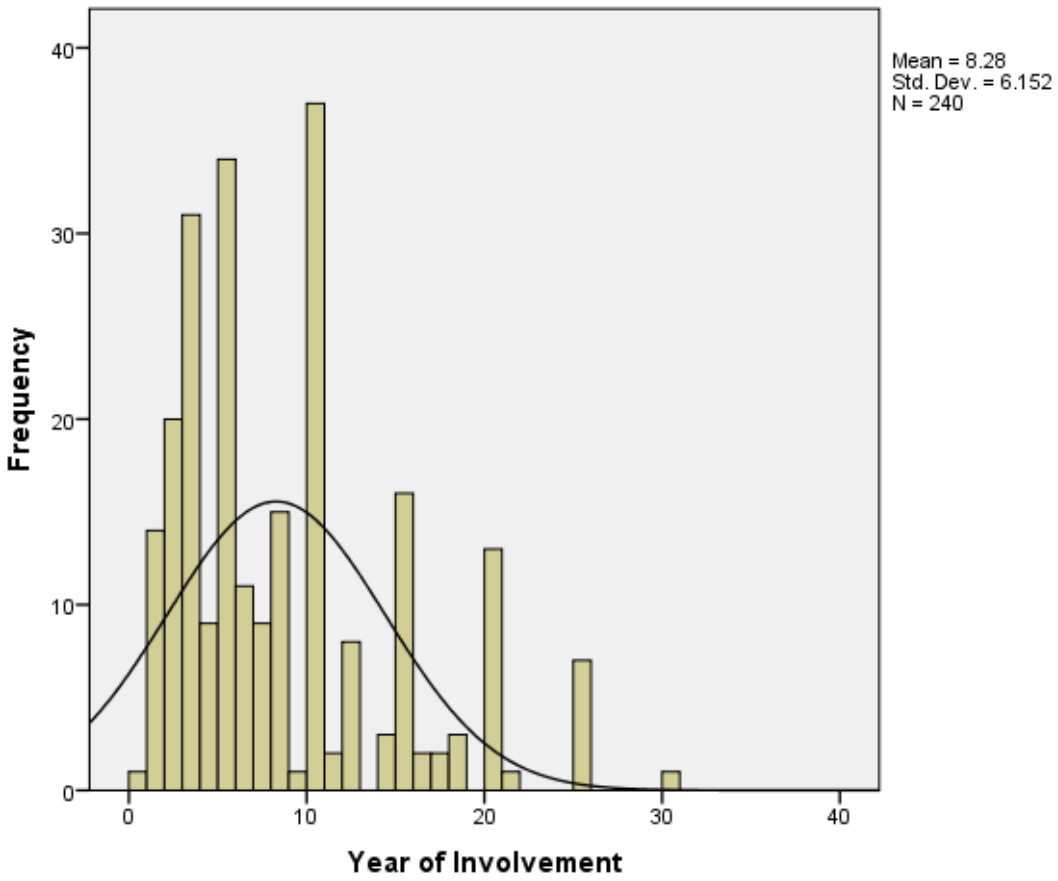
Table 4.14
Economic Impact of Underground Stone Collection

Variables		Count	Column N%	Mean (when applicable)
Direct involvement with stone business	No	77	24.3%	
	Yes	240	75.7%	
Year of involvement in stone collection	1-5	109	45.4%	8.28
	6-10	73	30.4%	
	11-15	29	12.1%	
	16-20	20	8.3%	
	>20	9	3.8%	
Previous occupation of the respondents	Agriculture labourer	78	32.5%	
	Businesses other than stone	11	4.6%	
	Rickshaw/van puller	7	2.9%	
	Farmer	37	15.4%	
	Have no occupation	86	35.8%	
	Other occupation	21	8.8%	
Previous family condition	Very bad	28	11.7%	
	Bad	60	25.0%	
	Not bad	133	55.4%	
	Good	16	6.7%	
	Very good	1	.4%	

	No change	2	.8%
Increase of income due to stone collection	No	39	12.3%
	Yes	278	87.7%
Causes of not increasing income	Low wage/not profitable	3	42.9%
	Physical problem	1	14.3%
	Crisis of work	0	0.0%
	Newly started	1	14.3%
	Business is not running well	1	14.3%
	Capital shortage	1	14.3%
Causes of increasing income	Working as a stone labourer	57	24.5%
	High wage	95	40.8%
	Increased working opportunity	3	1.3%
	Profitable business	78	33.5%
	Expansion of business	0	0.0%
Whether of 6-18 children goes to school	No	14	6.6%
	Yes	199	93.4%
Whether employment opportunity increased	No	2	.6%
	Yes	315	99.4%
Whose employment opportunity increased	Male labourers	6	1.9%
	Female labourers	1	.3%
	Both male and female labourers	310	97.8%
Whose employment opportunity decreased	Agriculture labourer	0	0.0%
	Rickshaw/van puller	0	0.0%
	Local businessman	1	100.0%
	Others	0	0.0%

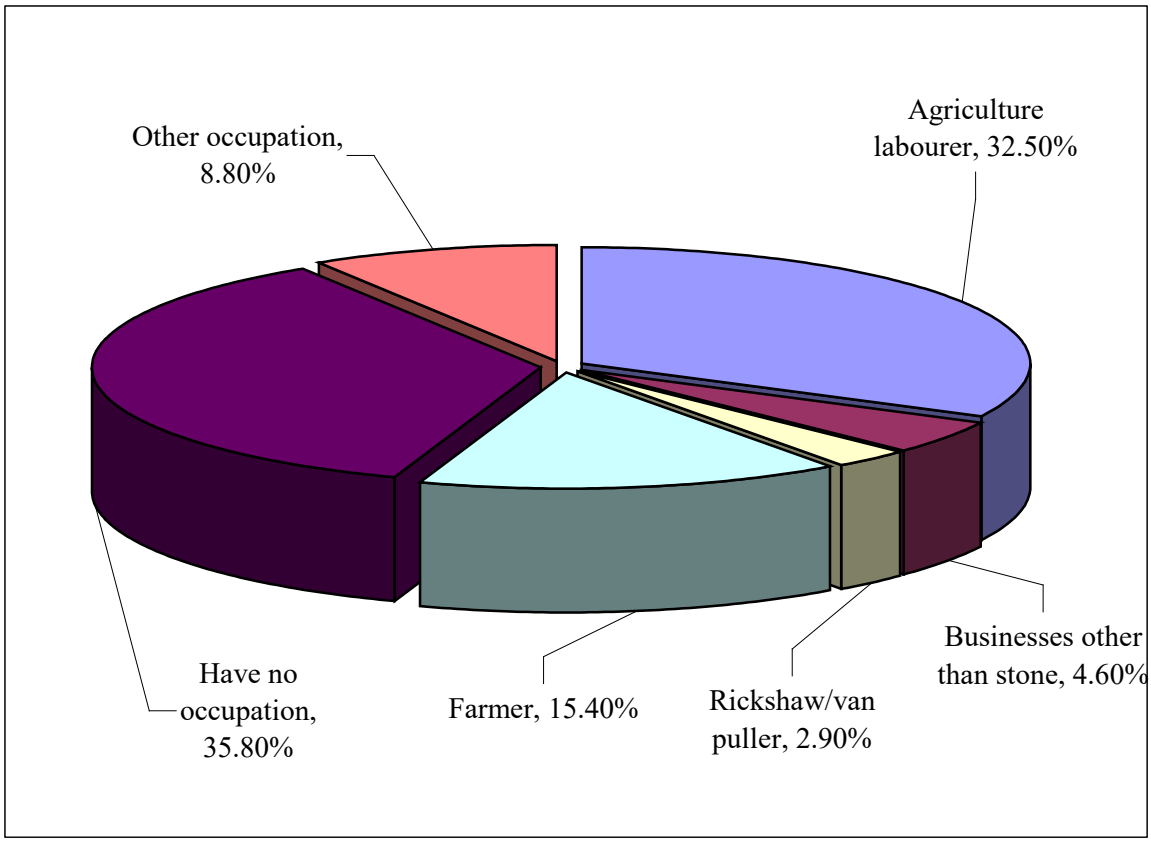
From the above table, it is seen that among the total respondents, 75.7% were directly involved in collecting stones. Here it was also seen that 45.4% among the respondents were involved in collecting stones for less than five years, 30.4% respondents were involved for 6-10 years and only 3.8% of the respondents were involved for 20 years or more. The findings are presented below through a bar diagram.

Figure 4.9
Year of Involvement in Stone Collection



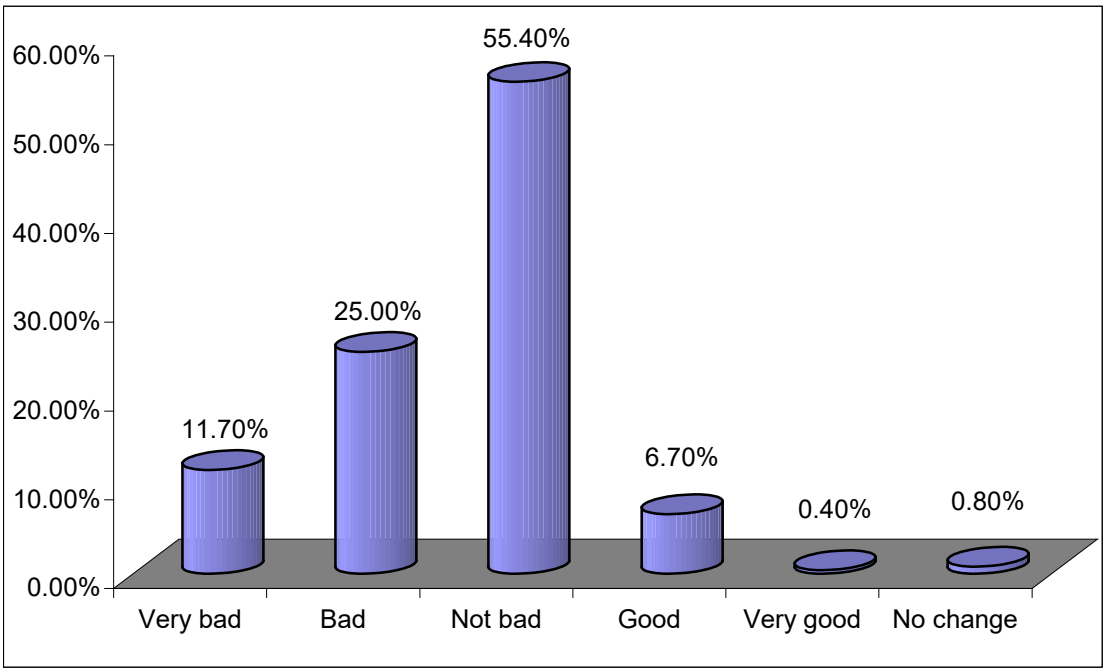
Another notable observation is that 32.5% of the respondents worked as agricultural labour and 35.8% respondents were not engaged in any income generating activities before being engaged in stone collection. That means, after the launching of stone collection, a huge opportunity for earning was created for the people of the study area.

Figure 4.10
Previous Occupation of the Respondents



From the Table 4.14, it was also seen that before getting involved in stone collection, the economic condition of 11.7% respondents was very bad and for 25% respondents it was bad. Among the total sample, 87.7% respondents said that their income had increased after the start of stone collection and only 12.3% of the respondents said that their income had not increased after stone collection started.

Figure 4.11
Previous Family Condition of the Respondents



A major part of the respondents (40.8%) opined that they earned more working as stone collectors compared to other occupation. Data regarding children's education of the respondents' families showed that 93.4% members under the age of 16 went to school. Here, it is notable that 104 families of the respondents did not have members in the 6-16 years age-group and as a result they were not included here.

After the start of stone collection, it is clear from the respondents' views that the employment sector was developing. Almost all (99.4%) respondents opined that after the start of stone collection the scope for getting employed had increased. This opportunity for employment was not for any special class; rather it was for all—according to 97.8% respondents.

4.1.12 Comparative Analysis of the Socio-economic Condition of Respondents directly Involved in Stone Collection

In this part, comparative analysis is conducted for the respondents who were directly involved in stone collection in relation to their socio-economic condition.

Table 4.15
Comparative Analysis of the Socio-economic Condition of the Respondents directly Involved in Stone Collection

Variables		Categories of persons related to stone collection		
		Stone labourer	Stone businessman	Land seller
Previous occupation of the respondents	Agriculture labour	48.4%	1.2%	100.0%
	Business other than stone	.7%	11.9%	0.0%
	Rickshaw/van puller	4.6%	0.0%	0.0%
	Farmer	1.3%	41.7%	0.0%
	Have no occupation	36.6%	35.7%	0.0%
	Other occupation	8.5%	9.5%	0.0%
Previous family condition	Very bad	15.0%	4.8%	33.3%
	Bad	30.1%	15.5%	33.3%
	Not bad	50.3%	65.5%	33.3%
	Good	2.6%	14.3%	0.0%
	Very good	.7%	0.0%	0.0%
	No change	1.3%	0.0%	0.0%
Increase of income due to stone collection	No	2.0%	4.8%	26.7%
	Yes	98.0%	95.2%	73.3%

Among the stone labourers, 48.4% were agriculture labourer before working as stone labourer, 36.6% of the stone labourers were not involved in income generating activities before getting involved in this work, and 4.6% of the stone labourers were rickshaw or van pullers. Among the businessmen, 41.7% were farmers before entering stone business, 35.7% were not involved in any other work and 11.0% of the respondents were involved in other businesses.

From the Table 4.15 it is seen that 15% of the stone labourers' family condition was much worse than at present and 50.3% of them had the same condition as at present. On the other hand, among the businessmen 4.8% of the respondents' family condition was much worse than at present, 15.5% of the businessmen's condition was bad and 65.5% of the businessmen's condition was quite good. Among the stone labourers, 98% of the respondents said that their income had increased after getting involved in this work. In the same way, 95% of the stone businessmen said that their income had increased after starting this work.

4.2 Social Problems due to Stone Collection

The respondents were asked about the problems created by underground stone collection. In the following table, the researcher has presented the problem-related data.

Table 4.16
Social Problems due to Stone Collection

Variables		Count	Column N%
Generation of conflict for stone collection	No	277	87.4%
	Yes	40	12.6%
Frequency of conflict	2-4 each month	2	5.0%
	1 each month	6	15.0%
	1 in six month	9	22.5%
	1 in a year	16	40.0%
	1 in 2-4 years	7	17.5%
Movement regarding stone collection	No	241	76.0%
	Yes	76	24.0%
Which type of movement	Hartal	22	27.5%
	Strike	55	68.8%
	Others	3	3.8%
Extortion in the transport sector	No	304	95.9%
	Yes	13	4.1%
Extortion in the business sector	No	302	95.3%
	Yes	15	4.7%
Whether stone collection from *khas* land	No	315	99.4%
	Yes	2	.6%
Whether land owner forced to collect stone	No	315	99.4%
	Yes	2	.6%

A lion's share of the respondents (87.4%) opined that there was no collision or fighting in this area centering on stone collection and 12.6% respondents said that sometimes fighting and collision took place centering on stone collection. From the above table, it is also seen that 24% respondents disclosed that movements were organized in this area centering on stone collection among which there were *hartals* and strikes. In reply to the question whether the stone businessmen had to face extortion, 95.3% respondents

answered in the negative. 95.9% respondents replied that there was no extortion in the stone transportation sector. Again, 99.2% of the respondents disclosed that there was no tendency of taking the land forcibly to collect stone, which means no huge problems arose here generally centering on stone collection.

4.3 Rights of the Stone Labourers

Labour welfare related aspect is one of the main facets of socio-economic condition. In this part, labour welfare-related data have been analyzed. To analyze the labour-welfare related aspect, the opinions of the stone labourers were taken into consideration.

Table 4.17
Rights of the Stone Labour

Variables		Count	Column N %
Enjoyment of labour rights	No	66	41.3%
	Yes	94	58.8%
Which rights were disallowed	Have to work long time	11	17.5%
	Low wage	35	55.6%
	Do not get wage properly	3	4.8%
	Dismissal from work any time	13	20.6%
	Do not get holiday	1	1.6%
	Others	0	0.0%
Accident in work-place	No	119	75.3%
	Yes	39	24.7%
Type of accident	Land slide	30	71.4%
	Cut of organs	10	23.8%
	Get pain	2	4.8%
Whether they get compensation	No	30	73.2%
	Yes	11	26.8%
Membership of labour organization	No	155	98.7%
	Yes	2	1.3%
Movement for Labour's demand	No	131	84.0%
	Yes	25	16.0%
Success of movement	Fully successful	20	76.9%
	Little bit successful	4	15.4%
	Failed to get success	2	7.7%

From the Table 4.17 it is seen that a lion's share of the respondents (58.8%) could enjoy their rights as a labourer and 41.3% respondents said that they could enjoy their rights as a labourer. Among the respondent who could not enjoy their rights, 55.6% said that they were paid less, 20.6% of the respondents said that the owners dismissed them at their will without prior notice, and 17.5% said that they had to work for longer period of time.

In reply to the question whether there was any accident at the work place, 24.7% of the respondents said that accidents like landslide, slashing of body organs occurred at the work-place. Responding to the question whether the owners compensated the workers in case of accident, a lion's share of the respondents (73.2%) said that they were not compensated at all and only 26.8% of the respondents said that the owners compensated them. There were no such organizations in this region to maintain the rights of the stone-workers. Among the respondents, 98.7% of the workers said that they were not members of any labour organization and only 1.3% workers said that they were members of labour organization. Responding to the question whether the workers were involved in any movement for their rights, a lion's share of the respondents (84%) said that they were not involved in any movement and only 16% of the respondents said that they were involved in movements. So, it is seen that labourers appointed in stone collecting activities were not involved in movements that much.

4.4 Situation of Women and Child Labourers

Women and children were the victims of discrimination in all the sectors of Bangladesh. In the study area, a good number of female and children were working as stone labourers so the researcher has tried to present the situation of women and child labor. The researcher also tried to find out whether the female and child labourers appointed as stone labourers were enjoying labor rights equally.

4.4.1 Situation of Female Labourers

In the present study, 29 female workers had been included in the sample. The researcher has presented the problems and rights-related issues of female workers below.

Table 4.18
Situation of Women Labourers

Variables		Count	Column N%
Whether getting wage like a male labour	No	24	82.8%
	Yes	5	17.2%
Change of social status due to work as a stone labour	Uplifted	12	41.4%
	Little bit uplifted	14	48.3%
	Decreased	0	0.0%
	No change	3	10.3%
Previous involvement with income generating activities	No	22	75.9%
	Yes	7	24.1%
Change in family status due to work as a stone labourer	Uplifted	14	48.3%
	Little bit uplifted	15	51.7%
	Decreased	0	0.0%
	No change	0	0.0%
Have any child bellow 8 years	No	16	59.3%
	Yes	11	40.7%
Who takes care of your child	Husband	3	23.1%
	Father/mother-in-law	0	0.0%
	Servant	0	0.0%
	Relatives	0	0.0%
	Other children	3	23.1%
	Nobody	7	53.8%
Oppression in work place	No	29	100.0%
	Yes	0	0.0%
Increase in females work opportunity	No	4	13.79%
	Yes	25	86.21%

From the above table, it is seen that a lion's share of the female respondents (82.8%) said that even though they worked as much as the male labourers they did not get equal payment and only 17.2% of the respondents said that they got the same payment as the male

workers. Responding to the question whether the female workers were involved in any productive work before joining this work, 24.1% of the respondents said that they were involved in other productive works before joining here and 75.9% of the respondents said that they were not involved in any productive work prior to that. From here, it can be deduced that after the start of stone collection, employment opportunities for women in this area increased a lot. From the Table 4.18, it is also seen that a lion's share of the female respondents (41.4%) claimed that after entering this work their status in the family got a boost slightly, 48.3% of them said that their status in the family was uplifted and only 10.3% said that their status in the family did not change. So it is seen that after starting stone collection, not only was employment opportunity created for the women of this region, but also their condition in family and society had improved. This research also tried to find out if the women faced difficulties in rearing their children after starting work as a stone labourer. Among the female respondents, 40.7% said that they had children below 8 years and 59.3% of the respondents said that they did not have children below 8 years. A lion's share of the respondents (53.8%) said that there were none to look after their children when they stayed in the work place. Responding to the question whether female workers became victims of oppression at the work-place, all the respondents said that they did not face any oppression. Analyzing the opinions of the female workers, it was seen that 86.21% of the females responded that a lot of working opportunity was created for the female labourers of this region as a result of starting stone collection.

4.4.2 Chai-square (χ^2) Test for Male and Female Labourer

Table 4.19 provides the test results for whether the "Highest education level", "enjoyment of labour rights", "availability of recreational activities", and "getting help from employer for illness" differed significantly between male and female stone labourers.

Table 4.19
Chai-Square (χ^2) Test for Male and Female Labour

Variables		Sex of the Respondent (within stone labour)			χ^2			Uncertainty coefficient	
		Male	Female	Total	Value	d.f	p-value	Value	p-value
Highest education level	No education	50.8%	85.2%	100%	11.5	3	.009*	0.044	.003*
	Literate	10.3%	7.4%						
	Primary	32.5%	7.4%						
	Secondary	6.3%	0.0%						
Enjoyment of labour rights	No	27.0%	100.0%	100%	49.4	1	.000*	0.286	.000*
	Yes	73.0%	0.0%						
Have recreational facilities	No	81.00%	88.90%	100%	.964	1	.326	.007	.304
	Yes	19.00%	11.10%						
Help from employer for illness	No	72.20%	81.50%	100%	.987	1	.320	.006	.306
	Yes	27.80%	18.50%						

*=significant at 5%

[Percentages are column percentages]

Table 4.19 shows that "highest education level" and "enjoyment of labour rights" differ significantly between male and female labourers at 5% level of significance. Also, uncertainty coefficient for "enjoyment of labour rights" (0.286) states that the variable "sex of the respondents" can correctly predict the variable "enjoyment of labour rights" 28.6% of the times.

4.4.3 Chai-square (χ^2) Test for Male and Female Labourers in Terms of their Income and Savings

Table 4.20 shows that, male labourers work less than female labourers on average but get higher salaries than female labourers.

Table 4.20
Chai-Square (χ^2) Test for Male and Female Labourers in Terms of their Income and Savings

Variable X Sex of the Respondent		N	Mean	Std. Deviation	Std. Error Mean
Time spent for the first occupation	Male	126	8.06	1.98	0.18
	Female	27	9.56	1.95	0.37
Respondents' income from first occupation	Male	126	5985.71	1612.74	143.67
	Female	27	3692.59	746.11	143.59
Earnings per hour	Male	126	790.31	287.32	25.60
	Female	27	399.14	115.42	22.21
Amount of savings	Male	39	5525.64	6990.85	1119.43
	Female	8	6125.00	5083.24	1797.20
No. of months, involved in stone collection	Male	115	5.95	1.24	.116
	Female	22	5.77	1.11	.237

[Earnings per hour was calculated in the sense that, the respondent worked only one hour a day throughout a month]

Also, there are differences in amount of savings and number of months working per year. To check whether these differences are significant, an independent sample t-test was applied.

4.4.4 Independent Sample Test

Table 4.21 shows the test results of independent sample t-tests and Levene's test for homogeneity of variances. Since, Levene's test became significant at 5% level of significance for the variable "earnings per hour" only, the t-test results with equal variance assumption will be considered for all variables except the variable "earnings per hour".

Table 4.21
Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	p-value	T	Df	p-value	Mean Difference	Std. Error Difference
Time spent for the first occupation	Equal variances assumed	1.51	0.222	-3.56	151.00	0.000*	-1.49	0.42
	Equal variances not assumed			-3.60	38.38	0.001*	-1.49	0.41
Respondents' income from first occupation	Equal variances assumed	2.45	0.120	7.21	151.00	0.000*	2293.12	318.03
	Equal variances			11.29	86.16	0.000*	2293.12	203.12

	not assumed							
Earnings per hour	Equal variances assumed	15.46	0.000*	6.94	151.00	0.000*	391.18	56.36
	Equal variances not assumed			11.54	103.09	0.000*	391.18	33.89
Amount of savings	Equal variances assumed	.127	.723	-.229	45	.820	-599.35897	2611.97167
	Equal variances not assumed			-.283	13.121	.782	-599.35897	2117.31854
No. of months, involved in stone collection	Equal variances assumed	.036	.850	.616	135	.539	.175	.284
	Equal variances not assumed			.665	31.920	.511	.175	.263

The t-test results show that there were significant differences among male and female labourers in terms of "Time spent for the first occupation", "Respondents' income from first occupation", and "Earnings per hour".

4.4.5 Situation of Child Labourer

In the present study, 8 child workers were included in the sample. The problems and rights-related issues of child workers have been presented below. Among the child labourers, 62.5% of the respondents said that even though they worked the same as the adult workers, they did not get equal payment and 37.5% of the child labourers claimed that they got the same payment as the adult workers.

Table 4.22
Situation of Child Labourer

Variables		Count	Column N%
Whether getting wage like an adult labourer	No	5	62.5%
	Yes	3	37.5%
Cause of entering the occupation	To meet the needs of the family	6	75.0%
	Do not get interest in study	0	0.0%
	To earn money	0	0.0%
	Compelled by parents	2	25.0%
	Others	0	0.0%
Oppression as a child labourer	No	8	100.0%
	Yes	0	0.0%
Type of oppression	Physical	0	100.0%
	Mental	0	0.0%
	Both physical and mental	0	0.0%
Whether compelled to do risky work	No	7	87.5%
	Yes	1	12.5%

Responding to the question why the children had joined this work, 75% of the respondents said that they joined this work to meet the needs of the family; and 25% of the respondents claimed that their parents made them join thus work. Responding to the question whether child labourers became victims of any kind of oppression, all the child labourers said that they did not become victims of any oppression. Among them, 87.5% of the child labourers said that they were not forced to do any work, and 12.5% of the respondents said that sometimes they were forced to do some work.

Table 4.23
Discrimination in Payment of Female and Child Labour

Criteria	Amount that a female labourers get less than a male labourers per day (in tk.)	Amount that a child labourers get less than an adult labourers per day (in tk.)
Mean	121.74	83.33
Median	100.00	100.00
Mode	100	100
Range	150	50
Minimum	50	50
Maximum	200	100

So it is seen that, though the female and child labourers did not face any oppression, but they faced discrimination in payment. From the Table 4.23 it is seen that the female workers got 121.74 Taka less than the male workers daily on an average, and the child labourers got 83.33 Taka less than the male workers daily on an average.

4.5 Situation of Stone Businessmen

In the present study, 84 stone businessmen were included in the sample. The social statuses, investment, income-related issues of the stone businessmen have been presented in the Tables 4.24 and 4.25.

Table 4.24
Status of the Stone Businessmen

Variables		Count	Column N%
Improvement of social status	Improved	63	75.0%
	Little bit improved	15	17.9%
	Decreased	2	2.4%
	No change	4	4.8%
Membership of business organization	No	40	47.6%
	Yes	44	52.4%
Do you pay income tax	No	79	94.0%
	Yes	5	6.0%

From the table 4.24 it was seen that among the stone businessmen a lion's share (75%) of the respondents said that their social status had changed due to engagement with stone business, 17.9% of the respondents said that their social status had changed a little, and 4.85% of the respondents said that there was no change in their social status. Responding to the question whether the respondents were engaged in any business organization, a lion's share (52.4%) of the respondents said that they were members of different business organizations and 47.6% of the respondents said that they were not members of any business organization. Responding to the question whether they paid income tax, a lion's share (94%) of the respondents said that they did not pay any income tax and only 6.0% of the respondents said that they paid income tax.

Table 4.25
Total Income and Investment of the Businessmen

Criteria	Total investment in stone business by a businessman	Number of labourers working under stone businessman	Yearly income tax paid by a stone businessman
Mean	612261.9048	82.76	2800
Median	200000.0000	35.00	3000
Mode	100000.00	20	1500
Range	4960000.00	995	3500
Minimum	40000.00	5	1500
Maximum	5000000.00	1000	5000

Analyzing the investment related information of the stone businessmen in the study area, it was seen that the stone businessmen invested 612261.90 Taka on an average in stone business, and 82.76% workers work under them on average daily. Through small investments in stone business, a lot of people were being employed in this area. However, a number of businessmen earned more than three lacs Taka in a year but only 6% respondent's paid income tax regularly and the average income tax was 2800 taka in a year.

4.6 Health Status and Healthcare Facilities in the Study Area

Mining has been viewed as one of the important economic activities which had the potential of contributing to the development of local economies. At the same time, the environmental and health impacts of mining on surrounding communities had been a major concern to governments, the general public and stakeholder organizations and individuals[4]. The health cost of mining operations sometimes outweighs the benefits gained[5]. Health care facilities and health-status related data have been analyzed in this part.

Table 4.26
Health Status and Healthcare Facilities of the Study Area

Variables		Count	Column N %
Special diseases due to stone collection	No	316	99.7%
	Yes	1	.3%
Special disease of stone labourers	No	233	73.50%
	Yes	84	26.50%
Name of special disease of the labourers	Silicosis	24	28.6%
	Asthma	30	35.7%
	Rheumatism	29	34.5%
	Invalid in short time	1	1.2%
Whether healthcare services available	No	196	61.8%
	Yes	121	38.2%

[4] Joseph Yaw Yeboah, "Environmental and Health Impact of Mining on Surrounding Communities: A Case Study of Anglogold Ashanti in Obuasi" [master's thesis, Kwame Nkrumah University of Science and Technology, 2008], 3.

[5] *Ibid.* 24.

Where they go for treatment	Kobiraj	4	1.3%
	Homeo	1	.3%
	Jhar-fuk	0	0.0%
	Self-treatment	24	7.6%
	Village doctor	219	69.1%
	Hospital	58	18.3%
	Clinic	10	3.2%
	No treatment	1	.3%
Do family members get sufficient nutritious food	No	165	52.1%
	Yes	152	47.9%
Why not getting nutritious food	Price hike	69	41.1%
	Low income	99	58.9%
Help from employers during illness	No	163	51.4%
	Yes	154	48.6%

Among the respondents, 99.7% said that they were not infected by any special disease due to starting underground stone collection. But responding to the question whether those who were directly related with stone collection felt victims of any disease, 26.50% of the respondents said that workers engaged in stone collection fell victim to some special diseases and 73.50% the respondents said that they did not fell victim to any disease. Among those who replied in the affirmative, 35.7% of the respondents said that workers engaged in stone collection fell victims of Asthma, 34.5% of the respondents said that they were victims of Arthritis and 28.6% of the respondents said workers were victims of Silicosis. Responding to the question whether there were enough healthcare facilities in the study area, 61.8% of the respondents said that there was insufficient healthcare facility in the study area, and 38.2% of the respondents said that there were enough healthcare facilities in the area. It is therefore clear that there was inadequate healthcare facility in the study area after analyzing the data about whether the respondents went to the public hospitals for treatment; 3.2% took treatment in private clinics and 7.6% of the respondents said they did not get any treatment and bought medicines from pharmacies themselves. From the Table 4.26 it is also seen that 52.1% of the respondents said that they did not get enough nutritious food and 47.9% of the respondents said that they got enough nutritious food.

Responding to the question whether the workers got any help from the employers when they were sick, 51.4% of the respondents said that the owners helped the workers if they became sick and 48.6% of the respondents said that the owners did not help the workers.

4.7 Changes in Different Sectors Due to Underground Stone Collection

Underground stone collection has brought about many changes in different sectors of the study area. In this part, the researcher has presented the types of changes that have occurred in the study area. The analysis has been tabulated in accordance with the respondents' opinions.

Table 4.27
Changes in Different Sectors Due to Underground Stone Collection

Variables		Category of the respondents				Total	
		Stone labourer	Stone businessman	Land seller	Mass people	Count	Percent
Change in roads	Very much developed	30.10%	44.00%	43.30%	46.00%	119	37.50%
	Developed	66.70%	52.40%	43.30%	50.00%	184	58.00%
	Degraded	2.00%	1.20%	0.00%	2.00%	5	1.60%
	Very much degraded	0.00%	0.00%	0.00%	0.00%	0	0.00%
	No change	1.30%	2.40%	13.30%	2.00%	9	2.80%
Change in houses	Very much developed	29.40%	44.00%	30.00%	28.00%	105	33.10%
	Developed	68.00%	54.80%	66.70%	70.00%	205	64.70%
	Degraded	0.70%	0.00%	0.00%	2.00%	2	0.60%
	Very much degraded	0.00%	0.00%	0.00%	0.00%	0	0.00%
	No change	2.00%	1.20%	3.30%	0.00%	5	1.60%
Opportunity of business	Very much expanded	31.40%	35.70%	33.30%	38.00%	107	33.80%
	Expanded	66.00%	64.30%	60.00%	58.00%	202	63.70%
	Narrowed	0.00%	0.00%	0.00%	0.00%	0	0.00%
	Very much narrowed	0.00%	0.00%	0.00%	0.00%	0	0.00%
	No change	2.60%	0.00%	6.70%	4.00%	8	2.50%
Rate of education	Very much increased	30.70%	50.00%	33.30%	46.00%	122	38.50%
	Increased	64.10%	48.80%	60.00%	46.00%	180	56.80%
	Decreased	2.60%	1.20%	3.30%	0.00%	6	1.90%
	Very much decreased	1.30%	0.00%	0.00%	0.00%	2	0.60%
	No change	1.30%	0.00%	3.30%	8.00%	7	2.20%
Treatment facility	Very much developed	13.10%	19.00%	16.70%	24.00%	53	16.70%
	Developed	56.90%	50.00%	40.00%	36.00%	159	50.20%
	Degraded	17.00%	8.30%	6.70%	10.00%	40	12.60%
	Very much degraded	0.00%	0.00%	0.00%	0.00%	0	0.00%
	No change	13.10%	22.60%	36.70%	30.00%	65	20.50%

Number of social organization	Very much increased	19.00%	25.00%	20.00%	32.00%	72	22.70%
	Increased	56.90%	59.50%	63.30%	46.00%	179	56.50%
	Decreased	2.60%	0.00%	0.00%	2.00%	5	1.60%
	Very much decreased	0.00%	0.00%	0.00%	0.00%	0	0.00%
	No change	21.60%	15.50%	16.70%	20.00%	61	19.20%
Child labour	Very much increased	5.20%	3.60%	0.00%	4.00%	13	4.10%
	Increased	37.30%	27.40%	30.00%	30.00%	104	32.80%
	Decreased	29.40%	42.90%	43.30%	42.00%	115	36.30%
	Very much decreased	20.30%	20.20%	26.70%	20.00%	66	20.80%
	No change	7.80%	6.00%	0.00%	4.00%	19	6.00%
Women's employment	Very much increased	28.10%	29.80%	53.30%	36.00%	102	32.20%
	Increased	69.30%	67.90%	43.30%	60.00%	206	65.00%
	Decreased	2.60%	1.20%	0.00%	0.00%	5	1.60%
	Very much decreased	0.00%	0.00%	0.00%	2.00%	1	0.30%
	No change	0.00%	1.20%	3.30%	2.00%	3	0.90%
Terrorism/ extortion	Very much increased	2.00%	1.20%	0.00%	0.00%	4	1.30%
	Increased	18.30%	14.30%	3.30%	10.00%	46	14.50%
	Decreased	9.20%	19.00%	33.30%	16.00%	48	15.10%
	Very much decreased	18.30%	26.20%	26.70%	30.00%	73	23.00%
	No change	52.30%	39.30%	36.70%	44.00%	146	46.10%
Life standard	Very much increased	20.30%	29.80%	20.00%	36.00%	80	25.20%
	Increased	71.90%	67.90%	76.70%	60.00%	220	69.40%
	Decreased	2.00%	1.20%	3.30%	2.00%	6	1.90%
	Very much decreased	0.00%	0.00%	0.00%	0.00%	0	0.00%
	No change	5.90%	1.20%	0.00%	2.00%	11	3.50%
Quarrel & conflict	Very much increased	0.70%	1.20%	0.00%	0.00%	2	0.60%
	Increased	23.50%	21.40%	10.00%	16.00%	65	20.50%
	Decreased	22.90%	27.40%	50.00%	28.00%	87	27.40%
	Very much decreased	11.80%	14.30%	10.00%	14.00%	40	12.60%
	No change	41.20%	35.70%	30.00%	42.00%	123	38.80%
Unemployment	Very much increased	2.60%	1.20%	3.30%	4.00%	8	2.50%
	Increased	11.80%	14.30%	20.00%	18.00%	45	14.20%
	Decreased	58.80%	53.60%	50.00%	52.00%	176	55.50%
	Very much decreased	23.50%	29.80%	23.30%	26.00%	81	25.60%
	No change	3.30%	1.20%	3.30%	0.00%	7	2.20%
Agricultural production	Very much increased	8.50%	8.30%	3.30%	2.00%	22	6.90%
	Increased	14.40%	23.80%	6.70%	6.00%	47	14.80%
	Decreased	55.60%	59.50%	70.00%	74.00%	193	60.90%
	Very much decreased	13.70%	1.20%	6.70%	12.00%	30	9.50%
	No change	7.80%	7.10%	13.30%	6.00%	25	7.90%

From the Table 4.27, it is seen that responding to the question whether the roads of this area had developed or not, 58% of the respondents said that the roads had developed, 37.5% of the respondents said that the roads had very much developed and only 2.8% of

the respondents said that there was no development or degradation. If the opinions of the respondents are analyzed according to their category, it is seen that 66.70% of the stone workers opined that roads had developed, for stone businessmen it was 52.40%, for land sellers it was 43.30% and for the general people it was 50% of the respondents. Respondents thought that roads were necessary for carrying stones and that was why roads had developed after starting underground stone collection.

Analyzing the opinions relating to whether there was any change in the houses after starting underground stone collection, 64.7% of the respondents viewed that houses had developed, 33.1% of the respondents thought that the houses had very much developed and 1.50% of the respondents opined that houses were not developed at all. Analyzing the opinions of the respondent according to the category of respondents, it is seen that after the introduction of the stone collection, 68% among the stone labourers, 54.80% among the stone businessmen, 66.70% among the land sellers and 70% among the general people opined that the houses had been developed.

From the Table 4.27, it is observed that 63.7% respondents had opined that after starting underground stone collection in this region, the opportunity of business had expanded, 33.8% opined that the opportunity of business had very much expanded and only 2.5% thought that the opportunity of business had remained the same. According to the categories of respondents, it is seen that 66% stone labourers, 64.30% stone businessmen, 60% land sellers, and 58% general people opined that the opportunity of business had expanded. That means, it can be said that the respondents of all categories had given their consent in favour of improvement and enhancement of trade and commerce.

On whether the rate of education had changed after starting underground stone collection, 56.80% respondents viewed that the rate had increased, 38.50% opined that the rate had

very much increased and 2.2% held the view that there was no connection between the rate of education and stone collection. According to the categories of respondents, it is seen that 30.7% stone labourers, 50% stone businessmen, 33.3% land sellers and 46% general people opined that the rate of education had very much increased.

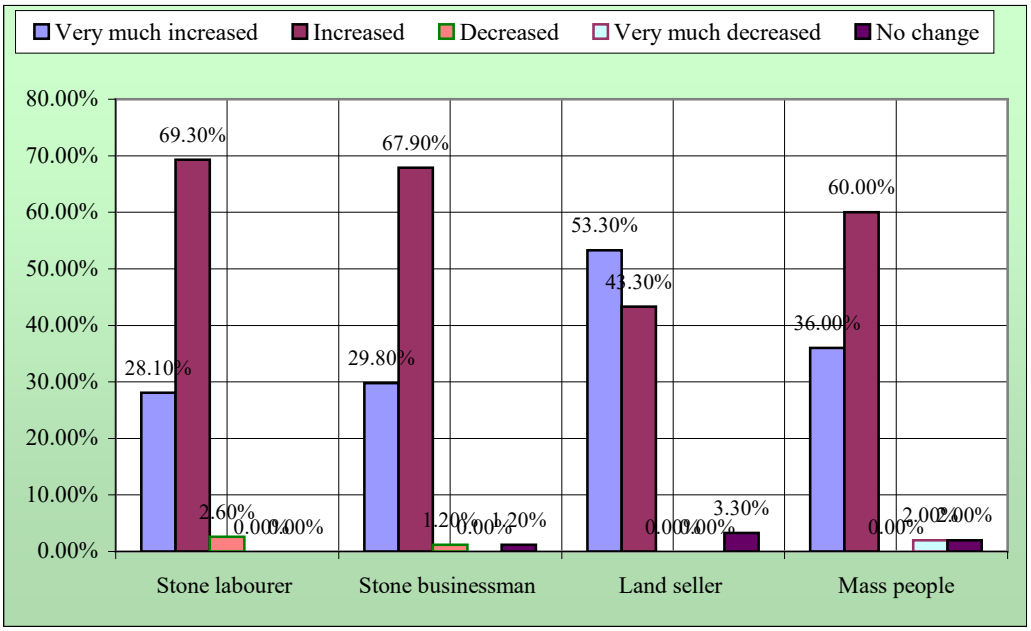
From the Table 4.27 it is seen that after starting underground stone collection, 50.2% respondents thought that the treatment facilities had developed, 16.7% opined that the treatment facilities had very much improved and 20.5% thought that the treatment facilities had remained unchanged. Among the respondents of different classes, the opinion that the medical services had improved was given by 56.9% stone labourers, 50% stone businessmen, 40% land sellers and 36% general people. It is notable that 12.60% respondents opined that the medical services had been degraded.

On whether social organization increased after starting underground stone collection, a lion's share of the respondents (56.5%) opined that the number of social organizations had increased, 22.7% viewed that the number had very much increased and 19.20% thought that the number had remained the same. According to the categories of respondents, it is seen that 30.7% stone labourers, 50% stone businessmen, 33.3% land sellers and 46% general people held the view that the rate of education had very much increased.

From the Table 4.27 it is seen that a major proportion of the respondents (36.3%) thought that child labour had decreased in the study area, 32.80% opined that it had rather increased. These respondents opined that because of the opportunity of becoming a worker in stone collection, a large number of children were working as labourers. The respondents who opined that child labour had decreased were 29.4% among the labourers, 42.9% among the stone businessmen, 43.3% among the land owners and 42% among the general people.

Inauguration of underground stone collection created working opportunity not only for the males but also for the females. Among the respondents, 65% opined that the scope for women's employment had increased after stone collection was introduced. 32.2% thought that the scope had increased very much. According to the categories of respondents, it is seen that 69.3% stone labourers, 67.9% stone businessmen, 43.3% land sellers and 60% general people held the view that the scope of work for females had increased.

Figure 4.12
Opportunity of Women's Employment in the Study Area



Due to underground stone collection, peoples' standard of living had improved very much. Among the respondents, 69.4% said that the quality of lifestyle had increased, 25.2% informed that the lifestyle had increased very much, and 3.50% thought that the lifestyle had remained unchanged. Among the stone labourers, 71.90% opined that due to stone collection the lifestyle had improved, and according to 20.30% lifestyle had very much improved. 67.9% among the stone businessmen, 76.7% among the land owners and 60% among the general people opined that because of stone collection lifestyle had

improved. So, it can be concluded that the lifestyle of the people of this area improved because of starting underground stone collection.

It is also seen from the Table 4.27 that a major proportion (38.80%) of the respondents of the study area thought that the cases of quarrels and conflicts had remained unchanged. Again, 20.50% opined that the number of quarrels and conflicts had increased, whereas 27.40% held the view that the number had decreased.

As a result of stone collection, the number of unemployed people in the study area lessened and the scope for employment had increased for all. Among the respondents, 55.5% thought that unemployment had decreased, 25.6% opined that it had very much decreased and 14.20% held the view that the rate of unemployment had increased. Among the labourers, 58.8% opined that the rate of unemployment had lessened, 23.50% viewed that it had very much decreased. The ratios for the stone businessmen were successively 53.60% and 29.80% respectively. So, analyzing the whole situation, it can be deduced that stone collection was playing a great role in employing the unemployed.

Though the underground stone collection was playing role in lessening the unemployment problem, it was playing a negative role in the agricultural sector of this area. A lion's share of the respondents (60.90%) thought that agricultural production had decreased due to start of underground stone collection, 9.50% opined that agricultural production had very much decreased, and 7.90% held the view that production remained unchanged. Among the land sellers, 70% opined that production had decreased and 6.7% thought that production had very much decreased. Among the general people, 74% opined that agricultural production had decreased and 12% held the view that the agricultural production had very much decreased. They opined that as stone was being collected from agricultural land extensively, the lands were becoming unfit for agricultural production.

4.8 Impact of Underground Stone Collection on Different Categories of People

As a result of underground stone collection, all the people were not equally benefitted or aggrieved. Some got a lot of profit, some were hampered and some were hugely aggrieved. In this part, opinions of the respondents regarding the loss and profit of stone collection have been analyzed.

4.8.1 Stone Labourers

Among the respondents, 60.3% believed that the stone labourers were getting more profit as a result of stone collection, 26.2% thought that the stone labourers were benefitted a little and 13.6% claimed that the stone labourers were hugely benefited. It is noteworthy that no respondents considered stone collection as harmful in any way for the labourers.

Table 4.28
Impact of Underground Stone Collection on Stone Labourers

Degree of benefit	Categories of the respondents					
	Stone labourer	Stone businessman	Land seller	General People	Total Count	Percent
Very much benefitted	8.50%	22.60%	23.30%	8%	43	13.60%
Benefitted	55.60%	64.30%	53.30%	72%	191	60.30%
Little bit benefitted	35.90%	13.10%	23.30%	20.00%	83	26.20%
Little bit disadvantaged	0.00%	0.00%	0.00%	0.00%	0	0.00%
Disadvantaged	0.00%	0.00%	0.00%	0.00%	0	0.00%
Very much disadvantaged	0.00%	0.00%	0.00%	0.00%	0	0.00%
No loss no profit	0.00%	0.00%	0.00%	0.00%	0	0.00%
Total					317	

Analyzing the opinion according to the classes of respondents about the impact of underground stone collection on the stone labourers it was seen that 55.6% of the stone labourers thought that they were benefitted and 35.9% opined that they were minimally benefitted. But 64% among the stone businessmen, 64.3% among the land sellers and 72% respondents among the general people thought that the stone labourers were benefitted. It is

noteworthy that 22.6% stone businessman, 23.3% land sellers and 8% general people held the view that the stone labourers were being hugely benefitted after stone collection had started.

4.8.2 Stone Businessmen

Among the total respondents 54.3% respondents thought that the businessmen were benefitted because of stone collection, 34.4% thought that the businessmen were getting much profit. Whereas according to 11%, they were getting little benefit and only 0.3% thought that the stone businessmen were aggrieved.

Table 4.29
Impact of Underground Stone Collection on Stone Businessmen

Degree of Benefit	Categories of the respondents					
	Stone labourer	Stone businessman	Land seller	General People	Total Count	Percent
Very much benefitted	39.90%	22.60%	36.70%	36.00%	109	34.40%
Benefitted	54.90%	56.00%	46.70%	54.00%	172	54.30%
Little bit benefitted	5.20%	20.20%	16.70%	10.00%	35	11.00%
Little bit disadvantaged	0.00%	1.20%	0.00%	0.00%	1	0.30%
Disadvantaged	0.00%	0.00%	0.00%	0.00%	0	0.00%
Very much disadvantaged	0.00%	0.00%	0.00%	0.00%	0	0.00%
No loss no profit	0.00%	0.00%	0.00%	0.00%	0	0.00%
Total					317	

Responding to the question how much the stone businessmen were benefitted, 56% of the stone businessmen said that they were benefitted and 22% of the stone businessmen said that they were benefitted a little. 39.9% among the stone workers, 36.7% among the land sellers and 36% of the general people thought that stone businessmen were very much benefitted because of stone collection and 54.9% of the stone workers, 46.7% of the land sellers and 54% of the general people thought that businessmen were benefitted because of stone collection.

4.8.3 On the Land Owners

A major part of the respondents (47.9%) thought that land owners were benefitted, 25.2% thought that land owners were benefitted a little. 20.5% thought that it had turned into a

much profitable business for the land owners and only 4.1% thought that the land owners were aggrieved. That means majority of the respondents did not think that land owners were facing huge troubles as a result of underground stone collection.

Table 4.30
Impact of Stone Collection on Land Owners

Degree of Benefit	Categories of the persons					
	Stone labourer	Stone businessman	Land seller	General People	Total Count	Percent
Very much benefitted	20.90%	23.80%	13.30%	18.00%	65	20.50%
Benefitted	49.70%	45.20%	53.30%	44.00%	152	47.90%
Little bit benefitted	24.80%	23.80%	30.00%	26.00%	80	25.20%
Little bit disadvantaged	2.00%	4.80%	0.00%	2.00%	8	2.50%
Disadvantaged	0.00%	1.20%	0.00%	6.00%	4	1.30%
Very much disadvantaged	0.00%	0.00%	0.00%	2.00%	1	0.30%
No loss no profit	2.60%	1.20%	3.30%	2.00%	7	2.20%
Total					317	

From the above table, it is seen that among the land sellers 44% of the respondents opined that they were benefitted because of stone collection, 18% thought that they were very much benefitted and 26% viewed that they were benefitted a little. But 20.90% of the stone labourers, 23.80% of the stone businessmen and 18% general people thought that they were very much benefitted. On the other hand, 49.7% of the stone workers, 45.2% of the stone businessmen and 44% general people held the view that the land sellers were benefited because of stone collection.

4.8.4 Local Administration

A lion's share of the respondents (63.7%) opined that the local administration was not being benefited nor faced loss due to underground stone collection. Among the respondents, 19.9% thought that the local administration was getting little benefit, whereas 12.9% opined that the local administration were very much benefitted due to underground stone collection.

Table 4.31
Impact of Stone Collection on the Local Administration

Degree of Benefit	Categories of the persons					
	Stone labourer	Stone businessman	Land seller	General People	Total Count	Percent
Very much benefitted	0.70%	0.00%	0.00%	0.00%	1	0.30%
Benefitted	10.50%	21.40%	10.00%	8.00%	41	12.90%
Little bit benefitted	17.60%	23.80%	30.00%	14.00%	63	19.90%
Little bit disadvantaged	3.90%	0.00%	0.00%	0.00%	6	1.90%
Disadvantaged	0.70%	1.20%	0.00%	0.00%	2	0.60%
Very much disadvantaged	0.00%	0.00%	0.00%	4.00%	2	0.60%
No loss no profit	66.70%	53.60%	60.00%	74.00%	202	63.70%
Total					317	

Though 17.6% of the stone labourers, 23.8% of the stone businessmen, 30% of the land sellers and 14% of the general people opined that the local administration was benefitted due to stone collection, 66.7% of the stone labourers, 53.60% of the stone businessmen, 60% of the land sellers and 74% of the general people thought that the local administration was neither benefitted nor faced any loss.

4.8.5 Political Leaders

A lion's share of the respondents (68.8%) thought that the political leaders were getting neither benefit nor facing loss. But 19.2% respondents opined that the political leaders were getting little benefit, whereas 9.8% believed that they were very much benefitted.

Table 4.32
Impact of Stone Collection on the Political Leaders

Degree of Benefit	Categories of the persons					
	Stone labourer	Stone Businessman	Land seller	General People	Total Count	Percent
Very much benefitted	1.30%	0.00%	0.00%	0.00%	2	0.60%
Benefitted	5.20%	21.40%	6.70%	6.00%	31	9.80%
Little bit benefitted	20.30%	16.70%	26.70%	16.00%	61	19.20%
Little bit disadvantaged	0.70%	0.00%	0.00%	0.00%	1	0.30%
Disadvantaged	2.00%	0.00%	0.00%	0.00%	3	0.90%
Very much disadvantaged	0.00%	0.00%	0.00%	2.00%	1	0.30%
No loss no profit	70.60%	61.90%	66.70%	76.00%	218	68.80%
Total					317	

From the above table, it is seen that 20.30% of the stone labourers, 16.70% of the stone businessmen, 26.70% of the land sellers and 16% of the general people opined that political leaders were benefitted because of stone collection, but 70.6% of the stone labourers, 61.9% of the stone businessmen, 66.7% of the land sellers and 76% of the general people held the view that the political leaders were neither benefitted nor faced any loss due to underground stone collection.

4.8.6 General People

A major segment of the respondents (45.1%) thought that the general people were getting neither benefit nor facing loss. But 29.3% respondents viewed that the general people were benefitted a little and 14.2% opined that the general people were very much befitted. According to them, though the general people were not directly benefitted by stone collection, but the expansion of the business sector because of underground stone collection brought benefits for the general people.

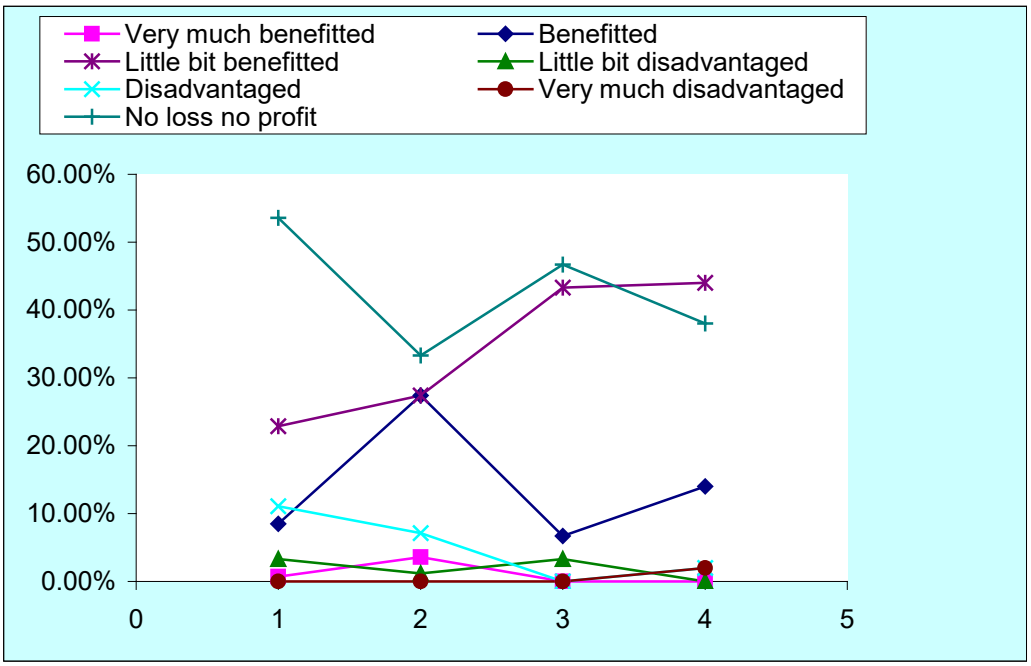
Table 4.33
Impact of Underground Stone Collection on the General People

Degree of Impact	Categories of the persons					
	Stone labourer	Stone businessman	Land seller	General People	Total Count	Percent
Very much benefitted	0.70%	3.60%	0.00%	0.00%	4	1.30%
Benefitted	8.50%	27.40%	6.70%	14.00%	45	14.20 %
Little bit benefitted	22.90%	27.40%	43.30%	44.00%	93	29.30 %
Little bit disadvantaged	3.30%	1.20%	3.30%	0.00%	7	2.20%
Disadvantaged	11.10%	7.10%	0.00%	2.00%	24	7.60%
Very much disadvantaged	0.00%	0.00%	0.00%	2.00%	1	0.30%
No loss no profit	53.60%	33.30%	46.70%	38.00%	143	45.10 %
Total					317	

From the above table, it is seen that among the general people, 44% respondents thought that they were benefitted a little because of stone collection, 14% opined that they were

benefitted, 2% viewed that they were facing lose and 38% responded that they were neither benefitted nor faced any loss. But 22.9% stone workers, 27.40% stone businessmen and 43.30% of the land sellers held the view that general people were benefitted because of underground stone collection.

Figure 4.13
Impact of Underground Stone Collection on the General People



4.9 Conclusion

Analyzing the overall scenario of this part, it is found that socio-economic development was achieved in all people's life of this area due to underground stone collection. But in some areas like healthcare, sanitation, housing etc. conditions have not improved much. Because of stone collection expansion of employment opportunities, roads, business sector etc. had taken place but agricultural production was obstructed and a lot of arable lands were becoming fallow, which should be everybody's concern.

Chapter Five
Environmental Impact of Underground Stone Collection

5.1 Introduction

Environmental impacts like land degradation and pollution of various forms (that is, air, water and noise) in the surrounding communities of Panchagarh district are associated with underground stone collection. Land degradation has resulted mainly from surface (open pit) mining. Air pollution has emanated from emission of dust and other particles into the air. Noise and vibrations are essentially the effects of crushing stone with sound producing machines. These have had adverse effects on food production in the district, as many lands have either degraded due to loss of nutrients or kept reserved for mining activities, resulting in a significant reduction in yield of major crops. Evidently, the proportion of farmers in the district has reduced drastically due to shifts (of labour) to the mining and commerce sectors, hence the situation. In this chapter, the researcher has presented the impact of underground stone collection on the physical environment. Different kinds of impact on various environmental elements like soil, water, rivers, forest and trees because of stone collection have been analyzed based on the respondents' opinion. So, in the case of analyzing the impacts on the environment, the researcher has given priority to the respondents' opinion. Besides, the researcher and the investigator have recorded what they observed during gathering information of that area.

5.2 Environmental Impact of Underground Stone Collection

The huge impact of surface mining on the topography, vegetation, and water resources has made it highly controversial. There are issues of land degradation, loss of biodiversity and pollution of various forms. Surface mining can have adverse effects on the surrounding surface and ground water if protection measures are not exercised. The result can be unnaturally high concentrations of some chemical elements, notably arsenic and

sulfuric acid, over a significantly large area of surface or subsurface[1]. In the table 5.1, different kinds of impact on soil, water, air, trees, lakes etc. due to underground stone collection have been shown on the basis of the opinion of respondents.

Table 5.1
Environmental Impact of Stone Collection

		Category of the respondents					
		Stone Labour	Stone Businessman	Land Seller	Mass People	Total	Column (N%)
Impact on soil	Loss of Soil Composition	43.80%	34.50%	33.30%	30.00%	121	38.20%
	Land slide	34.00%	29.80%	46.70%	36.00%	109	34.40%
	Loss of fertility	15.00%	13.10%	13.30%	14.00%	45	14.20%
	Loss of water preservation capacity	0.00%	2.40%	3.30%	0.00%	3	0.90%
	Land Erosion	0.70%	0.00%	0.00%	8.00%	5	1.60%
	No impact	6.50%	20.20%	3.30%	12.00%	34	10.70%
Impact on water	Water surface dropped	41.80%	61.90%	76.70%	48.00%	163	51.40%
	Shortage of drinking water	21.60%	8.30%	16.70%	16.00%	53	16.70%
	No impact	18.30%	20.20%	6.70%	32.00%	63	19.90%
	Water contamination	18.30%	9.50%	0.00%	4.00%	38	12.00%
Impact on natural disaster	Increased	31.40%	13.10%	10.00%	20.00%	72	22.70%
	Decreased	23.50%	45.20%	40.00%	34.00%	103	32.50%
	No change	45.10%	41.70%	50.00%	46.00%	142	44.80%
Impact on trees	Decreased trees	51.60%	44.00%	43.30%	52.00%	155	48.90%
	Decreased forest	33.30%	29.80%	40.00%	34.00%	105	33.10%
	No change	15.00%	26.20%	16.70%	14.00%	57	18.00%
Impact on animal biodiversity	Decreasing various animal	15.00%	11.90%	10.00%	24.00%	48	15.10%
	Decreasing domestic animals	66.00%	67.90%	70.00%	66.00%	212	66.90%
	No impact	19.00%	20.20%	20.00%	10.00%	57	18.00%
Impact on water body	Water body increasing	75.20%	84.50%	76.70%	84.00%	251	79.20%
	Water body decreasing	20.30%	13.10%	13.30%	8.00%	50	15.80%
	Decreasing water preservation capacity	0.70%	1.20%	10.00%	2.00%	6	1.90%
	No change	3.90%	1.20%	0.00%	6.00%	10	3.20%
Impact on air	Air polluted	56.20%	42.90%	36.70%	54.00%	160	50.50%
	Not polluted	9.20%	22.60%	10.00%	12.00%	42	13.20%
	No idea	34.60%	34.50%	53.30%	34.00%	115	36.30%

[1] Joseph Yaw Yeboah, "Environmental and Health Impact of Mining on Surrounding Communities: A Case Study of Anglogold Ashanti in Obuasi" [master's thesis, Kwame Nkrumah University of Science and Technology, 2008], 85.

From the above table, it is seen that among the total respondents, 38.2% said that soil composition was being damaged due to underground stone collection, 34.4% said that landslide was occurring as a result of this, 14.2% respondents said that soil fertility of land is decreasing and 10.7% said that there was no impact of underground stone collection on soil. Analyzing the opinion according to respondents' category, it was seen that 43.8% of the stone labours thought that soil composition was being damaged due to underground stone collection; it was 34.5% among the stone businessman, 33.3% among the land sellers and 30% among the general people. Again, among the stone labourers 34% thought that landslide occurred due to underground stone collection, it was 29.8% among the stone businessman, 46.7% among the land sellers and 36% among the general people. Among all the environmental effects of stone collection, the most deadly impact was, in most cases were damaged soil composition and the lands becoming uncultivable after stone collection.

Underground stone collection influences hydrologic systems in ways that cause changes to both water quality and quantity. Ground water can be affected by mine subsidence in various ways, including lowering of ground water levels, changes in flow rates, and impacts to water quality. Lowering of ground water levels may decrease the ground water supply and result in the reduction or loss of well water, and decreased surface transmission to springs, seeps and other surface water sources[2]. To know the hydrologic impact of underground stone collection, the researcher asked the respondents what kind of impact was observed on water. Responding to the question, most of the respondents (51.4%) said the layer of underground water was getting lower, 19.95% of the respondents said that no impact was seen on water. Discussing category-based opinion, it was seen that 41.8% of the stone labourers thought that the layer of underground water

[2] Steve Blodgett and James R. Kuipers, *Technical Report on Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impacts* (Bozeman: Center for Science in Public Participation, 2002), 10.

was being lowered, it was 61.9% among the stone businessman, 76.7% among the land sellers, and 48% among the general people; among the stone labourers 18.3% opined that no impact was observed on water, among the stone businessman it was 20.2%, among the land sellers it was 6.7% and among the general people it was 32%. Open pit mining related researches also showed that subsidence can cause the formation of open cracks, fissures or pits, which, if connected either directly or indirectly to surface water (streams, lakes, ponds), may lead to partial or complete loss of water that is drained to lower strata or mine workings. Depletion of water resources in this manner can impact their suitability (quality and quantity) as well as impact aquatic life forms and other life which may depend on surface water systems[3].

Responding to the question on what sort of impact was observed on natural disasters, 22% among the total respondents said natural disasters have increased and 44.8% of the respondents said that natural disasters had not increased or decreased. Analyzing the opinion according to respondents' category, it was seen that 31.4% of the stone labourers opined that natural disasters increased due to stone collection, among the stone businessmen it was 13.1%, among the land sellers it was 10% and among the general people it was 20%. Among the stone labourers 45.1% thought that natural disaster did not increase or decrease due to underground stone collection, it was 41.7% among the stone businessman, 50%, among the land sellers and 46% among the general people.

In the study area, the researcher observed that underground stone was collected from scrublands. To know the opinion regarding the issue, the researcher asked the respondents what kind of impact was visible on trees. Responding to it, 48.9% respondents said that the

[3] Steve Blodgett and James R. Kuipers, *Technical Report on Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impacts* (Bozeman: Center for Science in Public Participation, 2002), 10.

number of tree was decreasing, 33.1% of the respondents said that the amount of forest was decreasing and 18% of the respondents said that there was no impact of underground stone collection on trees. If the comparative analysis of the answers of different people from different classes are considered, then it is seen that 51% of the stone labourers, 44% of stone businessmen, 43.3% of land sellers and 52% of general people thought that the number of trees has lessened, whereas 15% of the stone labourers, 26.2% of the stone businessmen, 16.7% of the land sellers and 14% general people opined that the number of trees was remained the same. In reality, the forests of this area were getting destroyed because of stone collection. As stone was being collected from the forests and household areas, it was considered as the main cause of deforestation. The key informants of the study claimed that though the number of trees were decreasing, it was possible to repay the loss of trees by planting trees in those lands from where stone had been collected.

Views gathered from respondents in the study area revealed that loss of grazing land vegetation had been the most important negative effects of underground stone collection, and for those reasons the number of different species of animal was declining. Responding to the question if was there any impact on the animals of this area 15.1% of the total respondents opined that the number of animals of different species were being lessened, 66.9% of the respondents thought that the number of domestic animals were reduced and 18% of the respondents opined that there was no impact of underground stone collection on animal biodiversity. Analyzing the respondents' opinion according to their category, it was seen that 15% of the stone labourers, 11.9% of the stone businessmen, 10% of the land sellers and 24% of the general people opined that the number of animals were reducing and 66% of the stone labourers, 67.9% of the stone businessmen, 70% of the land sellers and 66% of the general people thought that the number of domestic animal was reduced. The key informants of the study also opined that

because of collecting underground stone, forest land, as well as grazing lands were being reduced; as a result the numbers of animals and domestic animals were being reduced. Responding to the question on the impacts made on water-bodies, 79.2% of the total respondents said that the number of water-bodies were increasing, 15.85% of the respondents said the number of water-bodies remained the same. Analyzing the opinions according to the category of respondents, it was seen that 75.2% of the stone labourers, 84.5% of the stone businessmen, 76.7% of the land sellers and 84% of the general people thought that the number of water-bodies was increasing a lot in the study area due to underground stone collection. According to their opinion land gets lower due to underground stone collection and most of the time they were not filled up; as a result they turned into lakes. As these lands were not planned and as the depth was substantial it was also not available for fish farming.

Effects of the Biological Oxidation method includes air pollution as higher concentrations of chemicals used such as carbon, sulphide and arsenic trioxide are often released into the air. In addition, ore which has been processed is known as tailings, and is generally slurry.[4] Responding to the question if there was any impact on air due to stone collection, 50.5% of the total respondents viewed that the air was being polluted, 13.2% thought that the air was not being polluted and 36.3% of the respondents opined that they had no idea about this. Analyzing the respondents' opinion according to their category, it was seen that 56.2% of the stone labourers, 42.9% of the stone businessen, 36.7% of the land sellers and 54% of the general people held the view that air pollution was increasing because of stone collection, whereas 9.2% of the stone labourers, 22.6% of the stone businessmen, 10% of the land sellers and 12% of the general people opined that there was

[4] Joseph Yaw Yeboah, "Environmental and Health Impact of Mining on Surrounding Communities: A Case Study of Anglogold Ashanti in Obuasi" [master's thesis, Kwame Nkrumah University of Science and Technology, 2008], 88.

no impact on air due to underground stone collection. Most of the respondents claimed that while collecting underground stone, machines were used in removing water and crushing stone; trucks were engaged in transporting the stones and the dust which was produced while crushing the stones got mixed with air and polluted it.

5.3 Degree of Impact on Environment

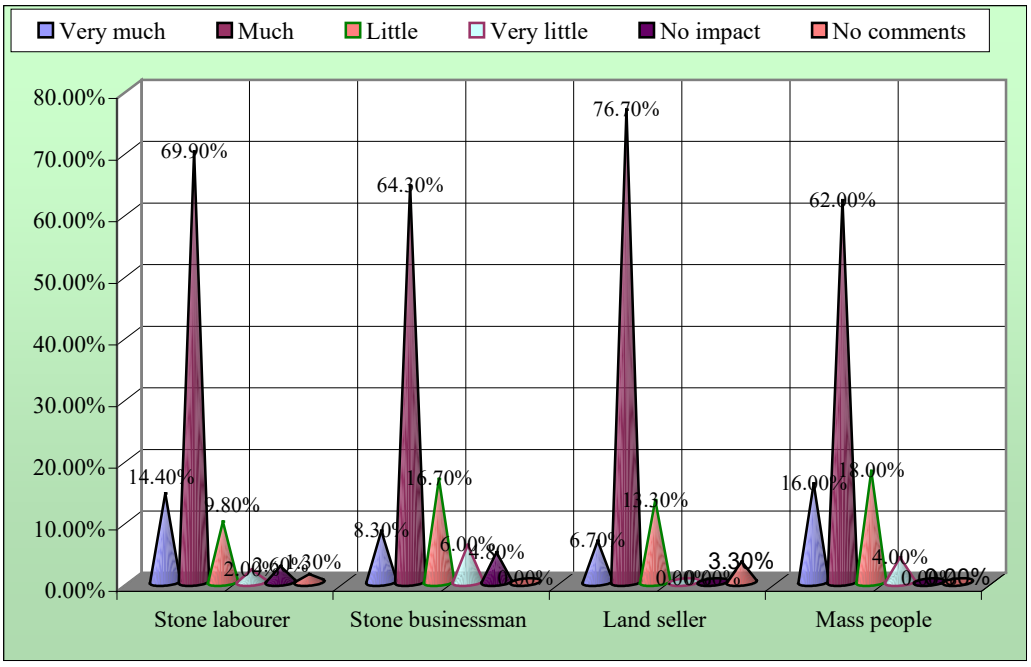
The following section discusses the degree of environmental impacts caused by underground stone collection. The researcher categorized the opinion of the respondents in terms of degree. The following table shows the degree of impact of underground stone collection.

Table 5.2
Degree of Impact on Environment due to Underground Stone Collection

		Category of the respondents					
		Stone Labour	Stone Businessmen	Land Seller	Mass People	Total	Column (N%)
Loss of soil fertility	Very much	14.40%	8.30%	6.70%	16.00%	39	12.30%
	Much	69.90%	64.30%	76.70%	62.00%	215	67.80%
	Little	9.80%	16.70%	13.30%	18.00%	42	13.20%
	Very little	2.00%	6.00%	0.00%	4.00%	10	3.20%
	No impact	2.60%	4.80%	0.00%	0.00%	8	2.50%
	No comments	1.30%	0.00%	3.30%	0.00%	3	0.90%
River bank erosion	Very much	2.60%	0.00%	0.00%	0.00%	4	1.30%
	Much	32.00%	22.60%	16.70%	26.00%	86	27.10%
	Little	39.20%	45.20%	50.00%	46.00%	136	42.90%
	Very little	13.10%	14.30%	26.70%	20.00%	50	15.80%
	No impact	9.80%	14.30%	3.30%	4.00%	30	9.50%
	No comments	3.30%	3.60%	3.30%	4.00%	11	3.50%
Impact on flood	Very much	4.60%	1.20%	3.30%	0.00%	9	2.80%
	Much	30.10%	15.50%	16.70%	26.00%	77	24.30%
	Little	31.40%	39.30%	26.70%	32.00%	105	33.10%
	Very little	15.00%	25.00%	36.70%	24.00%	67	21.10%
	No impact	13.70%	16.70%	16.70%	10.00%	45	14.20%
	No comments	5.20%	2.40%	0.00%	8.00%	14	4.40%
Impact on deforestation	Very much	9.20%	6.00%	3.30%	0.00%	20	6.30%
	Much	49.00%	44.00%	50.00%	46.00%	150	47.30%
	Little	16.30%	23.80%	26.70%	36.00%	71	22.40%
	Very little	10.50%	11.90%	16.70%	16.00%	39	12.30%
	No impact	9.80%	10.70%	3.30%	0.00%	25	7.90%
	No comments	5.20%	3.60%	0.00%	2.00%	12	3.80%
Impact on sound pollution	Very much	14.40%	8.30%	3.30%	2.00%	31	9.80%
	Much	20.30%	40.50%	26.70%	34.00%	90	28.40%
	Little	11.10%	14.30%	10.00%	22.00%	43	13.60%
	Very little	23.50%	13.10%	13.30%	16.00%	59	18.60%
	No impact	15.00%	13.10%	13.30%	6.00%	41	12.90%
	No comments	15.70%	10.70%	33.30%	20.00%	53	16.70%

Fertility of land is reduced because of stone collection. Stone is collected by making a hole after removing the upper layer of soil; so the fertility of the soil is reduced and the land becomes unfit for plantation. Responding to the question on the impact observed on land fertility, 12.3% of the respondents said that underground stone collection was very much responsible for loss of soil fertility, 13.2% claimed that it was a little bit responsible, 67.7% said much, and only 2.5% said that it was not responsible for loss of soil fertility. Among the land sellers, 6.7% of the respondents said that underground stone collection was very much responsible for loss of soil fertility, 76.7% said much, and nobody denied the negative impact of underground stone collection on soil fertility.

Figure 5.1
Views of Respondents Regarding Loss of Soil Fertility due to Underground Stone Collection



Another important finding of the study was the occurrence of underground stone collection along rivers and other water-bodies. Mining activities along these rivers could retard free flow of the water course. As indicated by Sandecki, such direct in-stream

mining could alter the channel geometry and bed elevation and might involve extensive clearing, diversion of flow, stockpiling of sediment, and excavation of deep pits[5]. This could also result in significant distortion of the channel morphology, which often caused silting as a result of erosion of the banks and consequent flooding, which may worsen especially during high precipitation[6]. Many people believed that stone collection was responsible for river erosion in this area. Due to underground stone collection from river banks or adjacent areas, people of this locality became victims of river erosion during the rainy season. Among the respondents 49.2% thought that stone collection was a little bit responsible for river erosion whereas 27.1% termed it as one of the main reasons. Here, it is noteworthy that 50% of the land sellers held stone collection responsible for river erosion. From the key informants, the researcher came to know that though, underground stone collection was strictly prohibited, sometimes the businessmen collect stone from the riverside, which caused river bank erosion.

Floods occurred due to river erosion and for this reason some respondents held stone collection responsible for flood. Among the total respondents 24.3% believed that stone collection was very much responsible for flood, 33.1% thought that it was a little bit responsible, whereas 21.1% believed that its responsibility was too little. It was noteworthy that 14.20% respondents did not believe stone collection was at all responsible for flood in the study area. Panchagarh district is elevated, 60-85m high from sea level, well-drained and free from normal flood hazards[7]; so the probability of flood was very low. But, underground stone collection from the riverside and river can increase the probability of flood in the study area. According to the category of the respondents,

---

[5] M. Sandecki, "Aggregate mining in river systems,"*California Geology* 42, no. 4 [1989]: 88. under "Settings" http://www.oalib.com/references/7579313 [accessed August 17, 2010].

[6] M. Rinaldi, B. Wyzga, and N. Surian, "Sediment mining in alluvial channels: Physical effects and management perspectives," *River Research and Applications* 21, no.7 (2005): 805–828.

[7] M. A. Khan *et. al*. "Prospects of Sweet (Citrus sinensis) and Mandarian (Citrus reticulata) Orange Cultivation at Panchagarh District of Bangladesh," *Pakistan Journal of Biological Sciences* 4 no.12 (2001):1499.

the researcher observed different views in this respect. It was seen that among the stone labourers 4.6% blamed stone collection for flood very much, 30.1% much, 31.4% a little and 15% blamed it very little. Among the stone businessmen 1.2% blamed stone collection for flood very much, 39.3% a little and 25% blames it very little. It is noteworthy that among the stone businessmen 16.70% thought that stone collection was not responsible for flood at all. Among the land sellers16.7% and among the general people 10.00% of the respondents opined that stone collection was not responsible for flood, whereas the other respondents held the view that stone collection was responsible for flood to different degrees.

In the study area, stone was being collected not only from the cultivable land but also from the bushes. For this reason, stone collection had a linkage with deforestation. Among the total respondents, 47.3% believed that because of the lessening of forests, stone collection was very much responsible, 22% opined that it was a little bit responsible, 12.3% respondents claimed that it was very little responsible and 6.30% viewed that it was very much responsible. Among the land sellers, 50% opined that stone collection was very much responsible for deforestation, whereas the same opinion was expressed by 49% stone labourers, 44% stone businessmen and 46% general people. Stone collection was very little responsible as believed by 16.3% stone labourers, 23.8% stone businessmen, 26.70% land sellers and 36% general people. That means, most of the respondents held the view that stone collection was responsible for deforestation.

Sound pollution was also predominant in communities that were close to mining areas, and the surrounding communities of Panchagarh district did not escape from this environmental problem. The sources of sound and vibration in the area included mobile equipment, air explosion and vibration from blasting and other machineries. In the study area, diesel-run

machines were used for stone collection and stone crushing machines were used for crushing stones which generated huge sound and black smoke. Analyzing the opinion of the respondents, it was observed that 9.80% respondents believed that because of stone collection sound pollution was taking place in this area on a large scale, 28.40% thought that sound pollution was taking place, 13.6% opined that sound pollution was taking place on a very minimal scale, 12% claimed that there was no sound pollution and the rest 16.70% opined that they had no idea about it. From the category-wise analysis, it was seen that 20.3% labourers believed that a huge amount of sound pollution was happening, whereas the same opinion was tendered by 40.5% stone businessmen, 34% land sellers and 28.4% general people. Again, stone collection did not play any role in sound pollution was believed by 15% stone labourers, 13.1% stone businessmen, 13.30% land sellers and 6% general people. That means, in spite of the differences in level, the people of the study area believed that sound pollution was being caused by stone collection.

5.4 Underground Stone Collection and Potentials of Natural Disaster

In this part, data on method of underground stone collection and its relations with natural disaster have been analyzed. In Bangladesh, two kinds of methods are used for stone collection. One is removing the upper layer of the soil manually and the other is with the help of dredging machine. In the study area, the first method is being used for stone collection. In this method, stone is collected by digging the upper layer of the soil manually with spade. The benefit of collecting stone through this method is that more labourers can work and the chances of natural disaster became less. But the problem in this method is that the cost of stone collection increases and a huge area of soil's upper layer cut off; for this reason the land or the place becomes uneven and it becomes unfit for cultivation. Because of the chances for employment of more people and lesser scope for natural disaster, most of the respondents

(96.2%) were in favour of collecting stone manually and only 3.8% of the respondents were in favour of collecting stone by using the dredging machine.

Table 5.3
Methods of Stone Collection and Potentials of Natural Disaster

		Count	Column n %
Method of stone collection	Digging	317	100.0%
	Dredging machine	0	0.0%
Which method you support	Digging	305	96.2%
	Dredging machine	12	3.8%
Do you think agricultural land has been decreased	No	26	8.2%
	Yes	291	91.8%
Which method is profitable	Produce crop	50	15.8%
	Stone collection	267	84.2%
Is there any problem due to stone collection from river side	No	218	68.8%
	Yes	99	31.2%

Mining activities usually scar the landscape with excavated pits and trenches, leaving behind unsightly views which as well render the land unsuitable for any productive purpose[8]. From the time when stone was being collected manually, stone had been collected from a huge expanse of land and as the soil was not filled up properly, holes were created which made the land uncultivable. Among the respondents, 91.8% thought that because of stone collection by this method, the amount of cultivable land started to lessen and just 8.2% opined that the area of cultivable land had not lessened. Though after collecting stone, the land becomes unsuitable for cultivation, 84.2% respondents were in favor of stone collection than cultivating land, as it was more profitable and just 15.8% considered cultivating land as more profitable.

[8] Jafaru Adam Musah, *Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining – A Case Study of East Gonja District (Ghana) and Gunnarsholt (Iceland)* (Ghana: Environmental Protection Agency, 2009), 99.

Because of stone collection, the rivers and riversides of the study area were also being affected. Already stone was collected from the rivers and riverside areas of Tetulia upazilla. As a result of stone collection from the riverside area, when the respondents were asked on whether river erosion, floods and various problems had been created, 68.8% respondents opined that there was no problem because of this; 31.2% believed that the problem was created due to stone collection.

5.5 Condition of Land after Underground Stone Collection

For stone collection in the study area, there is a tradition of selling land. In the study area where stone is found on a large scale below the earth, the lands are bought by the stone businessmen from the land owners for an amount of money. But this purchase is not for permanent. The stone businessmen buy the land for a specific period within which they collect stone from that land. After collecting underground stone, the land owners get the land back.

Table 5.4
Selling Land for Underground Stone Collection

		Count	Column n %
Have you sold land for stone collection last five years	No	266	83.9%
	Yes	51	16.1%
Which type of land it was	Agricultural land	33	64.7%
	Not arable land	16	31.4%
	Vita	1	2.0%
	Bushes	1	2.0%
Can you produce crop now	No	48	98.0%
	Yes	1	2.0%
If crop not produced, why	The land become very low	22	45.8%
	The land become uneven	14	29.2%
	Water preservation capacity lost and the land become very sandy	12	25%

The price of the land depends on the depth of the land from where stone can be collected and the thickness of the layer of stone. For selecting land for collecting stone, these two things are seen. Among the respondents, 51 sold their land in the last five years. In response to the question what kind of land it was, 64.7% respondents informed that they had sold cultivable land for stone collection, 31.4% sold their uncultivable land, 1% sold their living land and 1% bushes. Among the respondents, 98% opined that the lands they sold for stone collection had become unfit for cultivation. Among these lands, 45.8% lands became uncultivable because they become too low, 29.2% because of turning uneven and 25% because they become too sandy and were not capable of preserving water. That means, the land became uneven because of stone collection and lost the ability of preserving water for which agricultural production was hampered.

From the Table 5.5 it is revealed that on average the land sellers sold 49.19 decimals land for stone collection. The highest price of the sold land during last five years was Taka 30000 per decimal and the lowest was Taka 1500. It is noteworthy that the price value of land per decimal depended on the depth of the stone layer under soil and the thickness of stone layer.

Table 5.5
Land Selling Price

Criteria	How much land sold by land sellers (in decimal)	What was the highest price per decimal	What was the lowest price per decimal	Approx. production per decimal (in tk.)
Mean	49.19			380.29
Median	31.50			400.00
Mode	50			400
Range	497	30000	1500	400
Minimum	3			200
Maximum	500			600

From the above table, it is seen that the cultivable land sold for collecting stone could produce crops valued at 380.29 taka per year before stone collection. From the above table, it is seen that after collecting stone 98% land turned into uncultivable land. It means that though the land sellers were selling their land for instant profit, in the long run they were not getting much profit.

5.6 Conclusion

The types of impacts associated with underground stone collection are numerous, typically producing both short-term and long-term impacts. In the present chapter, the researcher only presented the impact of underground stone on the physical environment with a brief discussion. Besides those impacts there may be more adverse environmental impact of underground stone collection which can be traced by conducting studies of natural scientists.

Chapter Six
Peoples' Perception and Government Policy

6.1 Introduction

Underground stone mining in the study area is a particularly attractive source of aggregate as they are relatively well sorted, easily accessible and cheap to extract. This has potentially adverse impacts on the natural environment, society, the health and safety of mine workers, and communities based in close proximity to operations. However, although people in general are familiar with the need and importance of underground stone mining for construction material, awareness regarding its negative impact on vegetation, biodiversity and food security may not be as commonly known. Despite widespread occurrence and potential impact on the environment and agricultural lands, underground stone collection has received little attention from the local people, the government and local administration. Even though some studies have improved our consciousness of the impacts, attention usually seems to be focused on mining along river banks and is seldom considered in the context of farms/cultivated lands[1]. This study sought to assess peoples' perception regarding underground stone collection of the study area as well as to evaluate government policy.

6.2 Peoples' Perception Regarding Underground Stone Collection

In the study area, though some of the respondents indicated erosion, landscape, destruction and biodiversity loss, as the major negative environmental impacts, majority of the indicated positive impacts of mining like infrastructural development including roads and housing and providing employment to mine workers, as well as providing income for landowners. The views of people obtained during interviews on the socio-

[1] Jafaru Adam Musah, *Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining – A Case Study of East Gonja District (Ghana) and Gunnarsholt (Iceland)* (Ghana: Environmental Protection Agency, 2009), 78.

economic and environmental impacts of underground stone collection in Panchagarh district are illustrated in the following tables.

Table 6.1
Peoples' Perception Regarding Underground Stone Collection

		Count	Column n %
Do you think agricultural land has decreased	No	26	8.2%
	Yes	291	91.8%
Which one is profitable in your opinion	Produce crop	50	15.8%
	Stone collection	267	84.2%
Is natural disaster increasing	No	240	75.7%
	Yes	77	24.3%
Do you think natural disaster will increase in this area	No	109	34.4%
	Yes	208	65.6%

From the above table, it is seen that among the respondents, 91.8% opined that because of underground stone collection, the amount of cultivable land had started to lessen and just 8.2% thought that the amount of cultivable land had not lessened. Though the land becomes unsuitable for cultivation after collecting stone, 84.2% respondents were in favour of stone collection than cultivating land, as it was more profitable and just 15.8% viewed cultivating land as more profitable.

In response to the question, whether natural disaster had increased after starting underground stone collection, 75.7% respondents opined that natural disaster had not increased but the lion's share of the respondent (65.6%) opined that if this condition continued, natural disaster could be occur in future. That means, though the people of the study area had not yet faced any major natural disaster, they feared facing major risk in future.

6.3 Perception Regarding Development

Though stone is collected on a large scale in the Panchagarh district, the expected development has not occurred. From the previous chapters, it has been revealed that many

indicators of socio-economic development have not yet improved. But the people of the study area strongly believe that it is possible to bring about extensive socio-economic development by utilizing underground stone.

Table 6.2
Perception Regarding Development

		Count	Column N %
Development is possible by collecting stone	No	47	14.8%
	Yes	270	85.2%
If yes how possible	Developing stone-based industry	70	25.7%
	Collecting stone in a planned way	66	24.3%
	Investing money in other sectors	122	44.9%
	Others	14	5.1%
Suggestions for improvement	No comments	194	61.2%
	By innovating environment-friendly process	2	.6%
	Collecting according to needs	64	20.2%
	Land should be labeled	27	8.5%
	Stone should not be collected from cultivable land	12	3.8%
	Govt. intervention	7	2.2%
	By using dresser machine	5	1.6%
	Awareness building	5	1.6%
	Tree plantation	1	.3%

Majority of the respondents (78.9%) thought that by taking initiatives and government control, highest utilization of this stone resource is possible. For that reason, the government should take initiatives and maintain as well as utilize rules in this area. At present, stones are collected at own will of the businessmen in this area from the cultivable land, bushes and homestead which is a great threat to the natural environment and ecological system of this area for this reason, 52.4% respondents did not support stone collection in this way; the rest of (47.6%) respondents were in favour of this mode of stone collection. But, 85.2% of the respondents thought that a lot of development could be achieved in economic and social sectors using the stone resources of this area. So by ensuring the right use of the collected stone and establishing stone based employment, a lot of development can be achieved in the study area.

6.4 Land Use Policies, Regulations and Enforcement in the Study Area

In every country, there are some laws, rules and regulations for the procurement and management of mines and the minerals. The views of the respondents on state regulations regarding underground stone mining in the study area has been analyzed in this section. The results show that there was lack of cognizance about the laws and regulations regarding underground stone collection. In Bangladesh, there are some laws and regulations regarding mineral resources, such as, The Mines and Minerals (Regulations and Development) Act, 1967; The Mines and Minerals (Regulations and Development) Act, 1992 etc. In these laws, giving lease of mines, collection of revenue, giving license for exploring minerals etc. have been described. In this part, the legal aspect related to underground stone collection and development has been analyzed.

Stone is collected from all stone mines or stone quarry through personal initiatives in the district of Panchagarh. The stone businessmen collected processed and sold stones individually. Stone was not collected through government management. The stone businessmen collected stones according to their own will through private management. Generally, they did not take government permission for collecting underground stone. The scenario has been presented below.

Table 6.3
People's Knowledge and Perception about Legitimacy of Stone Collection

		Frequency	
Do you take govt. permission for stone collection	No	80	95.2%
	Yes	4	4.8%
	No idea	0	0.0%
Total		84	100%

From the above table, it is observed that 95.2% stone businessmen did not take any permission from the government officials and only 4.8% stone businessmen take government permission[2]. It is stated in The Mines and Minerals (Regulations and Development) Act, 1992 that to explore and collect any mineral resource it was obligatory to take government permission and if anyone disobeyed this law he or she would be punished with not more than 3 years confinement as well as fine[3]. But in reality, there was no implementation of this law in this area.

6.5 Payment of Tax for Stone Collection

As the stone collectors did not take government permission for collecting stones, they follow the same trend while paying revenue to the government. From the Table 6.4, it is seen that 97.62% stone businessmen (people involved in stone collection and stone dealing) does not pay any tax to the government. Whereas only 2.38% stone businessmen pay their taxes.

Table 6.4
Payment of Tax for Stone Collection

		Frequency	
Do you give tax for stone collection	No	82	97.62%
	Yes	2	2.38%
	No idea	0	0.0%
Total		84	100%

It is clear from the above statistics that the government was not getting the amount of revenue it is supposed to obtain from this area. But if proper steps were taken the government could earn a huge amount of revenue which could improve the economy.

6.6 Causes of Not Getting Revenue

Opinions were taken from the respondents to explore whether the government was getting its due revenue. The respondents identified various reasons for non-submission of revenue.

---

[2] Businessmen took government permission only when they collected underground stone from public land or *khas* land.

[3] Mines and Minerals (Regulations and Development) Act, 1992, (Act no, iv of 1923), Cluse 5. (ACT NT NO. IV OF 1923).

Table 6.5
Causes of Not Getting Revenue

Why government don't get Revenue	Due to absence of policy	152	51.2%
	Administrative indifference	33	11.1%
	Due to businessmen	89	30.0%
	Due to bribe taking	2	.7%
	Others	21	7.1%
Total		317	100%

A lion's share of the respondents (51.2%) considered lack of government rules as the main reason for which the government was unable to collect revenue. Among the respondents, 11.1% identified negligence of the administration and according to 30.0% the mischievous tendency stone businessmen was deprived the government from getting revenue.

6.7 Cognizance of Rules and Regulations

Though it was not legal to collect underground stone indiscriminately, stone was collected without any hindrance in front of the local administration in Panchagarh. Among the respondents, 98.7% said that the local administration did not stop or create any hindrance in collecting underground stone. That means, no one had to face any problem from the administration while collecting underground stone.

Table 6.6
Cognizance of Rules and Regulations

		Count	Column N %
Does the local administration create barrier	No	313	98.7%
	Yes	4	1.3%
Is stone collection legal	No	238	75.1%
	Yes	79	24.9%
Do you know the legal provision regarding natural resource	No	246	77.6%
	Yes	71	22.4%
If yes, is it maintained	No	72	93.5%
	Yes	5	6.5%
Do you think maximum utilization is possible through government initiative	No	67	21.1%
	Yes	250	78.9%
Do you support unplanned stone collection	No	151	47.6%
	Yes	166	52.4%

According to The Mines and Minerals (Regulations and Development) Act, 1992, stone is considered as a mineral resource and it is illegal to explore as well as collect mineral resources without the permission of the government. That means in the study area the provision of collecting underground stone was illegal. A lion's share of the respondents (75.1%) was aware of the fact that it was illegal whereas the rest 24.9% thought it was legal.

From the Table 6.6, it is also seen that 77.6% respondents were aware and conscious about the rules and regulations on the collection, exploration and use of mineral resources, whereas 22.4% respondents had no idea. Among those who had awareness of this law, 93.5% respondents knew that no rules and regulations were maintained for stone collection and the rest 6.5% respondents opined that the regulations were maintained.

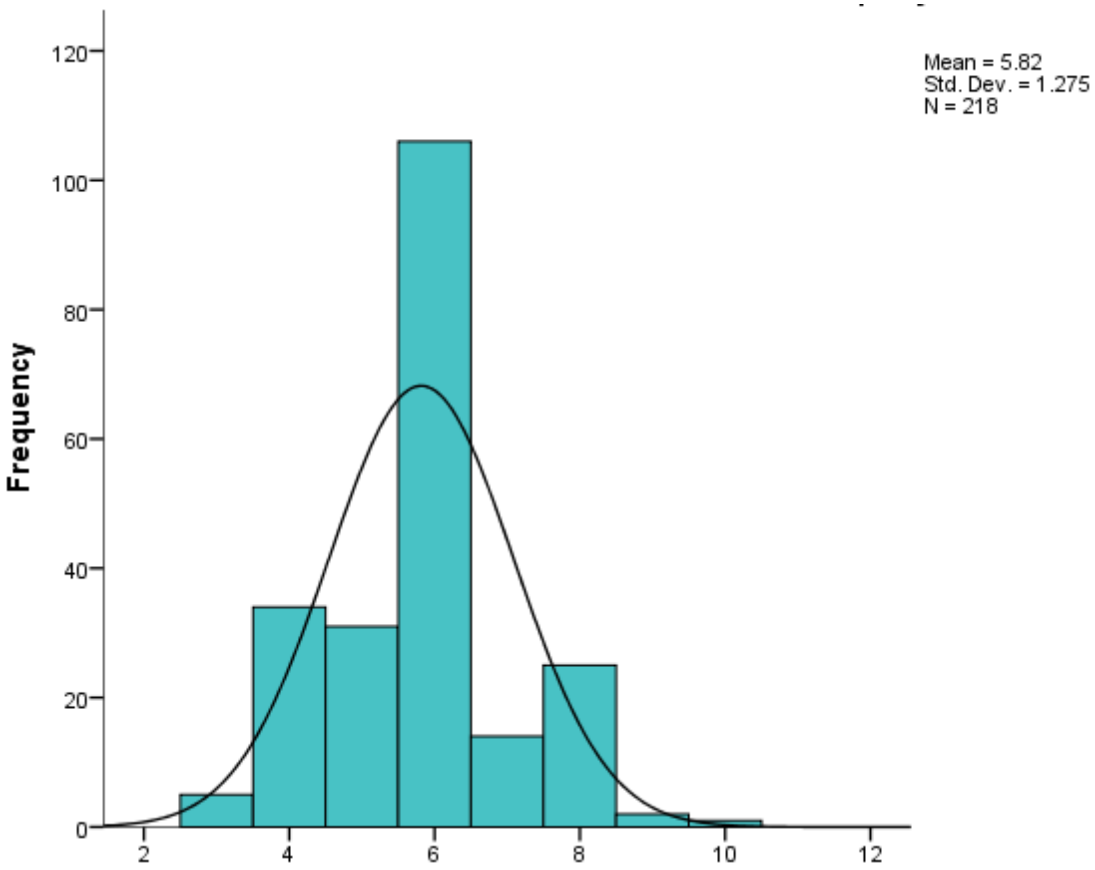
6.8 Opportunity of Work in Stone Sector

In Panchagarh district, stone is collected by digging soil. Here, the workers can't work during the rainy season. So, they have to either remain without work or to work in other sectors. Analyzing the respondents' data, it was seen that the respondents got stone-related work for 5.82 months annually on an average.

Table 6.7
Opportunity of Work in Stone Sector

		Stone Labour	Stone Businessmen
Do you work over the year	Not Applicable	0.0%	0.0%
	No	89.5%	92.9%
	Yes	10.5%	7.1%
Number of months working in stone collection	=<4 months	15.3%	23.1%
	>4 and =<6 months	65.0%	60.3%
	>6 and =<8 months	18.2%	15.4%
	>8 months	1.5%	1.3%
What do you do rest of the time	Agriculture labour	65.7%	0.0%
	Farming	2.9%	44.9%
	Rickshaw/van pulling	5.1%	1.3%
	Other occupation	6.6%	3.8%
	No work	19.7%	29.5%
	Business other than stone	0.0%	20.5%

Figure 6.1
Work Opportunity in Stone Collection in a Year



Among the stone labourers, 89.5% of the respondents did not have work the whole year and among the businessmen, 92.9% of the respondents did not have dealings the whole year. So they had to stay unemployed for a certain period of time (4-8 months). A lion's share of the stone labourers (65%) got work for 4-6 months a year, 18.2% of the labourers got work for 6-8 months, rest of the time they did not get any work. Among the businessmen, 60.3% of the respondents could do this business for 4-6 months, 15.4% could do this work for 6-8 months and for the rest of the time they sat idle or did other works.

Among workers who did not get work the whole year, a lion's share of them (65.7%) work as labourer in agriculture sector and 19.7% of the labourers remained unemployed. On the other hand, among the businessmen 44.9% of them were involved in agricultural

work, 20.5% were involved in other businesses and 29.5% did not do any work. Therefore, respondents of all class had to remain unemployed for a certain period of time or they were forced to do other works.

6.9 Conclusion

It was revealed form the presented data that inspite of showing a great promise, expected socio-economic development had not taken place in the study area. A considerable number of people who were engaged in stone-related activities had to remain workless for a long period. So, stone-based industries could be an important strategy for reducing seasonal unemployment. There is an opportunity to build up stone-based industries, as there were sufficient stones, gravels and sand resources on which industries could develop. Full-capacity exploitation of these resources would create thousands of new jobs at the study area and later on at industrial sites, which would help to alleviate poverty by providing jobs. All these together could accelerate the country's economic development.

Chapter Seven
Outcomes of Focus Group Discussion, Observation and Key Informant Interview

7.1 Focus Group Discussion

7.1.1 Introduction

The analysis and interpretation of focus group discussion requires a great deal of judgment and care, just like any other scientific approach, and regardless of whether the analysis relies on quantitative or qualitative procedures. A great deal of skepticism about the value of focus groups probably arises from the perception that focus group discussion are subjective and difficult to interpret. However, the analysis and interpretation of focus group discussions can be as rigorous as that generated by any other method. It can even be quantified and submitted to sophisticated mathematical analyses, though the purposes of focus group interviews seldom require this type of analysis. Indeed, there is no one best or correct approach to the analysis of focus group data. As with other types of data, the nature of the analysis of focus group interview data should be determined by the research question and the purpose for which the data are collected.

7.1.2 Focus Group Discussion

Focus group discussion is a newly introduced form of qualitative research where a group of people are brought together to talk about their lives and experiences in free-flowing, open-ended discussions which generally focus on a single topic. According to Gupta, "Focus group discussion as a qualitative research method with a definite goal, is essentially a group discussion taking place between people of more or less identical age, socio-economic status, sex and other common characteristics.[1] This method has been used in the present study to get in-depth data regarding the impact of underground stone collection and to cross check the data which was collected through interview.

---

[1] Achintya Das Gupta, *The Qualitative Approach to Social Research* (Dhaka: World View International Foundation, 1989), 15.

7.1.3 Purpose of Focus Group Discussion

The most common purpose of a focus group interview is to provide an in-depth exploration of a topic about which little is known. For such exploratory research, a simple descriptive narrative is quite appropriate and often all that is necessary. More detailed analyses are simply not an efficient or productive use of time, unless they serve a particular research objective. However, there are also other methods of analysis that may be appropriate for certain purposes. Focus group discussion allows interviewers to study people in a more natural conversation pattern than typically occurs in a one-to-one interview. It helps the researcher to learn more about a group or community opinion, their real situation and their needs. In this respect, the purpose of focus group discussion in the present study is to cross-check the data collected through interview and observation, and to collect in-depth data regarding the research issue. The purpose of Focus Group Discussions (FGD) is to draw upon respondents, views, attitudes, problems, prospects, experiences and suggestions in a way which would not be feasible in other methods, e.g. observation, one-to-one interviews or questionnaire surveys.

7.1.4 Methods of Discussion

Two groups were selected purposively for conducting Focus Group Discussions containing 10 members in each group. Members of one group were selected from the stone labourer and the other group from the stone businessmen and land sellers. The FGDs were held in Votipukur and Vojonpur of Tetulia Upzila respectively. Subject matter of the discussion, place, date and time were intimated earlier to the participants by the researcher. The researcher prepared checklists with open-ended questions for conducting the discussion. He appointed two writers to write down important subject matters of the discussion. The researcher introduced himself to the group and then gave an outline of the study; he acted as

the moderator of the sessions. The FGDs were transcribed and translated; in addition, observations were recorded in a notebook by the researcher. Here, FGDs were thematically analyzed.

Information on FGD was collected and then analyzed. There was no written consent form for the participants to sign. The participants were verbally asked for their approval to participate in the study.

Table 7.1
Introduction to the Participants

FGD No.	Type of Participants	No. (sex) of Participants	Education Level
1	Stone Labourer	10 (M:6,F:4)	4 Illiterate 3 Primary Education 2 Not passed SSC 1 HSC
2	Stone Businessman and Land Seller	10 (All Male)	2 Illiterate 2 Primary 3 Not passed SSC 2 Secondary 1 HSC

7.1.5 Result of the Focus Group Discussion

7.1.5.1 Economic Impact of Underground Stone Collection

In both the FGDs, the participants had opined that there was a lot of development in the economic sector due to underground stone collection. It is known from their discussion that as the soil of the study area was not fertile and as there was not many industries in this area, employment opportunity in this area was very limited. A lot of labourers had to go elsewhere in search of work and many of them used to stay unemployed due to lack of jobs. But as a result of stone collection, many people got the opportunity of employment. The income of the people of this area increased and with that their standard of life had improved.

7.1.5.2 Social Impact of Underground Stone Collection

According to the participating respondents in the discussion, there were also some improvements due to stone collection in the study area. A lot of improvement had been occurred in the sector of education, health, sanitation, habitation etc. according to the participants. But two of the participants in the discussion said that there was a negative impact of stone collection in the education sector. According to their opinion, a lot of children were working as child labourer in the stone quarry instead of going to school. A member of group-2 among the participants said that though there was some improvement in the social sectors as a result of starting stone collection, no improvement in the healthcare system had been accomplished.

7.1.5.3 Environmental Impact of Stone Collection

Though a lot of people opined that environment was being affected due to stone collection, yet many said that no harm was done due to stone collection. According to their opinion, as stone was collected by digging the soil, there was no possibility of soil erosion or earthquake. But 6 members among the participants said that if stone was to be collected continuously in such manner, dangerous natural calamities might appear at some stage. Especially, as the area from where stone was being collected in the foothills of the Himalayas, if earthquake appeared in this area there might be huge damage. Again, one of the members said that as a result of collecting stones from the riverside, the rivers were being affected and most often paths of rivers were being changed.

7.1.5.4 Agricultural Impact of Stone Collection

Though all the members agreed that agricultural production was being hampered due to underground stone collection, one of them stated a different view on the decrease in cultivable land. One of the participants in the discussion stated that if the lands were filled

up immediately after collecting stone, there would be no reason for lessening of arable land. But others said that most of them did not fill the land and as a result the lands remained uneven. There remained no possibility of cultivating anything there. Again they opined that as the fertility of land of this area was not much favourable for agricultural production, so they remained less profitable. As a result, most of the people did not want to bring the land to their previous condition by filling them up.

7.1.5.5 Other Problems Caused by Stone Collection

Participants of the discussion opined that there were no other problems of underground stone collection. But sometimes, conflict was seen regarding the ownership of land and forcible collection of stone from disputed land caused clashes. Though there was not much conflict centering on stone collection, but the labourers protested when the stone businessmen tried to collect stone using the dredging machine. In stone collection, conflict was only seen on using dredging machine.

7.1.5.6 Government Rules and Regulations

Participants in the discussion were not informed about government rules and regulations on collecting underground stone resources. According to them, the owner of the land also owned property beneath the land. For this reason, they collected and sold stone of their area. They did not take permission from the government or from any local administration. They also informed that no local administration or government organization created any hindrance in this work.

7.1.5.7 Problems of the Workers

Though a lot of workers were involved in stone collection, yet they had a lot of problems. The workers involved in stone collection informed that this work continued for six months on an average per a year, and they either had to sit idle or do other work for rest of the six

months. They also informed that they were often sacked from this work without any notice. Again, the female participants in the discussion said that they had to work for longer periods of time than the male workers, but they got lesser wages than the male workers. The participants who worked in the stone crashing mills said that they had to work for almost ten hours a day, but they get lesser wages than the workers who worked in the quarry. The stone workers said that sometimes while collecting or manufacturing stone, many of them got injured in accidents, but they did not get much from the owners' side. But the businessmen participating in the discussion said that they helped the workers as much as they could and they did not resort to any discrimination in paying the workers' wages.

7.1.5.8 Peoples' Point of View

The people of the study area considered stone collection as a positive aspect. Participants of the discussion said that there might be some damages to the environment due to underground stone collection, but the standard of life of the people of this area had improved a lot due to this. According to their opinion, living would become very hard for the people of this area if stone was not collected. If more working opportunities could be created centering on stone collection then it would be really helpful for the development of this area.

7.1.5.9 Suggestions from the Participants

The participants of FGD gave some suggestions, which included:

(I) The land must be leveled immediately after collecting stone.

(II) The portion of land which could not be leveled, fish should be cultivated there.

(III) Stone-based industries should be built.

(IV) Child labourers should not be recruited as stone laborers.

(V) No discrimination should be resorted to paying wages among workers.

7.1.6 Conclusion

From the data collected through FGDs, it is seen that people of the study area claimed that they were being benefited because of stone collection and it was contributing towards strengthening the economy of the study area. They were not much aware of the problems created due to stone collection and no notable measure had been taken in this area.

7.2 Observation

7.2.1 Introduction

Observation is a systematic data collection approach where researchers use all of their senses to examine people, place and phenomena in natural settings or naturally occurring situations. Observation may be defined as systematic viewing, coupled with consideration of the seen phenomena.[2] Under the observation method, the information is sought by way of investigator's own direct observation without asking from the respondent.[3] Observation is a fundamental way of finding out about the world around us. As human beings, we are very well equipped to pick up detailed information about our environment through our senses. However, as a method of data collection for research purposes, observation is more than just looking or listening.

7.2.2 Purpose of Observation

Observation method is useful to researchers in a variety of ways. It provides researchers with ways to check for nonverbal expression of feelings, determine who interacts with whom, grasp how participants communicate with each other, and get a real conception of the surroundings. Observation allows researchers to check definitions of terms that participants use in interviews, observe events that informants may be unable or unwilling

[2] Pauline. V. Young, *Scientific Surveys and Research* (New Delhi: Prentice Hall of India, 1977), 22.

[3] C. R. Kothari, *Research Methodology: Methods & Techniques,* 2nd ed. (New Delhi: New Age International Publishers, 2006), 96.

to share when doing so would be impolitic, impolite, or insensitive, and observe situations informants have described in interviews, thereby making them aware of distortions or inaccuracies in description provided by those informants[4].

The aim of using participant observation as a method is to develop a holistic understanding of the phenomenon under study that is as objective and accurate as possible. Observation can be used as a way to increase the validity of the study, as observations may help the researcher to have a better understanding of the context and phenomenon under study. Validity is stronger with the application of additional strategies used with observation, such as interviewing, document analysis, or surveys, questionnaires, or other more quantitative methods. In the present study, the researcher used the observation method to increase the validity of the study and to present a real picture of the study area.

7.2.3 Method of Observation

In the present study, the researcher used non-participant observation method for collecting data about the physical environment of the study area. The researcher used the method to observe the impact of underground stone collection on the physical environment of the study area. A checklist was used by the investigators for observing and it was structured in nature. To collect data through observation in the present study, stone quarry areas and areas where stone crushing mills were situated were chosen for observation. While collecting data through interviewing from different categories of respondents, condition of the physical environment of the study area was observed.

---

[4] Catherine Marshall and Gretchen B. Rossman, *Designing qualitative research* (Newbury Park: SAGE Publications, 1995), 8.

7.2.4 Outcomes of Observation: Outcomes of the observations have been presented in the following table.

Table 7.2
Interviewers' Observations about Surrounding Environment of the Study Area

		Count	Column N %
Number of trees	Very few	11	3.6%
	Few	70	22.7%
	Not bad	221	71.5%
	Much	6	1.9%
	Very much	1	.3%
Condition of land	Plain	20	6.5%
	Uneven	286	93.5%
Possibility of crop production	No	217	71.1%
	Yes	88	28.9%
Condition of top soil	Damaged	152	50.7%
	Sandy	145	48.3%
	Not changed	2	.7%
	Developed	1	.3%
Is stone being collected from bushes	No	155	50.5%
	Yes	152	49.5%
Communication system of the area	Very good	6	1.9%
	Good	139	45.0%
	Fair	146	47.2%
	Bad	17	5.5%
	Very bad	1	.3%
Is river being affected due to stone collection	No	114	37.0%
	Yes	194	63.0%
Sound pollution by machines	No	99	32.0%
	Yes	210	68.0%

Number of trees in the study area was observed by the field investigator. In the observed areas, number of trees was normal in 221 sites, number of trees was few in 70 sites and number of tree was very little in 11 sites.

Among the areas from where stones were collected, 93.5% of the land had become uneven which were either high or very low, and 65% of the land was all right. From the observations it was also seen that after stone collection, 71.1% of the land became totally unfit for cultivation and the rest of the 28.9% land remained fit for cultivation.

Observing the top soil of the land, it was seen that 50.7% top soil of the land had been damaged, 48.3% turned into so much sandy that they lost their ability to hold water. It was monitored from the surroundings of 49.5% observed area that the bushes had also been affected by stone collection.

Observing the roads of the study area, it was found that the communication and transportation system was good in 45% area, average in 47.2% area and bad in 5.5% area. In the areas where stone was being collected, the rivers and wet-lands were being affected.

Due to stone collection and stone crushing related activities, sound pollution was also found in the study area. The high volume of stone crushing machine, stone collecting machine, trucks and other vehicles used as transport system for stone were polluting 68% of the area and the rest 32% area was still free from this heavy sound pollution.

So, from the data provided by observation, it was clear that the cultivable land, rivers etc. were being affected badly by stone collection as well as sound pollution.

7.2.5 Conclusion

Though stone collection had a lot of negative impact, in the study area awareness was very scanty about this. A huge expanse of land was becoming uncultivable because of stone collection, which resulted in the gradual lessening of cultivable land. In these circumstances, efforts should be made so that the production from cultivable land does not lessen and for stone collection the environmental degradation due to underground stone collection can be minimized.

7.3 Key Informant Interview

7.3.1 Introduction

In the study the researcher was taken key informant interview to obtain extensive knowledge about the background of underground stone collection and its impact in Panchagarh district. The prime concern of taking key informant interview was to get an in-depth idea about underground stone collection process and to collect enough data from the experts which was not possible for him during interviews with the general people, stone labourer, land seller and stone businessmen associated with underground stone collection. Through the method of key informant interview the researcher was tried to synthesize the ideas of the general people and the experts view on underground stone collection issues.

7.3.2 Methods of Key Informant Interview

The researcher was selected fifty people as key informants who were the member of agriculture department, fisheries department, forest department, member of local government and local self-government, local administration and NGO personnel in Panchagarh Sadar upzila and Tetulia upzila in Panchagarh district. The researcher was included these persons in the sample through the method of purposive sampling. To collect information the researcher has used a checklist where open-ended questions were attached. He had been fixed the date, time and place of interview talking with the persons included in the sample by before the interview.

7.3.3 Background of Underground Stone Collection

Nobody could mention the exact time when actually underground stone collection was introduced commercially but the researcher came to know from the key informant that it was started at least four decades ago. Before that underground stone was collecting here

from the rivers of this area but underground stone was not collecting from different types of land. The current of the rivers was carried stones from upstream or India and when the current got low people used to collect them from rivers. After the post liberation period local people started the process of underground stone collection because of the uprising demand of stones.

7.3.4 Socio-economic Condition before Starting Underground Stone Collection

Panchagarh is an under-developed district of the north-east corner of Bangladesh. Socio-economic condition of people of this district was not so good due to limited opportunity of work. According to the key informants, agriculture production was not so developed here because of less water preservation capability of land and the vast quantity of sand in the land. For this reason there was shortage of food in the month of *Arshin* and *Kartik*. Besides, the communication system with other districts was not so developed for this reason migration of workers was not easier. People of this area were economically backward than the other areas of Bangladesh for those reason. The rate of unemployment was very high here as there was no industry except the sugar-mill in Panchagarh.

7.3.5 Present Socio-economic Condition

All the Key Informants informed that the socio-economic condition had improved at present. The development of transportation system, cultivation of new crops along with the underground stone collection contributed to the development of this area. According to them, more than fifty thousand people were working in underground stone collection and a number of people were depending on it indirectly. Development was taken place in the sector of communication, business, education, livelihood because of starting underground stone collection. Unemployment problem of this area had reduced and also workers from other districts were coming to this area. But some of the key informants

opined that this development was not as expected centering on underground stone collection. They mentioned that expected development was not occurred in the sector of electricity, healthcare facility, sanitation and housing.

7.3.6 Problems Centering on Underground Stone Collection

Most of the key informants thought that underground stone collection was not causing any socio-economic problem in this region. A number of them thought that it was not causing problems rather it was reducing problems. According to them because of underground stone collection unemployment problem had decreased and also various occurrence of crime had reduced. But some of the key informant accused underground stone collection as the cause of conflicts among people. Local labourers did not support use of dredging machine for collecting underground stone on the other hand some businessmen wanted to use that machines for reducing their cost. Sometimes conflicts taken place among the labourers and stone businessmen based on the issue.

7.3.7 Underground Stone Collection and Agriculture

The officers of agriculture and fisheries department considered underground stone collection as a threat for agriculture. According to them because of underground stone collection a huge amount of agricultural land had already turned into unsuitable for cultivation. They opined that the agricultural land was degrading the top soil had been destroyed due to underground stone collection. They thought that if this provision was going on, the agricultural system of Panchagarh especially in Tetulia upzila could be collapsed. Key informants of the study also said that as underground stone collection was associated with the livelihood of the people of this region it was not possible to stop it completely but to continue the agricultural activity underground stone collection should be stopped from agricultural land. They thought that businessmen should be compelled to fill-up the land immediate after collecting underground stone and soil should be brought

from other places to create top soil where necessary. They also opined that orange and tea could cultivate on those land as the soil of the area was suitable for fruits that contain citrus and tea cultivation. Again the officers of fisheries department said that the holes that were made for collecting underground stone were remaining useless. The holes were too deep to cultivate fish in it. Ponds that are deep more than ten feet are not suitable for fish cultivation in this situation the holes should be shaped like pond and to reduce the depth of the holes so that fish could be cultivated. Negative impact of underground stone collection on agriculture could be reduced by following the advice and direction of the officers of agriculture and fisheries department.

7.3.8 Environmental Impact

Analyzing the data collected from the key informants it was seen that people of this region had never faced any vital natural disaster yet due to underground stone collection. But they opined that some trifling problems like- reduction of trees, river erosion, land slide etc. were created due to underground stone collection. Many of them thought that earth quacks could be occurred as a result of underground stone collection. They also opined that as Panchagarh is situated just at the foot of the Himalaya so underground stone collection could affect the the Himalaya. Key informants of the study also thought that air pollution and sound pollution in this area had increased because of underground stone collection. They suggested that stone crushing machine should be placed in an area far from housing area as stone-dust caused air pollution.

7.3.9 Government Policy

Key informant of the study said that there was no government policy or law related to underground stone collection in this region indeed. Government only leased the government estates to different person every year for collecting stone from government estate. Government only got nominal revenue when stone was collected from government

estate but not got any revenue when stone was collected from personal lands. However, they also informed that businessmen did not take any permission from the government authourity for collecting underground stone. That's why government did not get any tax from this sector. Though government did not get proper revenue from this sector, district stone and sand businessmen association took 100 Taka for six wheeler trucks and 200 Taka for ten wheeler trucks. This amount of money was taken when the trucks went outside of the district. The key informant did not support to impose any restriction from the government in this sector. They wanted to continue the trend of development centering on underground stone collection and to raise consciousness for reducing the negative impacts of underground stone collection.

7.3.10 Conclusion

People of the study area considered that underground stone is an important asset of this area and it is possible to bring extensive socio-economic development in this area by ensuring the proper use of this asset. By using high quality stones, gravels, sands and other materials of these area industries can be built which can reduce unemployment problem as well as develop the economic condition of the study area.

Chapter Eight
Summary, Recommendations and Conclusion

8.1 Introduction

In the present chapter the researcher has presented the major findings of the study in a precise form. He has also made some recommendations for policy formulation and further development.

8.2 Findings of the Study

The researcher conducted this present research to determine the Socio-economic and Environmental impact of underground stone collection. The present study was an exploratory sample survey where the researcher tried to depict the economic, social and environmental impact of underground stone collection by using different methods of data collection. It was conducted in the farthest district of Bangladesh—Panchagarh. The study focused on these priority themes: (i) Assessment of socio-economic impact of underground stone collection, (ii) Trace the environmental changes that occurred after the start of underground stone collection and their effect, (iii) know people's attitude regarding stone collection, (iv) Opportunities of socio-economic and environmental development, and (v) Policy-making on underground stone collection. Data were collected from the stone labourers, stone businessmen, land sellers, general people, local leaders and GO-NGO personnel.

8.2.1 Demographic Characteristics of the Respondents

Among the respondents in the present study 48.3% were stone labourers, 26.5% were stone businessmen, 8.5% were farmers and others were involved in different professions. From the study it was seen that, the age of 31.9% of the respondents was in the range of

30 to 39 years, whereas for 28.1% it was 40 to 49 years. It was also seen that, 16% of the respondents were above 50 years. A major part of the respondents were uneducated (40.7%), rest of them (61.3%) were educated. Among the educated respondents, 26.5% completed primary education, 17.4% completed secondary education and only 5.7% of the respondents completed higher education. The percentages for stone-businessmen, land-sellers and general people were 26.5%, 9.5% and 15.8% respectively. Most of the respondents (71.3%) had small families with a mean of 4.15 members per family.

8.2.2 Residential Status and Living Facilities of the Respondents

Analyzing the data of the respondents, it was seen that 47% respondents lived in the bamboo and straw-made houses, 33.1% lived in tin and wooden houses, 14.5% respondents lived in the *semi-pucca* structures and only 5.4% lived in the buildings. Among the respondents, 92.4% lived in their own houses and only 1.3% lived in rented houses.

From the study, it was observed that 36.6% respondents used *kancha* latrine, 27.1% respondents used water cell latrine, 29.3% used sanitary latrine and 6.9% had no latrine. It was seen that 97.8% people drank water from the tube-well and 2.2% drank water from well. A Lion's share of the respondents (81.4%) had no electricity connection and only 15.1% people had the electricity connection whereas 3.5% respondents used solar panel for electricity. Here it can be mentioned that though according to Bangladesh Economic Review, 53% people enjoyed the electricity facility, the rate was 18.6% in this area was very frustrating. Among the respondents 66% thought that they had no opportunity for recreation and only 34% opined that they had enough recreational facility.

8.2.3 Income and Expenditure of the Respondents

It was found that, most of the respondents (39.2%) worked 7-8 hours a day in their first (main) occupation and only 2.8% respondents worked more than 12 hours a day in their

first occupation. Lions' share of the respondents (53.2%) earned 5,001-10,000 Taka per month and a number of them (29.7%) had earning of less than or equal to 5,000 Taka per month. In a similar way, most of the respondents' (53.2%) total monthly income remained within 5,001-10,000 Taka and a good number (25.3%) of them had a total monthly income below or equal to 5,000 Taka. In terms of combined family income, again most of these respondents' families had monthly incomes of Taka 5,001-10,000. A good number of them (19.2%) had monthly family income of Taka 10,001-20,000. 17% of these families had a total monthly income below or equal to 5,000 taka. Nearly half of the respondents (42.9%) informed that the amount of money they earned were just enough for their family expenditure, i.e. they had no surplus or no deficit in the balance of income and expenditure. But, there were also a good number of respondents who had some surplus over their expenditure (30.9%) and also some respondents who fell into deficit on their monthly expenditure (26.2%). Most of these respondents, who fell into deficit, covered their deficit by taking assistance from local NGOs, where 10.7% of them succeeded. Lions' share of the respondents (57.1%) had no family savings, whereas rest of them had family savings. The reverse situation was seen in family loans, where lions' share of the respondents (57.4%) had family loans and the rest of them did not have. Most of the respondents had family savings (59.1%) of or below 10,000 Taka. Most of the respondents having family loans had family loans of or below 10,000 Taka and 36.6% of them had loans of Taka 10,001-50,000.

Comparative analysis of the savings of the respondents show that 68% stone labourers had no savings while the rest 32% had savings, of whom 55.1% had less than 10000 Taka as savings. Among the stone businessmen, 61.9% respondents had savings and 35.7% had no savings. Among those who had savings among the businessmen, 28.8% respondents'

savings were less than 10000 Taka and 25% had savings between 10001-50000 Taka, while the rest of the respondents had savings of more than 50000 Taka. Among the land sellers, 50% had family savings, among whom 73.3% had savings of less than Taka 10000. Among the general people, 64% had the savings, among whom 66.7% had savings of less than 10000 Taka and 22.2% had savings between 10001-50000 Taka. Comparative analysis of the data regarding taking loan shows that 45.10% of the stone labourers, 59.5% of stone businessmen, 80% land sellers and 78% general people had the burden of loan. Among the stone labourers, 63.80% had loan of less than 10000 Taka, but among the stone businessmen the percentage was 22%, 40% had taken 10001-50000 Taka, 18% had taken 50001-200000 Taka and 20% had loan of more than 200000 Taka. Among the land sellers, majority of the loan takers (54.2%) had taken loan of less than 10000 Taka; among the general people, the percentage was 45%.

Most of the respondents had monthly income of Taka 6,000, as indicated by modal income value. Respondents who had a second occupation, worked 1 to 8 hours in a day, with a mean of 3.39 hours and had income from 150 Taka to 30,000 Taka with an average of 2,576.73 Taka. Respondents' total monthly income varied from 2,000 Taka to 58,000 Taka, with an average of around 10,000 taka per month. Monthly family income varied from 2,400 Taka to 73,500 Taka per month with an average of 10,806.15 Taka; and monthly family expenditure varied from 2,000 taka to 30,000 taka per month with an average expenditure of Taka 7,319.24. In both these criteria, the modal value was 6,000 Taka, again indicating that the income was just enough for the expenditure for many of these families. In terms of "income from first occupation", stone businessmen differed significantly from other three categories. Stone businessmen earned on average 11,079.67 Taka more than stone labourers, 9,394.05 Taka more than land sellers, and 10,528.06

Taka more than the general people. In terms of "Earnings per hour", stone businessmen differed significantly from other three categories. Stone businessmen earned on an average 1,060.80 Taka more than stone labourers, 1,034.02 Taka more than land sellers, and 1,083.23 Taka more than the general people.

8.2.4 Economic Impact of Underground Stone Collection

From the study it was also seen that before getting involved in stone collection, the economic condition of 11.7% respondents was very bad and for 25% respondents it was bad. Among the total sample, 87.7% respondents said that their income had increased after the start of stone collection and only 12.3% of the respondents said that their income had not increased after stone collection started. A major part of the respondents (40.8%) opined that they earned more working as stone collectors compared to other occupation. After the start of stone collection, it is clear from the respondents' views that the employment sector was developing. Almost all (99.4%) respondents opined that after the start of stone collection the scope for getting employed had increased. This opportunity for employment was not for any special class; rather it was for all—according to 97.8% respondents. Among the stone labourers, 48.4% were agriculture labourer before working as stone labourer, 36.6% of the stone labourers were not involved in income generating activities before getting involved in this work, and 4.6% of the stone labourers were rickshaw or van pullers. Among the businessmen, 41.7% were farmers before entering stone business, 35.7% were not involved in any other work and 11.0% of the respondents were involved in other businesses.

8.2.5 Social Problems due to Stone Collection

From the study findings it was found that a lion's share of the respondents (87.4%) opined that there was no collision or fighting in this area centering on stone collection and 12.6% respondents said that sometimes fighting and collision took place centering on

stone collection. It was also seen that 24% respondents disclosed that movements were organized in this area centering on stone collection among which there were *hartals* and strikes. In reply to the question whether the stone businessmen had to face extortion, 95.3% respondents answered in the negative. 95.9% respondents replied that there was no extortion in the stone transportation sector. Again, 99.2% of the respondents disclosed that there was no tendency of taking the land forcibly to collect stone, which means no huge problems arose here generally centering on stone collection.

8.2.6 Rights of the Stone Labourers

From the study findings, it was seen that a lion's share of the respondents (58.8%) could enjoy their rights as a labourer and 41.3% respondents said that they could enjoy their rights as a labourer. Among the respondent who could not enjoy their rights, 55.6% said that they were paid less, 20.6% of the respondents said that the owners dismissed them at their will without prior notice, and 17.5% said that they had to work for longer period of time.

A lion's share of the respondents (73.2%) said that they were not compensated at all in case of accident at work place and only 26.8% of the respondents said that the owners compensated them. There were no such organizations in this region to maintain the rights of the stone-workers. Among the respondents, 98.7% of the workers said that they were not members of any labour organization and only 1.3% workers said that they were members of labour organization. Responding to the question whether the workers were involved in any movement for their rights, a lion's share of the respondents (84%) said that they were not involved in any movement and only 16% of the respondents said that they were involved in movements.

8.2.7 Situation of Women and Child Labourers

From the study findings it was seen that a lion's share of the female respondents (82.8%) said that even though they worked as much as the male labourers they did not get equal payment and only 17.2% of the respondents said that they got the same payment as the male workers. Responding to the question whether the female workers were involved in any productive work before joining this work, 24.1% of the respondents said that they were involved in other productive works before joining here and 75.9% of the respondents said that they were not involved in any productive work prior to that. From the study findings it was also seen that a lion's share of the female respondents (41.4%) claimed that after entering this work their status in the family got a boost slightly, 48.3% of them said that their status in the family was uplifted and only 10.3% said that their status in the family did not change.

Among the child labourers, 62.5% of the respondents said that even though they worked the same as the adult workers, they did not get equal payment and 37.5% of the child labourers claimed that they got the same payment as the adult workers. Responding to the question why the children had joined this work, 75% of the respondents said that they joined this work to meet the needs of the family; and 25% of the respondents claimed that their parents made them join thus work. All the child labourers informed that they did not become victims of any oppression. Among them, 87.5% of the child labourers said that they were not forced to do any work, and 12.5% of the respondents said that sometimes they were forced to do some work.

8.2.8 Situation of Stone Businessmen

Among the stone businessmen a lion's share (75%) of the respondents said that their social status had changed due to engagement with stone business, 17.9% of the

respondents said that their social status had changed a little, and 4.85% of the respondents said that there was no change in their social status. Responding to the question whether the respondents were engaged in any business organization, a lion's share (52.4%) of the respondents said that they were members of different business organizations and 47.6% of the respondents said that they were not members of any business organization. Responding to the question whether they paid income tax, a lion's share (94%) of the respondents said that they did not pay any income tax and only 6.0% of the respondents said that they paid income tax.

8.2.9 Health Status and Healthcare Facilities in the Study Area

Among the respondents, 99.7% said that they were not infected by any special disease due to starting underground stone collection. But responding to the question whether those who were directly related with stone collection felt victims of any disease, 26.50% of the respondents said that workers engaged in stone collection fell victim to some special diseases and 73.50% the respondents said that they did not fell victim to any disease. Among those who replied in the affirmative, 35.7% of the respondents said that workers engaged in stone collection fell victims of Asthma, 34.5% of the respondents said that they were victims of Arthritis and 28.6% of the respondents said workers were victims of Silicosis. Responding to the question whether there were enough healthcare facilities in the study area, 61.8% of the respondents said that there was insufficient healthcare facility in the study area, and 38.2% of the respondents said that there were enough healthcare facilities in the area. It is therefore clear that there was inadequate healthcare facility in the study area after analyzing the data about whether the respondents went to the public hospitals for treatment; 3.2% took treatment in private clinics and 7.6% of the respondents said they did not get any treatment and bought medicines from

pharmacies themselves. It is also seen that 52.1% of the respondents said that they did not get enough nutritious food and 47.9% of the respondents said that they got enough nutritious food. Responding to the question whether the workers got any help from the employers when they were sick, 51.4% of the respondents said that the owners helped the workers if they became sick and 48.6% of the respondents said that the owners did not help the workers.

8.2.10 Changes in Different Sectors Due to Underground Stone Collection

Underground stone collection has brought about many changes in different sectors of the study area. From the study, it was seen that responding to the question whether the roads of this area had developed or not, 58% of the respondents said that the roads had developed, 37.5% of the respondents said that the roads had very much developed and only 2.8% of the respondents said that there was no development or degradation.

Analyzing the opinions relating to whether there was any change in the houses after starting underground stone collection, 64.7% of the respondents viewed that houses had developed, 33.1% of the respondents thought that the houses had very much developed and 1.50% of the respondents opined that houses were not developed at all.

From the study findings, it was observed that 63.7% respondents had opined that after starting underground stone collection in this region, the opportunity of business had expanded, 33.8% opined that the opportunity of business had very much expanded and only 2.5% thought that the opportunity of business had remained the same.

On whether the rate of education had changed after starting underground stone collection, 56.80% respondents viewed that the rate had increased, 38.50% opined that the rate had very much increased and 2.2% held the view that there was no connection between the rate of education and stone collection.

Among the respondents 50.2% thought that the treatment facilities had developed, 16.7% opined that the treatment facilities had very much improved and 20.5% thought that the treatment facilities had remained unchanged. On whether social organization increased after starting underground stone collection, a lion's share of the respondents (56.5%) opined that the number of social organizations had increased, 22.7% viewed that the number had very much increased and 19.20% thought that the number had remained the same.

From the study, it was seen that a major proportion of the respondents (36.3%) thought that child labour had decreased in the study area, 32.80% opined that it had rather increased. These respondents opined that because of the opportunity of becoming a worker in stone collection, a large number of children were working as labourers.

Inauguration of underground stone collection created working opportunity not only for the males but also for the females. Among the respondents, 65% opined that the scope for women's employment had increased after stone collection was introduced. 32.2% thought that the scope had increased very much. According to the categories of respondents, it is seen that 69.3% stone labourers, 67.9% stone businessmen, 43.3% land sellers and 60% general people held the view that the scope of work for females had increased.

Due to underground stone collection, peoples' standard of living had improved very much. Among the respondents, 69.4% said that the quality of lifestyle had increased, 25.2% informed that the lifestyle had increased very much, and 3.50% thought that the lifestyle had remained unchanged. Among the stone labourers, 71.90% opined that due to stone collection the lifestyle had improved, and according to 20.30% lifestyle had very much improved.

It is also seen that a major proportion (38.80%) of the respondents of the study area thought that the cases of quarrels and conflicts had remained unchanged. Again, 20.50%

opined that the number of quarrels and conflicts had increased, whereas 27.40% held the view that the number had decreased.

As a result of stone collection, the number of unemployed people in the study area lessened and the scope for employment had increased for all. Among the respondents, 55.5% thought that unemployment had decreased, 25.6% opined that it had very much decreased and 14.20% held the view that the rate of unemployment had increased.

Though the underground stone collection was playing role in lessening the unemployment problem, it was playing a negative role in the agricultural sector of this area. A lion's share of the respondents (60.90%) thought that agricultural production had decreased due to start of underground stone collection, 9.50% opined that agricultural production had very much decreased, and 7.90% held the view that production remained unchanged.

8.2.11 Impact of Underground Stone Collection on Different Categories of People

As a result of underground stone collection, all the people were not equally benefitted or aggrieved. Some got a lot of profit, some were hampered and some were hugely aggrieved. Among the respondents, 60.3% believed that the stone labourers were getting more profit as a result of stone collection, 26.2% thought that the stone labourers were benefitted a little and 13.6% claimed that the stone labourers were hugely benefited. It is noteworthy that no respondents considered stone collection as harmful in any way for the labourers. Among the total respondents 54.3% respondents thought that the businessmen were benefitted because of stone collection, 34.4% thought that the businessmen were getting much profit. Whereas according to 11%, they were getting little benefit and only 0.3% thought that the stone businessmen were aggrieved.

A major part of the respondents (47.9%) thought that land owners were benefitted, 25.2% thought that land owners were benefitted a little. 20.5% thought that it had turned into a much profitable business for the land owners and only 4.1% thought that the land owners were aggrieved. That means majority of the respondents did not think that land owners were facing huge troubles as a result of underground stone collection.

It was also observed from the study, a lion's share of the respondents (63.7%) opined that the local administration was not being benefitted nor faced loss due to underground stone collection. Among the respondents, 19.9% thought that the local administration was getting little benefit, whereas 12.9% opined that the local administration were very much benefitted due to underground stone collection. A lion's share of the respondents (68.8%) thought that the political leaders were getting neither benefit nor facing loss. But 19.2% respondents opined that the political leaders were getting little benefit, whereas 9.8% believed that they were very much benefitted.

A major segment of the respondents (45.1%) thought that the general people were getting neither benefit nor facing loss. But 29.3% respondents viewed that the general people were benefitted a little and 14.2% opined that the general people were very much befitted. According to them, though the general people were not directly benefitted by stone collection, but the expansion of the business sector because of underground stone collection brought benefits for the general people.

8.2.12 Environmental Impact of Underground Stone Collection

The huge impact of surface mining on the topography, vegetation, and water resources has observed. From the study, it was seen that among the total respondents, 38.2% said that soil composition was being damaged due to underground stone collection, 34.4% said

that landslide was occurring as a result of this, 14.2% respondents said that soil fertility of land is decreasing and 10.7% said that there was no impact of underground stone collection on soil. Among all the environmental effects of stone collection, the most deadly impact was, in most cases were damaged soil composition and the lands becoming uncultivable after stone collection.

Underground stone collection influences hydrologic systems in ways that cause changes to both water quality and quantity. To know the hydrologic impact of underground stone collection, the researcher asked the respondents what kind of impact was observed on water. Responding to the question, most of the respondents (51.4%) said the layer of underground water was getting lower, 19.95% of the respondents said that no impact was seen on water. Responding to the question on what sort of impact was observed on natural disasters, 22% among the total respondents said natural disasters have increased and 44.8% of the respondents said that natural disasters had not increased or decreased. Among the stone labourers 45.1% thought that natural disaster did not increase or decrease due to underground stone collection.

In the study area, the researcher observed that underground stone was collected from scrublands. To know the opinion regarding the issue, the researcher asked the respondents what kind of impact was visible on trees. Responding to it, 48.9% respondents said that the number of tree was decreasing, 33.1% of the respondents said that the amount of forest was decreasing and 18% of the respondents said that there was no impact of underground stone collection on trees.

Views gathered from respondents in the study area revealed that loss of grazing land vegetation had been the most important negative effects of underground stone collection, and for those reasons the number of different species of animal was declining. Responding

to the question if was there any impact on the animals of this area 15.1% of the total respondents opined that the number of animals of different species were being lessened, 66.9% of the respondents thought that the number of domestic animals were reduced and 18% of the respondents opined that there was no impact of underground stone collection on animal biodiversity. The key informants of the study also opined that because of collecting underground stone, forest land, as well as grazing lands were being reduced; as a result the numbers of animals and domestic animals were being reduced. Responding to the question on the impacts made on water-bodies, 79.2% of the total respondents said that the number of water-bodies were increasing, 15.85% of the respondents said the number of water-bodies remained the same. Responding to the question if there was any impact on air due to stone collection, 50.5% of the total respondents viewed that the air was being polluted, 13.2% thought that the air was not being polluted and 36.3% of the respondents opined that they had no idea about this. Most of the respondents claimed that while collecting underground stone, machines were used in removing water and crushing stone; trucks were engaged in transporting the stones and the dust which was produced while crushing the stones got mixed with air and polluted it.

8.2.13 Degree of Impact on Environment

The researcher categorized the opinion of the respondents in terms of degree. Fertility of land is reduced because of stone collection. Stone is collected by making a hole after removing the upper layer of soil; so the fertility of the soil is reduced and the land becomes unfit for plantation. Responding to the question on the impact observed on land fertility, 12.3% of the respondents said that underground stone collection was very much responsible for loss of soil fertility, 13.2% claimed that it was a little bit responsible, 67.7% said much, and only 2.5% said that it was not responsible for loss of soil fertility. Due to underground stone collection from river banks or adjacent areas, people of this

locality became victims of river erosion during the rainy season. Among the respondents 49.2% thought that stone collection was a little bit responsible for river erosion whereas 27.1% termed it as one of the main reasons. Here, it is noteworthy that 50% of the land sellers held stone collection responsible for river erosion. Floods occurred due to river erosion and for this reason some respondents held stone collection responsible for flood. Among the total respondents 24.3% believed that stone collection was very much responsible for flood, 33.1% thought that it was a little bit responsible, whereas 21.1% believed that its responsibility was too little. It was noteworthy that 14.20% respondents did not believe stone collection was at all responsible for flood in the study area. It was seen that among the stone labourers 4.6% blamed stone collection for flood very much, 30.1% much, 31.4% a little and 15% blamed it very little.

In the study area, stone was being collected not only from the cultivable land but also from the bushes. For this reason, stone collection had a linkage with deforestation. Among the total respondents, 47.3% believed that because of the lessening of forests, stone collection was very much responsible, 22% opined that it was a little bit responsible, 12.3% respondents claimed that it was very little responsible and 6.30% viewed that it was very much responsible.

Sound pollution was also predominant in communities that were close to mining areas, and the surrounding communities of Panchagarh district did not escape from this environmental problem. Analyzing the opinion of the respondents, it was observed that 9.80% respondents believed that because of stone collection sound pollution was taking place in this area on a large scale, 28.40% thought that sound pollution was taking place, 13.6% opined that sound pollution was taking place on a very minimal scale, 12% claimed that there was no sound pollution and the rest 16.70% opined that they had no idea about it.

8.2.14 Underground Stone Collection and Potentials of Natural Disaster

From the time when stone was being collected manually, stone had been collected from a huge expanse of land and as the soil was not filled up properly, holes were created which made the land uncultivable. Among the respondents, 91.8% thought that because of stone collection by this method, the amount of cultivable land started to lessen and just 8.2% opined that the area of cultivable land had not lessened. Though after collecting stone, the land becomes unsuitable for cultivation, 84.2% respondents were in favor of stone collection than cultivating land, as it was more profitable and just 15.8% considered cultivating land as more profitable.

The rivers and riversides of the study area were also being affected because of stone collection. Already stone was collected from the rivers and riverside areas of Tetulia upazilla. As a result of stone collection from the riverside area, when the respondents were asked on whether river erosion, floods and various problems had been created, 68.8% respondents opined that there was no problem because of this; 31.2% believed that the problem was created due to stone collection.

8.2.15 Condition of Land after Underground Stone Collection

Among the respondents who sold their land in the last five years, 64.7% respondents informed that they had sold cultivable land for stone collection, 31.4% sold their uncultivable land, 1% sold their living land and 1% bushes. Among the respondents, 98% opined that the lands they sold for stone collection had become unfit for cultivation. Among these lands, 45.8% lands became uncultivable because they become too low, 29.2% because of turning uneven and 25% because they become too sandy and were not capable of preserving water. That means, the land became uneven because of stone collection and lost the ability of preserving water for which agricultural production was hampered.

The study revealed that on an average the land sellers sold 49.19 decimals land for stone collection. The highest price of the sold land during last five years was Taka 30000 per decimal and the lowest was Taka 1500. It is noteworthy that the price value of land per decimal depended on the depth of the stone layer under soil and the thickness of stone layer. From the study, it was seen that the cultivable land sold for collecting stone could produce crops valued at 380.29 taka per year before stone collection. It was also seen that after collecting stone 98% land turned into uncultivable. It means that though the land sellers were selling their land for instant profit, in the long run they were not getting much profit.

8.2.16 Peoples' Perception Regarding Underground Stone Collection

In the study area, though some of the respondents indicated erosion, landscape, destruction and biodiversity loss, as the major negative environmental impacts, majority of the indicated positive impacts of mining like infrastructural development including roads and housing and providing employment to mine workers, as well as providing income for landowners. From the study findings, it was seen that among the respondents, 91.8% opined that because of underground stone collection, the amount of cultivable land had started to lessen and just 8.2% thought that the amount of cultivable land had not lessened. Though the land becomes unsuitable for cultivation after collecting stone, 84.2% respondents were in favour of stone collection than cultivating land, as it was more profitable and just 15.8% viewed cultivating land as more profitable. In response to the question, whether natural disaster had increased after starting underground stone collection, 75.7% respondents opined that natural disaster had not increased but the lion's share of the respondent (65.6%) opined that if this condition continued, natural disaster could be occur in future. That means, though the people of the study area had not yet faced any major natural disaster, they feared facing major risk in future.

8.2.17 Perception Regarding Development

It was found from the study that a lion's share of the respondents (78.9%) thought that by taking initiatives and government control, highest utilization of this stone resource is possible. For that reason, the government should take initiatives and maintain as well as utilize rules in this area. At present, stones are collected at own will of the businessmen in this area from the cultivable land, bushes and homestead which is a great threat to the natural environment and ecological system of this area. And for this reason, 52.4% respondents did not support stone collection in this way; the rest of (47.6%) respondents were in favour of this mode of stone collection. But 85.2% of the respondents thought that a lot of development could be achieved in economic and social sectors using the stone resources of this area.

8.2.18 Land Use Policies, Regulations and Enforcement in the Study Area

It was found that stone was collected from all stone mines or stone quarry through personal initiatives in the district of Panchagarh. The stone businessmen collected processed and sold stones individually. Stone was not collected through government management. The stone businessmen collected stones according to their own will through private management. Generally, they did not take government permission for collecting underground stone. From the study findings, it was observed that 95.2% stone businessmen did not take any permission from the government officials and only 4.8% stone businessmen take government permission.

8.2.19 Payment of Tax for Stone Collection

As the stone collectors did not take government permission for collecting stones, they follow the same trend while paying revenue to the government. From the study findings it was seen that 97.62% stone businessmen (people involved in stone collection and stone dealing) does not pay any tax to the government. Whereas only 2.38% stone businessmen pay their taxes. It is clear from the above statistics that the government was not getting the

amount of revenue it is supposed to obtain from this area. But if proper steps were taken the government could earn a huge amount of revenue which could improve the economy.

8.2.20 Causes of Not Getting Revenue

Opinions were taken from the respondents to explore whether the government was getting its due revenue. The respondents identified various reasons for non-submission of revenue. A lion's share of the respondents (51.2%) considered lack of government rules as the main reason for which the government was unable to collect revenue. Among the respondents, 11.1% identified negligence of the administration and according to 30.0% the mischievous tendency stone businessmen was deprived the government from getting revenue.

8.2.21 Cognizance of Rules and Regulations

Though it was not legal to collect underground stone indiscriminately, stone was collected without any hindrance in front of the local administration in Panchagarh. Among the respondents 98.7% said that the local administration did not stop or create any hindrance in collecting underground stone. That means, no one had to face any problem from the administration while collecting underground stone. From the study findings it was also seen that 77.6% respondents were aware and conscious about the rules and regulations on the collection, exploration and use of mineral resources, whereas 22.4% respondents had no idea. Among those who had awareness of this law, 93.5% respondents knew that no rules and regulations were maintained for stone collection and the rest 6.5% respondents opined that the regulations were maintained.

8.2.22 Opportunity of Work in Stone Sector

In Panchagarh district, stone is collected by digging soil. Here, the workers can't work during the rainy season. So, they have to either remain without work or to work in other sectors. Analyzing the respondents' data, it was seen that the respondents got stone-related work for 5.82 months annually on an average. Among the stone labourers, 89.5%

of the respondents did not have work the whole year and among the businessmen 92.9% of the respondents did not have dealings the whole year. So they had to stay unemployed for a certain period of time (4-8 months). A lion's share of the stone labourers (65%) got work for 4-6 months in a year, 18.2% of the labourer got work for 6-8 months, rest of the time they did not get any work. Among the businessmen, 60.3% of the respondents could do this business for 4-6 months, 15.4% could do this work for 6-8 months and for the rest of the time they sat idle or did other works.

Among workers who did not get work the whole year, a lion's share of them (65.7%) work as labourer in agriculture sector and 19.7% of the labourers remained unemployed. On the other hand, among the businessmen, 44.9% of them were involved in agricultural work, 20.5% were involved in other businesses and 29.5% did not do any work. Therefore, respondents of all class had to remain unemployed for a certain period of time or they were forced to do other works.

8.3 Recommendations and Policy Implications

1. Collecting stone from cultivable and fertile lands must be stopped and stone must only be collected from those lands where crops do not grow well or those which are not suitable for cultivation (See: Table 5.4).

2. At present, the land from where the stones are being collected gets damaged due to the method applied in collecting underground stone. To make sure that the lands do not get damaged, the lands have to be covered when open mining method is followed and while covering sticky and fertile soil must be put on the upper layer of the land. Through this, cultivation will be again possible in the land. If stone is collected by covering land like this, at the end there will be holes in some of the lands; the holes should not be kept unused, fish farming can be done by rather turning it into a pond and the whole land will get back its productivity after stone collection.

3. On those uncultivable lands from where stone is collected, trees must be planted after stone collection. The number trees in this area will then be increased.

4. The stone labourers of this area can work for 5-6 months on an average in a year and for the rest of the time many of them have to remain unemployed; so stone-based industry can be built here so that the labourers can work during the idle period. By using stone and cheap sand of this area, electric-pillar making factory, house making pillar, building making blocks, cement factory etc. could be built, which could generate employment opportunities in this area as well as play an enhanced role in the national economy (See: Table 6.7).

5. At present there is no interference of the Government on the manner stone is being collected in the district of Panchagarh. In this regard, supervision of the Government has to be increased not only to ensure the right use of mineral resources but also to make sure that the Government earns revenue from it (See: Table 6.4 and Table 6.5).

6. Through close inspection of the Government, the amount of stored stones of this area and the potentials of this sector should be calculated.

7. Stone collected by destroying forest and from rivers and river bank areas increases the possibility for natural calamities; for this reason, stone collection from the rivers and river bank areas have to be stopped. Here the government needs to take strict measures (See: Table 7.2).

8. To break stone, many stone crushing machines are built in disorderly fashion at various places of this area. Not only this, machines create a lot of noise and produce a lot of dust, which pollutes the environment by mixing with air. For this reason, a particular place should be fixed for this instead of building stone crushing machines everywhere. Through this, people will be saved from sound and air pollution (See: Table 7.2).

9. In the study area there was no fixed structure of wage for the stone labourers. In addition, the researcher observed wide disparity among the child, female and male labourers. For this reason a definite salary structure should be developed following the subsistence theory of wages (See: Table 4.18 and Table 4.22).

10. Huge number of child labourers is seen working in stone collection. But appointing child labourers in these kinds of work is very risky. The government has to take necessary steps so that the child labourers are not appointed to this work.

11. In the stone quarries, a disease called silicosis is seen mostly among those who collect stone from the lower part of the soil. For this reason, water proof gloves in hands and legs must be provided to those who collect stone from the lower part of the soil, so that the workers remain healthy (See: Table 4.26).

12. Existence of all mineral resource is limited. So a certain level of control should be maintained in the sector of stone collection. Stone should be collected only according to necessity. Excess collection and reckless use must be prevented.

13. Underground stone of this area is collected under individual management, from which the government does not get any tax. The government only leases out the collected stone at a very low price and this is taken by district stone-sand dealers association, usually they take a particular percentage of toll from each truck. As a result the government is losing a huge amount of tax from the stone resource of this area. The government should therefore take necessary steps to collect tax from the stone resources (See: Table 6.5).

14. Before collecting stone from the land, taking permission from the government or the local administration should be made mandatory and a written obligation should be provided pledging that the land will be filled perfectly after collecting underground stone (See: Table 6.3).

15. A part of the profits earned from stone collection and stone business should be used in developing the environment of this area.

16. Environmental agencies which have the responsibilities of prescribing standards and guidelines to prevent all forms of environmental damage including those due to sand and gravel in the study area should develop and strengthen binding and enforceable standards and specifications for effective regulation of underground stone collection. This should be done in consultation and harmonization with all relevant stakeholders in the mining sector as well as various district and municipal authorities (participatory approach).

17. An Integrated Environmental Assessment, Management and Monitoring program should be a part of any stone extraction operation, and this should implemented at national, regional, district, and local levels. Assessment is used to predict possible environmental impacts and encourage public participation at the decision level, whereas management is used to implement plans to prevent or minimize negative impacts. A mitigation and restoration strategy should also be included in any management program. Monitoring must be done to determine if the assessments were correct, detect environmental changes, and support management decisions.

18. More intensive research work should be carried out on the environmental impact of underground stone collection in this area. For this reason, more authentic and scientific research should be conducted where the inclusion of geologists is required.

8.4 Conclusion

From the findings of the study, it was revealed that besides creating job opportunities and positive socio-economic changes, underground stone collection practices had already caused ecological impacts in the study area. These problems included land degradation, damage to water, loss of productive farmlands, destruction of landscape and land beauty,

spread of diseases and harm to wildlife and biodiversity. Unfortunately, the government, the NGOs and the local people showed totally indifferent views towards these issues and they are not taking any initiative to address the potential environmental threats. Again, it was also found that existing laws and regulations were also not enforced in the study area while collecting underground stones. But the regulatory authorities for land use policy and mineral resource management are very reluctant to take necessary initiatives to ensure optimum use of this resource. Comprehensive measures are required to minimize environmental threats, ensure sustainable development and bring about more economic development.

Bibliography

Books

Abbott, Patrick. *Natural Disasters.* New York: McGraw-Hill Higher Education, 2002.

Abedin, M. Zainul. *A Handbook of Research*. Dhaka: Book Syndicate, 2005.

Ahmed, M. Feroze, Saleh A Tanvir and A. B. M. Badruzzaman, eds. *Bangladesh Environment 2002,* vol 1 and 2. Dhaka: BAPA, 2002.

Ahuja, Ram. *Research Methods.* Jaipur: Rawat Publications, 2002.

Barker, Robert. L. *The Social Work Dictionary*. 5th ed. Washington DC: NASW, 2003.

Bhattacharya, Dipen. et al. eds. *Climate Change and Tasks for Bangladesh.* Dhaka: BAPA, 2009.

Blodgett, M.S. Steve, P. E. James and R. Kuipers, *Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impact.* Bozeman: Center for Science in Public Participation, 2002.

Bloor, Michael. et al. *Focus Groups in Social Research*. London: SAGE Publications, 2001.

Chowdhury, Quamrul Islam. Ed. *Bangladesh State of Environment Report 2001.* Dhaka: Forum of Environmental Journalists of Bangladesh (FEJB), 2002.

Crabtree, Benjamin. F. and Miller I. William. *Doing Qualitative Research*. California: Sage Publications Inc., 1999.

Craig, James. R. and Lerroy P. Metze. *Methods of Psychological Research*. California: Brooks Publishing Company, Monterey, 1986.

Economic and Social Commission for Asia and the Pacific United Nations. *Handbook on Community Awareness Programmes Concerning Disability.* New York: ESCAP, 1989.

Elaine, Enarson. *Gender and Natural Disasters.* Geneva: Recovery and Reconstruction Department, 2000.

Gupta, Achintya Das. *The Qualitative Approach to Social Research*. Dhaka: Worldview International Foundation, 1989.

Hamid, Md. Abdul. *Factors in Environmental Degradation Due to Technological Interventions.* Comilla: Bangladesh Academy for Rural Development, 2004.

Haque, Nazmul. *History and Folklore of Panchagar*. Dhaka: Bangla Academy, 1999.

Islam, M. Aminul. *Environment, Land Use and Natural Hazards in Bangladesh.* Dhaka: University of Dhaka, 1995.

Islam, M. Nurul. *Towards Sustainable Development: Energy and Mineral Resources of Bangladesh.* Dhaka: National Conservation Strategy of Bangladesh, Ministry of Environment and Forest, 1990.

Islam, Sirajul. ed. *Banglapedia: National Encyclopedia of Bangladesh.* Dhaka: Asiatic Society of Bangladesh, 2012.

Kabir, M. M., B.C. Saha and J. M. A. Hye. *Cyclonic Strom Surge Modelling for Design of Costal Polder.* Dhaka: Institute of Water Modelling, 2007.

Karim, Z. and M Anwar Iqbal eds. *Impact of Land Degradation in Bangladesh: Changing Scenarioin Agricultural Land Use*, Dhaka: Soils Division, Bangladesh Agricultural Research Council, 2001.

Khan, F. H. *Geology of Bangladesh.* Dhaka: The University Press Ltd. 2001.

Khuda, Zinatunnessa R.M.M. *Environmental Degradation: Challenges of the 21st Century.* Dhaka: Environmental Survey and Resource Unit, 2001.

Klein, Naomi. *The shock Doctrine: The Rise of Disaster Capitalism*. New York: Metropolitan Books, Henry Holt and Company, 2008.

Kothari, C. R. *Research Methodology: Methods & Techniques*. 2nd ed. New Age International Publishers, New Delhi, 2006.

Langer, William H. *Potential Environmental Impacts of Quarrying Stone in Karst—A Literature Review.* USA: U.S. Department of the Interior, 2001.

Lees, Ray. *Research Strategies for Social Welfare*. London: Routledge & Kegan Paul, 1975.

Marshall, Catherine and Gretchen B. Rossman. *Designing qualitative research.* Newbury Park: SAGE Publications, 1995.

Mirza, M. Monirul Qader and Paul, Subrata. Prakritic Durjog O' Bangladesher Poribesh, Dhaka: Centar for Environmental Studies and Research, 1992.

Musah, Jafaru Adam. *Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining – A Case Study of East Gonja District (Ghana) and Gunnarsholt (Iceland).* Ghana: Environmental Protection Agency, 2009.

Polansky, Norman A. ed. *Social Work Research*. Chicago: The University of Chicago Press, 1966.

Rahman, A. Atiq. et al. eds. *Environment and Development in Bangladesh.* Vol. 1 and 2, Dhaka: University Press Limited, 1994.

Rasheed, K. B. sajjadur. *Bangladesh Resource and Environmental Profile.* Dhaka: A. H. Development Publishing House, 2008.

Rouf, Quazi Abdur, and Shekh Mohammad Ilias. *Poribasik Abakhay O Biparjoy Babosthapana*. Dhaka: Shujonesu Prokashani, 2008.

Rychlak, Ronald J. and David W. Case. *Environmental Law: Oceana's Legal Almanac Series*. New York: Oxford University Press. 2010.

Saxena, H.M., Environmental Geography, New Delhi: Rawat Publications, 2004.

Sethi, Manmohan Singh, and Inderjeet Kaur Sethi. *Understanding Our Environment.* New Delhi: Commonwealth Publishers, 1991.

Sharma, P. D. *Ecology and Environment*. New Delhi: Rastogi Publications, 2007.

Singh, Sivindra, *Environmental Geography.* Allahabad: Prayag Pustak Bhaban, 1997.

Slade, Carole. *Form and Style: Research Papers, Reports, Theses*. New York: Houghton Mifflin Company, 1997.

Turabian, Kate L. *A Manual for Writers of Research Papers, Theses, and Dissertations.* Chicago: The University of Chicago Press, 2007.

United Nations Development Program. *Reducing Risk of Natural Disasters: A Development Challenge*. New York: Bureau for Crisis Prevention and Recovery, 2004.

Vaus, D. A. De. *Surveys in Social Research*. Jaipur: Rawat Publications, 2003.

Warhurst, A. *Environmental Degradation from Mining and Mineral Processing in Developing Countries: Corporate Responses and National Policies*. Paris: Development Centre, OECD, 1994.

William, P. Cunningham and Barbara Woodworth Saigo. *Environmental Science*. 5th ed. New York: McGraw-Hill Companies, 1999.

Wisner, B. et al. *At Risk: Natural Hazards, People's Vulnerability, and Disasters*. London and New York: Rutledge, 2007.

Young, Pauline. V. *Scientific Surveys and Research,* New Delhi: Prentice Hall of India Pvt. Ltd., 1977.

Articles/Journals

Ahmed, M. Feroze. "Environment and Sustainable Development: A Conceptual Model." In *Bangladesh Environment 2002,* edited by M. Feroze Ahmed, Saleh A Tanvir and A. B. M. Badruzzaman, 1048-1061. Dhaka: BAPA, 2002.

Ahmed, Mahiuddin and M. Reazuddin. "State of Land Degradation in Bangladesh." *Bangladesh State of Environment Report 2001,* edited by Quamrul Islam Chowdhury, 257-264. Dhaka: Forum of Environmental Journalists of Bangladesh (FEJB), 2002.

Akhtar, Afia. “Coal and hard rock resources in Bangladesh,” *Geological Survey of Bangladesh* 23, no. 1 (March 2000): 25-28.

Alam, Md. Ashraful, K. M. Rezaul Karim and Pervez Sazzad Cowdhury. "The Role of Civil Society to Control the Environmental Degradation in Bangladesh." In *Bangladesh Environment 2002,* edited by M. Feroze Ahmed, Saleh A Tanvir and A. B. M. Badruzzaman, 17-25. Dhaka: BAPA, 2002.

Ali, Md. Omar and Mahiuddin Ahmed. "Bio-diversity conservation: Vision for Bangladesh." *Bangladesh State of Environment Report 2001,* edited by Quamrul Islam Chowdhury, 166-184. Dhaka: Forum of Environmental Journalists of Bangladesh (FEJB), 2002.

Brent, Alan C. and Sibbele Hietkamp. “The Impact of Mineral Resource Depletion.” *International Journal of Life Cycle* 11, no: 5 (2006). http://researchspace.csir.co.za /dspace/handle/10204/1957 (accessed September 21, 2011).

Canon, T. "Vulnerability Analysis and the Explanation of 'Natural' Disasters." *Disasters, Environment and Development*, edited by A. Varley. London: John Wiley & Sons, (1994).

Gray, William M. “Global view of the Origin of Tropical Disturbances and Storms.” *American Metrological Society Journals* 96, no. 10 (October 1968).

Hasan, M. K. and A. K. M. Ashraful Alam. “Land Degradation Situation in Bangladesh and Role of Agroforestry.” *Journal of Agriculture & Rural Development 4,*no.1 (2006): 19-25.

Heath, M.J., J. R. Merefield, & A. G. Paithankar. “Environmental Impact of Mining on Tropical Forest.” *Mining Environmental Management 37*, (1993).

Hitzschky, K. & J. Silviera. “A proposed impact assessment method for genetically modified plants (As-GMP method).” *Environmental Impact Assessment review 29*, no.6 (2009): 348-358.

Hossain, Monirul Alam. "Corporate Environmental Disclosure in Developing Countries: Evidence from Bangladesh." In *Bangladesh Environment 2002,* edited by M. Feroze Ahmed, Saleh A Tanvir and A. B. M. Badruzzaman, 1077-1089. Dhaka: BAPA, 2002.

Hunter, Lori M. "Migration and Environmental Hazards." *Population and Environment* 26, no. 4 (March 2005).

Islam, M. Aminul and Howard Kunreuther. “The Challenge of Long Term Recovery from Natural Disaster - Implications for Bangladesh.” *The Oriental Geographer* 27, no. 2, (1973): 51-62.

Islam, M. Aminul. "Linking bio-diversity with poverty alleviation." edited by Quamrul Islam Chowdhury, 147-150. Dhaka: Forum of Environmental Journalists of Bangladesh (FEJB), 2002.

Islam, Nazrul. “Income-Environment Relationship: How Different in Asia.” *Asian Development Review* 15, no. 1 (1997).

Khan, Habibur Rahman. “Environment and Sustainable Development in Bangladesh.” *BIISS Journal* 17, no. 2 (1996).

Khan, M.A. et al. “Prospects of Sweet (Citrus sinensis) and Mandarian (Citrus reticulata) Orange Cultavitation at Panchagarh District of Bangladesh.” *Pakistan Journal of Biological Sciences* 4, no.12 (2001).

Khan, Mizan R. "Convention on Biological Diversity: An analytical Overview." edited by Quamrul Islam Chowdhury, 185-191. Dhaka: Forum of Environmental Journalists of Bangladesh (FEJB), 2002.

Khan, Murad. et al. “Effects of Stone Dust Exposure on Some Liver and Kidney Related Serum Parameters of Stone Crush Plant Workers.” *Journal of Biology and Life Science* 3, no. 1 (2012).

Nasreen, Mahbuba and Khondoker Mokaddem Hossain. "Environment and Sustainable Development: Bangladesh Perspective." In *Bangladesh Environment 2002,* edited by M. Feroze Ahmed, Saleh A Tanvir and A. B. M. Badruzzaman, 1122-1136. Dhaka: BAPA, 2002.

Peche, R. & E. Rodriguez, “Environmental impact assessment procedure: A new approach based on Fuzzy logic.” *Environmental Impact Assessment Review* 29, no.5 (2009).

Peckenham J.M., T. Thornton & B. Whalen. “Sand and gravel mining: effects on ground water resources in Hancock County, Maine, USA.” *Environmental Geology* 56, no.6. (2009). http://link.springer.com/article/10.1007%2Fs00254-008-1210-7 [accessed May 3, 2013].

Ray, Mohit K., "Strategic Environmental Assessment-A Management Tool for Developing Countries." In *Bangladesh Environment 2002,* edited by M. Feroze Ahmed, Saleh A Tanvir and A. B. M. Badruzzaman, 1137-1143. Dhaka: BAPA, 2002.

Reazuddin. M. and Mahiuddin Ahmed. “State of Land Degradation in Bangladesh.” edited by Quamrul Islam Chowdhury, 257-264. Dhaka: Forum of Environmental Journalists of Bangladesh (FEJB), 2002.

Saviour, M. Naveen. “Environmental Impact of Soil And Sand Mining: A Review.” *International Journal of Science, Environment and Technology* 1, no. 3 (2012).

Udin, M. J. et al. “Study on Some Soils of the Himalayan Piedmont Plain of Bangladesh.” *Journal of the Asiatic Society of Bangladesh, Science* 38, vol. 2 (December 2012): 199-206.

Ullah, Mahbub. “Economy and Environment”, in *Bangladesh Environment Outlook 2001*, edited by Ainun Nishat, Mahfuz Ullah and A. K. Enamul Haque Dhaka: Centre for Sustainable Development, 2001.

Dissertations/Thesis

Greenberg, C. “Adaptation Process of Riverbank Erosion Displaces n an Urban Environment: A Case Study of Squatters of Sirajgonj, Bangladesh.” Masters Thesis. Department of Geography, University of Manitoba, 1986.

Kamruzzaman, Md. “Climate Modeling, Drought Risk Assessment and Adaptation Strategies in the Western Part of Bangladesh.” PhD Diss., University of Rajshahi, 2014.

Khalil, Md. Ibrahim. “Coping Strategies of the Cyclone-affected Farmers in Costal Areas of Bangladesh: Indigenous Practices and Institutional Mechanisms.” PhD Diss., University of Rajshahi, 2012.

Mahmud-Ul-Ala. “Cultural and Environmental Dynamics of Poverty in Bangladesh: A Study of Joypurhat District.” PhD Diss., University of Rajshahi, 2011.

Moral, Md. Jahan Boksh. “Agro-ecology, Foodgrain Production and Poverty in North-West Bangladesh.” MPhil Thesis. University of Rajshahi, 2004.

Islam, M. Zulfiquar Ali. “Environmental Adaptation and Survival Strategies of the Riverbank Erosion Displaces in Bangladesh: A Study of Two Villages in Nawabgonj District.” PhD Diss., University of Rajshahi, 1995.

Rashid, A. N. M. Bazlur. “Socio-environmental Rearrangement of the Riverbank Erosion Displaces in Bangladesh: A Study on Rajshahi and Chapai Nawabganj Districts.” PhD Diss., University of Rajshahi, 2009.

Razzaque, Mohd.Abdur. “Social Values and Perceptions towards the Disabled in Bangladesh: A Study on Barisal City.” PhD Diss., University of Rajshahi, 2012.

Sarker, Md. Al Mamun. “Natural Disaster in Coastal Zone of Bangladesh: The Case of the Differently-Abled People.” PhD Diss., University of Rajshahi, 2014.

Yeboah, Joseph Yaw. “Environmental and Health Impact of Mining on Surrounding Communities: A Case Study of Anglogold Ashanti in Obuasi.” Masters Thesis. Kwame Nkrumah University of Science and Technology, 2008.

Reports & Documents

A Global Report Reducing Disaster Risk: A Challenge for Development; UNDP, 2004.

Bangladesh Bureau of Statistics, *Population Census 2012.* Dhaka: BBS, 2012.

Bangladesh Bureau of Statistics, *Statistical Pocketbook of Bangladesh 2006.* Dhaka: BBS, 2007.

Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh 2011.* Dhaka: BBS, 2012.

Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh 2007.* Dhaka: BBS, 2008.

CEGIS for CDMP under the study on *Inventory of Community Risk Reduction Programme.* November, Dhaka: 2006.

Centre for Disability and Development. *A Brief Report from Bangladesh: National Dialogue on Disaster and Persons with Disabilities.Dhaka.* Dhaka:CCD, 2009.

Disaster Report, Bangladesh Disaster Preparedness Forum, Dhaka, bngladesh, 1997.

Disaster Report, Bangladesh Disaster Preparedness Forum, Dhaka, bngladesh, 2000.

Governments of the People's Republic of Bangladesh, *Bangladesh Climate Change Strategy and Action Plan 2009.* Dhaka: Ministry of Environment and Forests, 2009.

Homes Destroyed by Cyclone Aila and Associated Flooding. Dhaka: Unnayan Onneshan, May 2009.

Impact Assuagement of Climate Change on the Coastal zone of Bangladesh. Water Resource Planning Organization (WARPO), Dhaka,2005.

Intergovernmental Panel on Climate Change Report 2001.

Maunuddin, *et al.*, *Stakeholders' Information Needs for Planning and Management of Natural Resources in the CHT.* Dhaka: CHARMP Project, 2007.

Ministry of Finance, *Bangladesh Economic Review 2010*. GOB: Finance Division, Ministry of Finance, 2010.

Ministry of Finance, *Bangladesh Economic Review 2011*. GOB: Finance Division, Ministry of Finance, 2011.

Ministry of Finance, *Bangladesh Economic Review 2012*. GOB: Finance Division, Ministry of Finance, 2012.

Mohanty, Reena. "Disaster Preparedness and Mitigation of the Disabled of Jagatsinghpur District Pilot Survey Status Report." *Shanta Memorial Rehabilitation Centre Bhubaneswar in Collaboration with School of Women's Studies*. Utkal University: 2005.

Musah, Jafaru Adam. *Assessment of Sociological and Ecological Impacts of Sand and Gravel Mining – A Case Study of East Gonja District (Ghana) and Gunnarsholt (Iceland).* Environmental Protection Agency, Tamale, Ghana, 2009.

Principle of Environmental Impact Assessment Best Practice. International Association for Impact Assessment, 1999.

Proceedings of ICBEN-2002, *Environment Under Threat: Save Bangladesh*. Dhaka: Bangladesh Poribesh Andolon, 2002.

Sear, D.A. & Archer, D.R. *The effects of gravel extraction on the stability of gravelbed rivers: A case study from the Wooler Water, Northumberland.* U.K. 1998.

Steve Blodgett, M.S. and James R. Kuipers, P.E., *Technical Report on Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impacts.* Center for Science in Public Participation, Bozeman, 2002.

The Daily Ittefaq, October 22, 2009.

UNDP/UNDRO Disaster Management Manual, May 1991.

United Nations, World Disaster Report, 2007.

United Nations, World Disaster Report, 2010.

Welhan, J. *Ground-water interactions near the highway pond gravel pit*, *Pocatello*, *Idaho*. Staff Report 01-3. Moscow: Idaho Geological Survey, 2001.

Related Websites (Retrieved During January, 2009-December 2014)

http://dfid.gov.uk

http://uncwil.edu/stuaff/SDS/disterm.html

http://www. banglajol.info

http://www. geology.gsapubs.org/content/26/8/715.full.pdf

http://www.etd.lib.ttu.edu/theses/.../31295001104776.pdf

http://www.iaia.org

http://www.macrothink.org

http://www.ncd.gov.newsroom.publications/2006/hurricanes_impact.htm

http://www.redcross.org/

http://www.researchgate.net

http://www.researchspace.csir.co.

http://www.scialert.net

http://www.socialworkers.org/pubs/encyclopedia

http://www.ucp.org/ucp_channel/doc.

http://www.un.org/esa/agenda21/natlinfo/countr/iceland/natur.htm#land.

http://www.who.int/classifications/icf/en/

http://www.wikipedia.org/wiki/Triangulation_(social_science)

http://www.wikipedia//Environmental impact assessment

http://www.wikipedia//Social impact assessment

http://www.worldbank.org/mining.xls.

Appendices

Appendix-1
Questionnaire Schedule

Group:

Questionnaire Schedule

Institute of Bangladesh Studies, University of Rajshahi, Rajshahi

Title of the Study: Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh	Village:	Schedule No.			
	Union:	Name of the Interviewer:			
	Thana:				
	Date:				

(Data of this questionnaire schedule will be used only for academic purpose. Privacy will be maintained strictly)

i. Personal and Family Data

1. Please tell about your family: [Keep the respondent in number 1, Identify the head of the family with a circle mark.]

Serial No.	The name of the family members(those who share same meal)	Gen-der		Relation with the respon dent	Age		Academic Qualification	Marital Status					Occupation and monthly Income						Total monthly Income
													Occupation						
		Male	Female		Year	Month		Unmarried	Married	Widow/widow-er	Divorced	Separated	Main Occupation	Daily Working Hour	Income from the main occupation	Other occupation	Daily working hour	Income from other occupation	

Total monthly income of the family =

ii. Data about Socio-economic Condition

1. What is the type of your house?

① *Pucca* ② Semi-*Pucca* ③ Tin/wooden made ④ Bamboo/Straw fence

2. The house you live in-

① Own ② Own but mande in other's land ③ Live in *khas* land ④ Rented House

a. If it is rented, then the monthly rent is..... Taka

3. How many rooms do you have in your house? .....

4. Your Latrine is- ① *Kancha* ② Water celled ③ Sanitary ④ No latrine

5. What is the source of your drinking water? ① Tube-well ② Pond ③ River ④ Supply ⑤ Well

6. Do you have any electricity connection? ① No ② Yes

7. Are you a permanent resident of this area ① No ② Yes

➢ If no, then what is your permanent address? Village .....Thana.....District.....

9. Please tell about your cattle's and other productive possessions.

Name	Cows	Goats	Ducks/Hens	Rickshaw/Van	Truck/ Trolley	Stone Crushing Machine	Machine (uses for stone collection)	Land (in decimal)
Quantity								
Approximate Price								

10. Please tell about your movable and immovable properties:

Property	TV	Radio	CD/DVD Player	Cycle	Motor cycle	Private car	Bed	Dressing table	Chair	Sofa	Refrigerator
Number											

11. What is your monthly family expenditure? ..... Taka

12. How does your family go with your income? ① Remain surplus ② No Surplus no deficit ③ There is some deficit

➢ If there is any deficit, how do you make it up? (Multiple answers are possible)

① Thirsting ② Government help ③ Help from NGOs ④ Help from relatives ⑤ Taking Loan

13. Is there any savings of your family? ① No ② yes

➢ If Yes, then where; and how much?

① Cash..... Taka

② In a bank ..... taka ③ N.G.O./Association .....Taka

④ Where else ..... how much? ..... Taka

14. Is there any debt of your family? ① No ② yes

➢ If Yes, then where; and how much?

① Relatives/ Neighbors .....Taka, percentage of interest.....%

② N.G.O/Association ..... Taka, percentage of interest.....%

③ Bank ..... …….. Taka, percentage of interest.....%

④ Shop ..... Taka, percentage of interest.....%

⑤ Somewhere else? .....Taka, percentage of interest.....%

15. Do you get enough opportunity of recreation? ① No ② yes

iii. Socio - economic Impact of Underground Stone Collection

1. Are you directly involved in stone collection or stone Business? ① No ② yes

➢ If the answer is yes,

a. for how long ..... Years

b. What did you do before getting involved with this? .....

c. What was the condition of your family then? ① Very bad ② Bad ③ On average ④ Better than average ⑤ Well run ⑥ Like present

2. Has your income increased after the starting of stone collection? ① No ② Yes

➢ If no, then why?.....

➢ If Yes, then how? .....

3. Does our work continue for all the year long? ① No ② Yes

a. If it is not, then how long does it continue? .....

➢What do you do in the rest of the time? .....

4. Do all the children of your family between the ages 6-18 go to school regularly? ① No ② Yes ③ Not applicable

5. Has the employment opportunity increased after the starting of stone collection? ① No ② Yes

➢ If yes, which class do they belong?

① Male labourer ② Female labourer ③ Both for the male and female

➢ If the answer is no, then who are facing the unemployment problem?

① Agricultural labourer ② Rickshaw-van puller ③ Local business man ④ Other (Specify).....

6. According to you, who are being benefitted and who are being harmed?

Relevant Individual or organization	Very much benefitted	Benefitted	A little bit benefitted	A little bit harmed	Harmed	Very much harmed	No benefit no harm
Stone Labourer							
Stone businessman							
Land owner							
Local Administration							
Political leader							
General people							

7. Is there any problem centering stone collection in this area? ① No ② Yes

➢ If yes, then

a.what type of problem is there?

① Dacoity ② Teriorrism ③ Extortion ④ Owning other's land by force ⑤ Others (Specify).....

b. Who are responsible for these problems?

① Labourer ② Land owner ③ Local Terrorist ④ Local administration ⑤ Outsiders ⑥ Political Leaders ⑦ Stone businessman ⑧ Others…….....

8. Has any major violence happened in this area centering stone collection? ① No ② Yes

➢ If yes, then how often does it happen?

① 2-4 each month ② 1 per month ③ 1 after six months on average ④ Annually one ⑤ One in every 2-4 years

9. Is there any movement centering stone collection? ① No ② Yes

➢ If yes, then what type of problem?

① Strike ②Withdrawal from work ③ Others .....

10. Is there any extortion happening in the transportation sector? ① No ② Yes

11. Do the businessmen need to give any extortion in this area? ① No ② Yes

12. Is the stone collected from other's or *khas* land by force? ① No ② Yes

13. Is the land owner made bound to sell the land for stone collection if s/he is not willing to sell the land? ① No ② Yes

iv. Data on Labourer and Labor Welfare (Only for the Stone Labourers)

1. Can you enjoy all the facilities as a stone labourer you are supposed to have? ① No ② Yes

➢ If no, then, a)Which rights you are deprived of?

① Has to work for a long time ② Insufficient wage ③ Wages are not given properly ④ They dismiss the workers according to their will ⑤ Absence of leave ⑥ Others (Specify).....

2. Do any kind of accident happen during collecting underground stone? ① No ② Yes

➢ If yes, a) What type of accident…….....

b) Do the worker get any help from the employer? ① No ② Yes

3. Are you member of any labour organization? ① No ② Yes

➢ If yes, then what is the name of the organization? .....

4. Do you participate any movement for your rights? ① No ② Yes

➢ If yes, what is the rate of success? ① Fully successful ② Partially successful ③ Failed

♯ If the respondent is female

5. Do you get the same wage like a male labourer? ① No ② Yes

➢ If not, what is the amount of the fewer wage daily? ..... Taka

6. Because of working as a stone labourer, your position in the society has ① Developed ② Little bit developed ③ Deteriorated ④ Remained unchanged.

7. Were you involved in any kind of earning occupation before joining this work? ① No ② Yes

➢ If yes, then what type of work? .....

8. Your status after being involved in the occupation of stone labourer has ① Developed ② Little bit developed ③ Deteriorated ④ Remained unchanged.

9. Do you have any child under the age of 8? ① No ② Yes

➢ If yes, then who looks after them when you are in work place? ①Husband ② Father/mother in laws ③ Maid servant ④ Relatives ⑤ Other children ⑥ None

10. Do you oppress in your work place? ① No ② Yes

➢ If yes, then of what type? ① Physical ② Mental ③ Both physical and mental

11. Do you think that the underground stone collection has opened a new gate of immense possibility for the female workers? ① No ② Yes

♯ If the respondent is under the age of 16

12. Do you get wage like other labourers? ① No ② Yes

➢ If not, then what is the amount you get less or much? ..... Taka

13. Why have you come to this occupation giving up your studies?

① To meet up the necessities of the family ② Disliking for study ③ Scope of getting a good amount of money working as stone labourers ④ Made bound by the parents ⑤ Others .....

14. Do you become the victim of any violence in your work place? ① No ② Yes

➢ If the answer is yes, then of what type? ① Physical ② Mental ③ Both physical and mental

15. Are you compelled to do any risky work? ① No ② Yes

➢ If yes, then of what type? .....

♯ **If the respondent is stone businessman**

16. What is the amount of money you have invested in this business? ..... Taka

17. How many labourers work under you daily on average? ..... Person

18. Your condition after getting involved in stone business has ① Developed ② Little bit developed ③ Deteriorated ④ Remained unchanged.

19. Are you a member of any business organisation? ① No ② Yes

20. Do you pay income tax to the govt. annually? ① No ② Yes

➢ If the answer is yes, then what is the amount annualy? ..... Taka

v. Health and Health Care Facilities

1. Has any special kind of disease outbroken after the starting of collecting underhround stone? ① No ② Yes

➢ If yes, then of what type?.....

2. Are the stone labourers being affected with any special disease because of collecting stone? ① No ② Yes

➢ If the answer is yes, then what type.....

3. Is there sufficient medical facilities in this area? ① No ② Yes

4. Where do you go for treatment when you/ your family members become sick? ① Kabiraji ② Homeo ③Jhar-Fuk④ Buy medicine from the store ⑤ Meeting the quack ⑥ Go to hospital ⑦ Go to private clinic ⑧ No medication

5. Do you think that the members of your family get proper and nutritious food? ① No ② Yes

➢ If no, then why? ① Price hike ② Low income

6. Do the businessmen take any initiatives if the workers become sick during their work? ① No ② Yes

vi. Environmental Impact of the Underground Stone Collection

1. What type of changes have taken place in the physical environment because of collecting underground stone in this area?

Subject	Impact
1. On the soil	① Increasing soil erosion ② Land slide ③ Lessening the fertility of the Land ④ Lack of the capacity of preserving water ⑤ Destruction of soil composition ⑥ No Impact
2. On water	① Lowering down the level of water ② Lack of drinking water ③ Contamination of water ④ No impact
3. On the local weather	① Increasing temperature ② Decreasing rain fall ③ Increasing dryness ④ No Impact
4. Natural disaster	① Increased ② Lessened ③ Remained unchanged If it is increased, then of what type.....
5. On trees	① Lessening the number of trees ② Lessening forest lands ③ Remained unchanged
6. Bio-diversity	① Extinction of different animals ② Lessening the number of cattle's ③ No Impact
7. Water-bodies	① Increasing the number of water bodies ② Lessening the number of water bodies ③ Has decreased the capacity of containing water ④ Remained unchanged
8. On air	① Air is being polluted ② Not polluted③ No Idea

2. According to you how much the underground stone collection is liable for following environmental problems?

Types of problem	Degree of impact					No Comment
	Too much	Much	A little	Very Little	Not Liable	
Lack of the fertility of the land						
River erosion						
Flood						
Natural disaster						
Deforestation						
Sound pollution						

3. Applying which method stone is being collected in the study area? ① By digging soil manually ② Using dredging machine

4. Which method do you support? ① By digging soil manually ② Using dredging machine

➢ If you support the manual method, then why? ① Wide scope of work for the labourers ② Low chance of soil erosion ③ Environment friendly ④ Others .....

➢ If you support dredging method, then why? ① Less expense ② No chance of destruction soil fertility ③ Effective for alltime ④ Stone can be collected from the deppest area ⑤ Too much profitable ⑥ Others .....

5. Do you think that the amount of arable land is decreasing because of underground stone collection? ① No ② Yes

6. Have you sold any of your land in the last five years? ① No ② Yes

a. If the answer is yes, then what is the amount of land? .....

b. What was the highest price for every decimal? ..... Taka

c. What was the lowest price for every decimal……..... Taka

d. What have you done by that money you got selling the land?.....

e. What was the type of the land ① Arable ② Not-arable ③ Homestead ④ Bushes

➢ If it is arable, what was your production annually per decimal? .....Taka

f. Can you cultivate the land now? ① No ② Yes

➢ If the answer is no, why? ① The land has turned into wholes ② The land has become uneven ③ The land has lost its capacity of holding water ④ The soil of the land has become unsuitable for cultivation ⑤ Others (specify) .....

g. Which one do you think more profitable and why? ① Crops cultivation ② Stone collection

➢ Why…….....

7. Is there any kind of problem being created because of collecting underground stone from the river or river-side areas? ① No ② Yes

➢ If the answer is yes, what type of problem?

① Flood ② Depth of the river is lessening ③ Rivers are filling up ④ River erosion ⑤ Others .....

8. Have the natural disasters increased than the previous time? ① No ② Yes

9. Do you think that collecting stone in this way can bring natural disasters in this area? ① No ② Yes

vii. Changes happened in the study area after beginning underground stone collection

1. What were the changes happened in the study area after beginning underground stone collection?

Subject	Type of Change	If it is improved or undeveloped, then why?
1. Roads	① Improved a lot ② Improved ③ Deteriorated ④ Deteriorated a lot ⑤ No change	
2. Houses	① Developed a lot ② Developed ③ Deteriorated ④ Deteriorated a lot ⑤ No change	
3. Market and *hat-bazar*	① Developed a lot ② Developed ③ Decreased ④ Decreased a lot ⑤ No change	
4.Education facility	① Developed a lot ② Developed a little ③ Decreased ④ Decreased a lot ⑤ No change	
5. Healthcare facility	① Developed a lot ② Developed ③ Decreased ④ Decreased a lot ⑤ No change	
6. Social organization	① Increased a lot ② Increased ③ Decreased ④ Decreased a lot ⑤ No change	
7. Child Labour	① Increased a lot ② Increased ③ Decreased ④ Decreased a lot ⑤ No change	
8. Employment of the women	① Increased a lot ② Increased ③ Decreased ④ Decreased a lot ⑤ No change	
9. Terrorism	① Increased a lot ② Increased ③ Decreased ④ Decreased a lot ⑤ No change	
10. Overall lifestyle	① Improved a lot ② Improved ③ Deteriorated ④ Deteriorated a lot ③ No change	
11. Clashes	① Increased a lot ② Increased ③ Decreased ④ Decreased a lot ③ No change	
12. Unemployment	① Decreased a lot ② Decreased ③ Increased ④ Increased a lot③ No change	
13. Agricultural Production	① Increased a lot ② Increased ③ Declined ④ Become ineffective ⑤ No change	

viii. Government Policy and Peoples' Perception

1. Stone is being collected in this area— ① Through government management ② Through private management ③ Both government and private management

2. Is any kind of tax paid to the government for collecting stone? ① No ② Yes

➢ If the answer is yes, what is the rate? .....

3. Do you think that the government is earning proper revenue from this sector? ① No ② Yes

➢ If the answer is no, then why? ① Lack of government regulations ② Indifference of the administration ③ Corruption of the businessmen ④ Taking bribes of the authoritative personnel ⑤ Others .....

4. Do you think that it is possible to bring out the best possible outcome of the stone resource through government initiatives? ① No ② Yes

5. Do you take permission from the government authority for collecting underground stone? ① No ② Yes

6. Does the local administration create any hindrance in collecting underground stone? ① No ② Yes

7. Is it legal to collect underground stone? ① No ② Yes

➢ If it is not, how the stone is collected? ① By giving bribe to the local administration ② By not letting the administration know about this ③ With the help local leaders ④ By other means (specify) .....

8. Do you know the rules and regulations of government for collecting underground resources? ① No ② Yes

➢ If yes, are the rules and regulations maintained here? ① No ② Yes

9. Do you think that rules and regulations needed for collecting underground stones in this area? ① No ② Yes

10. Is extensive development possible through collecting underground stones in this area? ① No ② Yes

➢ If the answer is yes, then how?

i) By building up stone based industries

ii) By collecting stones at a minimum level and ensuring the proper use of it.

iii) By investing the money in others sector earned from selling the stones

iv) Others (Specify)…….....

11. Do you support collecting underground stones extensively without environmental consideration? ① No ② Yes

12. How can development achieve in economic and social sector by using underground stone minimizing environmental harm?

…….....
.....
.....

Thanks a lot for your cooperation.

Appendix-2
Observation Report

[Fill in the box observing the areas from where you have collected data]

Serial No.	Area of Observation	Findings
1.	Number of trees in the area	(1) Very low (2) low (3) As usual (4) High (5) Very High
2.	Is the land become uneven due to underground stone collection?	(1) No (2) Yes
3.	Is cultivation possible now if it is cultivable land?	(1) No (2) Yes
4.	Condition of top soil after stone collection	(1) Damaged (2) Sandy (3) Appropriate (4) Has been developed
5.	Number of water bodies in the area?	(1) More than necessary (2) Appropriate (3) Very low
6.	Is stone being collected damaging the forests and bushes?	(1) No (2) Yes
7.	Communication system of the area is?	(1) Very Good (2) Good (3) Average (4) Bad (5) Very Bad
8.	Has any of the river or canals been affected because of stone collection?	(1) No (2) Yes
9.	Is any machines been used liable for environmental pollution or air pollution, sound pollution?	(1) No (2) Yes

Appendix-3
Questionnaire Schedule (For Key Informants)

Institute of Bangladesh Studies, University of Rajshahi, Rajshahi.

Title of the study: Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh	Village:	Schedule No.			
	Union:	Name of the Interviewer:			
	Thana:				
	Date:				

[Data of this questionnaire schedule will be used for only academic purpose. Privacy will be maintained always.]

[For the interview of the elected members of local government, non-government organizations, government officers.]

1. From how long ago stone collection has been started in this area commercially?
2. How was the socio-economic condition of the people before starting stone collection?
3. Has lifestyle of the inhabitants of this area developed?
   (a) If it is, then what kind of development?
   (b) If it is not, then why?
4. Has any kind of problem created in the social life of the people in this area?
   (a) If it is, then in which type?
5. Is the environment of this area being damaged because of underground stone collection?
6. Does there go any possibility of facing any natural disaster due to underground stone collection in this area?
   (a) If it is, then what type of?
7. Is there any organizational attempt in this area to solve the environmental problems created due to underground stone collection?
   (a) If there is, then what are the names of the organization and their activities?
8. Does there have any chance of development through underground stone collection?
   (a) If it is possible, then how?
9. Are there any government initiatives to ensure proper use of underground stone from the area?
   (a) If there is, then what type of initiatives do they have?
   (b) If there is none, then what is the reason according to you?

Name of the Respondent:
Occupation:
Address:

Appendix-4
Questionnaire Schedule (In Bengali)

M“ct

mv¶vrKvi AbmwP

Bbw÷wUDU Ae evsjv‡`k ÷vwWR, ivRkvnx wekwe`¨vjq, ivRkvnx|

M‡elYv wk‡ivbvgt Socio-economic and Environmental impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh	Mvgt	AbmwP bs			
	BDwbqbt	mv¶vrKvi MnYKvixi bvgt			
	Dc‡Rjvt				
	ZwiLt				

[GB ckgvjvi Z_¨vejx ïagvÎ GKv‡WwgK M‡elYvi Kv‡R e¨envi Kiv n‡e Ges Z‡_¨i †MvcbxqZv i¶v Kiv n‡e]

i. e¨w³MZ I cwievwiK Z_¨vejx

1. AbMnceK Avcbvi cwievi m¤‡Ü ejb: [DËi`vZv‡K 1bs µwg‡K ivLb, cwievi cavb‡K eË wPwýZ Ki“b]

µwgK bs	cwievi‡ii m`m¨e‡›`i bvg (hv‡`i Lvbv GK mv‡_)	wj½		DËi`vZvi mv‡_ m¤úK	eqm		wk¶vMZ †hvM¨Zv	‰eewnK Ae¯v					†ckv Ges gvwmK Avq						†gvU gvwmK Avq
													†ckv						
		ci“l	gwnjv		eQi	gvm		AweewnZ	weewnZ	weaev/wecZœxK	ZvjvK cÖvß	c_K	cavb †ckv	^`wbK KZ NÈv mgq w`‡Z nq	cavb †ckv †_‡K Avq	Ab¨ †ckv	^`wbK KZ NÈv mgq w`‡Z nq	Ab¨ †ckv †_‡K Avq	

cwievv‡ii †gvU gvwmK Avq=

ii. Av_©mvgvwRK Ae¯v msµvšÍ Z_¨vejx

1. Avcbvi evm¯v‡bi aiY wK?
① cvKv wewìs ② AvavcvKv ③ wUb/Kv‡Vi †eov ④ evk/Q‡bi †eov
2. Avcwb †h ewo‡Z _v‡Kb †mwUÑ
① wb‡Ri ewo ② A‡b¨i Rwg‡Z Ni K‡i _wK ③ Lvm Rwg‡Z _wK ④ fvovi ewo
K. hw` fvovi ewo nq, Z‡e gvwmK fvov .... UvKv
3. Avcbvi ewo‡Z _vKvi Ni Av‡Q KqwU? .... wU
4. Avcbvi j¨wUb Ñ ① KvPv ② Rjve× ③ m¨vwbUvix ④ j¨vwUb †bB
5. Avcbvi Lvevi cvwbi Drm wK? ① wUDe‡qj ② cKi ③ b`x ④ mvcøvB ⑤ Kc
6. Avcbvi evox‡Z we`¨r ms‡hvM Av‡Q wK? ① bv ② n¨v
7. Avcwb wK GB GjvKvi ¯vqx evwm›`v? ① bv ② n¨v

8. hw` bv nq, Zvn‡j ¯vqx wVKvbv wK? Mvg ..... Dc‡Rjv ..... †Rjv .....

9. AbMn ceK Avcbvi ewoi c`icwL I Ab¨vb¨ Drcv`bgLx DcKiY m¤ú‡K ejbt

DcKiY	Mi“	QvMj	nvm/giwM	wi·v/f¨vb	UvK/Uwj	cv_i fv½v †gwkb	cv_i D‡Ëvj‡b e¨eüZ †gwkb	Rwg (kZK)
msL¨v								
Avbgwb bK gj¨								

10. AbMn ceK Avcbvi cwiev‡ii ¯vei/A¯vei m¤úwË m¤ú‡K ejbt

m¤úwË	wUwf	‡iwWI	wmwW/wWwfwW †cqvi	mvB‡Kj	‡gvUi mvB‡Kj	cvB‡fU Kvi	LvU	‡Wwms †Uwej	‡Pqvi	‡mvdv	wdR
msL¨v											

11. Avcbvi cwiev‡ii Mo gwmK msmvi LiP KZ? ..... UvKv

12. me wgwj‡q Avcbvi hv Avq nq Zv w`‡q †Kgb P‡j? ① DØË _v‡K ② †L‡q c‡i P‡j hvq ③ NvUwZ c‡i

K) hw` NvUwZ c‡i, Z‡e ciY K‡ib wK fv‡e? (GKwaK DËi m¤e)

① bv †L‡q ② miKvix mvnvh¨ ③ Gb.wR.I mvnvh¨ ④ AvZ¥‡qi mvnvh¨ ⑤ avi †`bv K‡i|

13. Avcbvi cwiev‡ii wK †Kvb mÂq Av‡Q? ① †bB ② Av‡Q

K) hw` _v‡K, †Kv_vq KZ UvKv? ① bM` Kv‡Q ..... UvKv

② e¨vs‡K ..... UvKv ③ Gb.wR.I./mwgwZ‡Z ..... UvKv

④ Ab¨ †Kv_vq ..... KZ? ..... UvKv

14. eZgv‡b Avcbvi cwiev‡ii †Kv_vI †Kvb FY Av‡Q wK? ① bv ② n¨v

➢ hw` n¨v nq Z‡e, †Kv_vq, KZ UvKv?

❒ AvZ¥q/cwZ‡ekx i Kv‡Q ..... UvKv, m‡`i nvi .....%

❒ GbwRI/mwgwZ‡Z ..... UvKv, m‡`i nvi .....%

❒ e¨vs‡K ..... UvKv, m‡`i nvi .....%

❒ †`vKv‡b ..... UvKv, m‡`i nvi.....%

❒ Ab¨ †Kv_vI? ..... UvKv, m‡`i nvi .....%

15. Avcwb chvß wPË we‡bv`‡bi m‡hvM cvb wK? ① bv ② n¨v

iii. fMf¯ cv_i D‡Ëvj‡bi Av_Ñmvgwa RK cfve

1. Avcwb cv_i D‡Ëvjb ev cv_i e¨emvi mv‡_ mivmwi RwoZ wK bv? ① bv ② n¨v

➢ DËi n¨v n‡j,

K. KZ w`b hver .....

L. Gi mv‡_ RwoZ nevi c‡e wK Ki‡Zb? .....

M. ZLb Avcbvi msmvi †Kgb Pj‡Zv? ① Le Lvivc ② Lvivc ③ †gvUvgwU P‡j †hZ ④ fvjB PjZ ⑤ Le fvj Pj‡Zv ⑥ GKB iKg

2. cv_i D‡Ëvjb ï‘i“ nevi d‡j Avcbvi Avq ew× †c‡q‡Q wK? ① bv ② n¨v

K. hw` bv n‡q _v‡K Z‡e †Kb nqwb? .....

.....

L. hw` DËi n¨v nq, Z‡e wK fv‡e? .....

.....

3. Avcbvi KvRwU wK mviv eQi nq? ① bv ② n¨v

K. DËi bv n‡j, Kq gvm nq ....., evKx mgq wK K‡ib .....?

4. Avcbvi cwiev‡ii 6-18 eQi eqmx mKj †Q‡j †g‡q wbqwgZ ¯‹‡j hvq wK? ① bv ② n¨v ③ c‡hvR¨ bq

5. cv_i D‡Ëvjb ïi“ nevi ci wK Avcbvi GjvKvi gvb‡li Kgms¯v‡bi m‡hvM e¨× †c‡q‡Q? ① bv ② n¨v

➢ hw` n¨v nq, Z‡e †Kvb †kYxi †jv‡Ki?

① ci“l kwgK‡`i ② bvix kwgK‡`i ③ ci“l-bvix Df‡qiB

L. hw` bv nq, Z‡e Kv‡`i Kgms¯v‡bi Afve †`Lv w`‡q‡Q?

① Kwl kwgK‡`i ② wi·v-f¨vb PvjK‡`i ③ ¯vbxq e¨emvqx‡`i ④ Ab¨vb¨ .....

6. Avcbvi g‡Z f-Mf¯ cv_i D‡Ëvj‡bi d‡j Kviv jvfevb Ges Kviv ¶wZM¯ n‡"Q?

msweké e¨w³ ev cwZôvb	A‡bK jvfevb	jvfevb	wKQUv jvfevb	wKQUv ¶wZM¯	¶wZM¯	A‡bK ¶wZM¯	jvf ¶wZ wKQB †bB
cv_i kwgK							
cv_i e¨emvqx							
Rwgi gwjK							
¯vbxq ckvmb							
ivR‰bwZK †bZe›`							
mvaviY RbMY							

7. cv_i D‡Ëvjb‡K †K›` K‡i GB BDwbq‡b †Kvb mgm¨v Av‡Q wK? ① bv ② n¨v

➢ hw` n¨v nq, Z‡e wK ai‡Yi?

① WvKwiZ ② mšvm ③ Pv`vewR ④ Rwg `Lj ⑤ Ab¨vb¨ (wbw`ó Ki“b) .....

L) GB mgm¨v¸wj mwói †cQ‡b `vqx †K ev Kviv?

① kwgK ② Rwgi gwjK ③ ¯vbxq mšvmx ④ ¯vbxq ckvmb ⑤ ewnivMZ mšvmx ⑥ ivR‰bwZK †bZe›` ⑦ cv_i e¨emvqx ⑧ Ab¨vb¨.....

8. cv_i D‡Ëvjb‡K †K›` K‡i GB AÂ‡j †Kvb eo ai‡Yi gvivgvwi mwó nq wK? ① bv ② n¨v

K. n‡q _vK‡j †mUv KZUv Nb Nb?

① cwZ gv‡m 2-4Uv ② cwZ gv‡m 1Uv ③ Qq gv‡m 1Uv ④ eQ‡i 1Uv ⑤ 2-4 eQ‡i GKUv

9. cv_i D‡Ëvjb‡K †K›` K‡i GLv‡b †Kvb Av‡›`vjb nq wK? ① bv ② n¨v

K. n¨v n‡j †Kvb ai‡Yi?

① niZvj/Ae‡iva ② Kg wei wZ ③ Ab¨vb¨ .....

10. GB AÂ‡j cwienb †m±‡i †Kvb Pv`vewR nq wK? ① bv ② n¨v

11.GB AÂ‡j e¨emvqx‡`i wK †Kvb Pv`v w`‡Z nq? ① bv ② n¨v

12. GB AÂ‡ji Lvm I miKvix Rwg †_‡K wK †Rvi K‡i cv_i D‡Ëvjb Kiv nq? ① bv ② n¨v

13. ‡Kvb Rwgi gwjK cv_i D‡Ëvj‡bi Rb¨ Rwg we¡µ Ki‡Z bv PvB‡j Zv‡K Rwg we¡µ Ki‡Z eva¨ Kiv nq wK? ① bv ② n¨v

iv. kwgK I kgKj¨vY msµvš Z_¨vejxt (ïa cv_i kwgK‡`i Rb¨)

1. Avcbviv kwgK wn‡m‡e Avcbv‡`i me AwaKvi †fvM Ki‡Z cv‡ib wK? ① bv ② n¨v

➢ DËi hw` bv nq Z‡e, K) †Kvb †Kvb AwaKvi †_‡K ewÂZ?

① †ewk mgq a‡i KvR Ki‡Z nq ② gRwi Kg †`q ③ KvR K‡i wVKgZ UvKv cvBbv ④ hLb B"Qv ZLb KvR †_‡K ev` †`q ⑤ QwU cvB bv ⑥ Ab¨vb¨.....

2. cv_i D‡Ëvjb ev cwµqvRvZKi‡Yi mgq wK †Kvb ai‡Yi `NUbv N‡U? ① bv ② n¨v

K. n¨v n‡j, wK ai‡Yi .....

L. `NUbvi wkKvi kwgK‡K wK †Kvb ai‡Yi ¶wZciY †`qv nq? ① bv ② n¨v

3. Avcbviv wK †Kvb kwgK msMV‡bi m`m¨? ① bv ② n¨v

DËi n¨v n‡j, †Kvb msMVb? .....

4. Avcbviv wK Avcbv‡`i `we-`vIqv Av`v‡qi Rb¨ †Kvb Av‡›`vjb msMVg K‡ib? ① bv ② n¨v

➢ DËi n¨v n‡j, Avcbv‡`i Av‡›`vj‡b mdjZv KZUK? ① c‡ivcwi mdj ② wKQUv mdj ③ e¨_

❒ DËi `vZv hw` gwnjv kwgK nq

5. Avcwb wK ci"l kwgK‡`i gZ GKB gRwi cvb? ① bv ② n¨v

➢ hw` bv cvb, ^`wbK KZ UvKv Kg cvb ev †ewk cvb? ..... UvKv

6. cv_i kwgK wn‡m‡e KvR Kivi Kvi‡Y mgv‡R Avcbvi Ae¯v‡bi Ñ ① DbœZ n‡q‡Q ② wKQUv DbœZ n‡q‡Q ③ AebœZ n‡q‡Q ④ AcwiewZZ i‡q‡Q|

7. cv_i kwgK wn‡m‡e KvR ïi"i Av‡M Avcwb wK †Kvb DcvRbgjK Kv‡Ri mv‡_ RwoZ wQ‡jb? ① bv ② n¨v

➢ hw` n¨v nq, Z‡e wK KvR? .....

8. cv_i D‡Ëvj‡bi Kv‡R h³ nevi ci Avcbvi Ae¯v‡biÑ ① DbœZ n‡q‡Q ② wKQUv DbœZ n‡q‡Q ③ AebœZ n‡q‡Q ④ AcwiewZZ i‡q‡Q|

9. Avcbvi wK 8 eQ‡ii wb‡P †Kvb ev"Pv Av‡Q? ① bv ② n¨v ➢ hw` n¨v nq, Z‡e Avcwb hLb evB‡i KvR K‡ib ZLb Zvi †`Lv‡kvbv †K K‡i? ①¯vgx ② kï‡i kvïox ③ Kv‡Ri †g‡q ④ AvZ¥q ⑤ Ab¨ †Q‡j †g‡q ⑥ †KD bv|

10. Kg †¶‡Î wK Avcwb †Kvb ai‡Yi wbhvZ‡bi wkKvi nb? ① bv ② n¨v

n¨v n‡j wK ai‡YiÑ ① kvixwiK ② gvbwmK ③ kvixwiK I gvbwmK Dfq ai‡Yi|

11. Avcwb wK g‡b K‡ib fMf¯ cv_i D‡Ëvjb G AÂ‡ji gwnjv kwgK‡`i m¤vebvi bZb GKwU `qvi L‡j w`‡q‡Q? ① bv ② n¨v

❒ DËi `vZvi eqm hw` 16 eQ‡ii wb‡P nq

12. Avcwb wK Ab¨ kwgK‡`i gZ GKB gRwi cvb? ① bv ② n¨v

➢ hw` bv †c‡q _v‡Kb Z‡e ^`wbK KZ UvKv Kg ev †ewk cvb? ..... UvKv

13. Avcwb covïbv bv K‡i G Kv‡R †Kb Avm‡jb?

① msmv‡i Afve †gUv‡Z ② cov‡kvbv fvj jv‡M bv ③ cv_i kwgK wn‡m‡e KvR Ki‡j A‡bK UvKv cvlqv hvq

④ evev gv eva¨ K‡i‡Q ⑤ Ab¨vb¨ .....

14. GLv‡b KvR Ki‡Z G‡m Avcwb wK †Kvb wbhvZ‡bi wkKvi nb? ① bv ② n¨v

➢ DËi n¨v n‡j wK ai‡Yi? ① kvixwiK ② gvbwmK ③ kvixwiK I gvbwmK Dfq ai‡Yi|

15. Avcbv‡`i Øviv wK †Kvb SwKcY KvR Kiv‡bv nq? ① bv ② n¨v

➢ hw` n¨v nq, Z‡e wK ai‡Yi? .....

❒ DËi `vZv hw` cv_i e¨emvqx nq

16. Avcwb GB e¨emvq KZ UvKv wewb‡qvM K‡i‡Qb? ..... UvKv

17. Avcbvi Aax‡b M‡o ^`wbK KZRb kwgK KvR K‡i| ..... Rb

18. cv_i e¨emvi mv‡_ RwoZ nevi ci Avcbvi Ae¯v‡biÑ ① DbœZ n‡q‡Q ② wKQUv DbœZ n‡q‡Q ③ AebœZ n‡q‡Q ④ AcwiewZZ i‡q‡Q|

19. Avcwb wK †Kvb e¨emvqx msMV‡bi m`m¨? ① bv ② n¨v

20. Avcwb wK miKvi‡K BbKvg U¨v· c`vb K‡ib? ① bv ② n¨v

DËi n¨v n‡j, evrmwiK KZ UvKv? ..... UvKv

v. ¯v¯¨ mµvš Z_¨vejx

1. cv_i D‡Ëvjb ïi" nlqvi ci GB AÂ‡j wK †Kvb we‡kl †iv‡Mi cv`fve ew× †c‡q‡Q? ① bv ② n¨v

DËi n¨v n‡j, wK ai‡Yi .....

2. cv_i kwgKiv wK cv_i D‡Ëvjb ev cv_i fv½vi KvR Kivi Kvi‡Y †Kvb we‡kl ai‡Yi †iv‡Mi wkKvi nq? ① bv ② n¨v

DËi n¨v n‡j, †Kvb ai‡Yi.....

3. GB AÂ‡j ¯v¯¨ †mevi chvß m‡hvM mwea Av‡Q wK? ① bv ② n¨v

4. Avcbv‡`i AmL n‡j wK/†Kv_vq wPwKrmv MnY K‡ib? ① Kwei wR ② †nwgI ③ SvoÑdK ④ wb‡RB †`vKvb †_‡K Jla wK‡b LvB ⑤ Mvg¨ Wv³vi †`LvB ⑥ nvmcvZv‡j hvB ⑦ cvB‡fU wKwb‡K hvB ⑧ †Kvb wPwKrmv †bB bv

5. Avcwb wK g‡b K‡ib Avcbvi cwiev‡ii m`m¨iv chvß cwóKi Lvevi †L‡Z cvb? ① bv ② n¨v

➢ hw` bv nq, †Kb? ① D"P `e¨ gj¨ ② Avq Kg

6. kwgKiv KgiZ Ae¯vq Am¯¨ n‡j gwjK c¶ Zv‡`i wPwKrmvi Rb¨ †Kvb e¨e¯v MnY K‡i wK? ① bv ② n¨v

vi. fMf¯ cv_i D‡Ëvj‡bi cwi‡ekMZ cfve

1. cv_i D‡Ëvj‡bi d‡j GLvbKvi ewn¨K cwi‡e‡k wK ai‡Yi cwieZb n‡q‡Q e‡j Avcbvi g‡b nq?

welq	cfve
1. gwUi Dci	① fwg¶q ew× ② fwg aÿm ③ DeiZv nvm ④ cwb avivY ¶gZv nvm ⑤ Soil composition webó ⑥ †Kvb cfve c‡owb
2. cwbi Dci	① cwbi ¯i wb‡P bvgv ② cvbxq R‡ji Afve ③ Lvj wej, b`x-bvjvi cwb `wlZ nlqv ④ †Kvb cfve c‡owb|
3. ¯vbxq Avenvlqvi Dci	① Zvcgv‡Îv ew× ② ew×cvZ nvm ③ ï®Zv ew× ④ †Kvb cfve c‡owb
4. cvKwZK `‡hvM	① ew× †c‡q‡Q ② K‡g‡Q ③ †Kvb cwieZb nqwb hw` ew× cvq Z‡e wK ai‡Yi.....
5. MvQvcvjvi Dci	① MvQcvjvi msL¨v Kg‡Q ② ebfwgi cwigvY Kg‡Q ③ †Kvb cwieZb nqwb
6. cvYx ^Re ^ewPÎ¨	① wewfb cvYx wejß n‡"Q ② Mi" QvM‡ji msL¨v Kg‡Q ③ †Kvb cfve c‡owb
7. Rjvavi	① Rjvav‡ii msL¨v evo‡Q ② Rjvav‡ii msL¨v Kg‡Q ③ Rjvavi¸‡jvi Rj avivY ¶gZv nvm †c‡q‡Q ④ Acwiewzz i‡q‡Q|
8. evqi Dci	① evq `wlZ n‡"Q ② `wlZ n‡"Q bv ③ G m¤ú‡K avivYv †bB|

2. Avcbvi g‡Z wbgwjwLZ cwi‡ekMZ mgm¨v¸wji Rb¨ fMf¯ cv_i D‡Ëvjb KZUv `vqx?

mgm¨vi aiY	gvÎv					gše¨ †bB
	Le †ewk	‡ewk	mvgvb¨	AwZ mvgvb¨	`vqx bq	
gwUi Deiv kw³ nvm						
b`x fv½b						
eb¨v/Rjve×Zv						
cvKwZK `‡hvM						
MvQcvjv wbab						
kã `lY						

3. eZgv‡b Avcbvi GjvKvq †Kvb c×wZ‡Z fMf¯ cv_i D‡Ëvjb Kiv n‡"Q? ① g¨vbqwj Lbb c×wZ‡Z ② †WwRs †gwkb w`‡q

4. Avcwb †Kvb c×wZ‡Z cv_i D‡Ëvj‡bi c‡¶? ① g¨vbqwj Lbb c×wZ ② †WwRs †gwkb w`‡q

K. hw` g¨vbqvj c×wZ‡K mg_b K‡ib Z‡e, †Kb? ① G‡Z kwgK‡`i KvR Kivi m‡hvM †ewk ② G‡Z fwg aÿ‡mi m¤vebv Kg _v‡K ③ GUv cwi‡ek evÜe ④ Ab¨vb¨ .....

L. hw` †WwRs †gwkb c×wZ‡K mg_b K‡ib Z‡e †Kb? ① G‡Z LiP Kg ② G‡Z Rwgi Deiv kw³ bó nq bv ③ GUv me mgq e¨envi Dc‡hvMx ④ G‡Z A‡bK Mfxi †_‡K cv_i D‡Ëvjb Kiv hvq ⑤ GUv A‡bK jvfRbK ⑥ Ab¨vb¨ .....

5. Avcwb wK g‡b K‡ib cv_i D‡Ëvj‡bi d‡j GB AÂ‡j Avev`x Rwgi cwigvY K‡g hv‡"Q? ① bv ② n¨v

6. Avcwb weMZ cvP eQ‡i wK †Kvb Rwg cv_i D‡Ëvj‡bi Rb¨ wewµ K‡i‡Qb? ① bv ② n¨v

K. n¨v n‡j, KZ kZK ev wWwmgj? .....

L. cwZ kZK m‡ev"P KZ `v‡g wewµ K‡i‡Qb? ..... UvKv

M. cwZ kZK mewbg KZ `v‡g wewµ K‡i‡Qb? ..... UvKv

N. Rwg wewµi UvKv w`‡q wK K‡i‡Qb? .....
O. Avcwb †h Rwg cv_i DË‡jv‡bi Rb¨ wewµq K‡i‡Qb †mwU wK ai‡Yi Rwg wQj? ① Avev`x ② Abvev`x ③ wfUvgwU ④ †Svc-R½j
➢ hw` Avev`x nq, Z‡e cwZ eQi Avcbvi kZK cwZ Drcv`b †Kgb n‡Zv? ..... UvKvi
P. Avcwb wK eZgv‡b RwgwU‡Z dmj djv‡Z cvi‡Qb? ① bv ② n¨v
➢ hw` bv nq, †Kb cvi‡Qb bv?
① RwgwU MZ n‡q †M‡Q ② RwgwU DP wbP n‡q‡Q ③ RwgwUi cwb avivY ¶gZv nvm †c‡q‡Q ④ RwgwUi gwU Avev‡`i Abc‡hvMx n‡q c‡o‡Q ⑤ Ab¨vb¨ .....
Q. Avcbvi †KvbwU‡K †ewk jvfRbK g‡b nq? ① dmj djv‡bv ② cv_i D‡Ëvjb ➢ †Kb .....
.....
7. b`x ev b`x ZxieZx AÂj †_‡K fMf¯ cv_i DË‡jv‡bi d‡j wK †Kvb mgm¨v mwó n‡"Q? ① bv ② n¨v
➢ DËi n¨v n‡j, wK ai‡Yi mgm¨vÑ
① eb¨v ② b`xi be¨Zv nvm cvIqv ③ b`x g‡i hvIqv ④ b`x fv½b ⑤ Ab¨vb¨ .....
8. GB AÂ‡j cvKwZK `‡hvM wK Av‡Mi †P‡q ew× †c‡q‡Q? ① bv ② n¨v
9. Avcwb wK g‡b K‡ib Gfv‡e fMf¯ cv_i D‡Ëvj‡bi d‡j GB AÂ‡j gvivZ¥K cvKwZK `‡hvM †`Lv w`‡Z cv‡i?
① bv ② n¨v

vii. cv_i D‡Ëvjb ï‡i“ nIqvi ci msNwUZ cwieZb mgn

1. fMf¯ cv_i D‡Ëvjb ï‡i“ nevi ci GB AÂ‡j wbgwjwLZ welq ¸wj‡Z wK ai‡Yi cwieZb G‡m‡Q?

welq	wK ai‡Yi cwieZb	DbœZ ev Aebœ n‡j †Kb
1. iv¯vNvU	① A‡bK DbœZ n‡q‡Q ② DbœZ n‡q‡Q ③ AebœZ n‡q‡Q ④ A‡bK AebœZ n‡q‡Q ⑤ †Kvb cwieZb nqwb	
2. Ni-ewo	① A‡bK DbœZ n‡q‡Q ② DbœZ n‡q‡Q ③ AebœZ n‡q‡Q ④ A‡bK AebœZ n‡q‡Q ⑤ †Kvb cwieZb nqwb	
3. nvU evRvi I e¨emv ewYR¨	① A‡bK m¤cmwiZ n‡q‡Q ② m¤cmwiZ n‡q‡Q ③ msKwPZ n‡q‡Q ④ †ek msKwPZ n‡q‡Q ⑤ †Kvb cwieZb nqwb	
4. wk¶v	① wk¶vi nvi A‡bK †e‡o‡Q ② wk¶vi nvi wKQUv †e‡o‡Q ③ wk¶vi nvi K‡g‡Q ④ wk¶vi nvi A‡bK K‡g‡Q ⑤ †Kvb cwieZb nqwb	
5. wPwKrmv e¨e¯v	① A‡bK DbœZ n‡q‡Q ② DbœZ n‡q‡Q ③ AebœZ n‡q‡Q ④ A‡bK AebœZ n‡q‡Q ⑤ †Kvb cwieZb nqwb	
6. mvgwRK msMVb	① A‡bK ew× †c‡q‡Q ② wKQUv ew× †c‡q‡Q ③ K‡g‡Q ④ A‡bK K‡g‡Q ⑤ AcwiewZZ i‡q‡Q	
7. wkï kg	① A‡bK †e‡o‡Q ② †e‡o‡Q ③ K‡g‡Q ④ A‡bK K‡g‡Q ⑤ AcwiewZZ i‡q‡Q	
8. bvix‡`i Kgms¯vb	① A‡bK †e‡o‡Q ② †e‡o‡Q ③ K‡g‡Q ④ A‡bK K‡g‡Q ⑤ AcwiewZZ i‡q‡Q	
9. mšvm/ Pv`vewR	① A‡bK †e‡o‡Q ② †e‡o‡Q ③ K‡g‡Q ④ A‡bK K‡g‡Q ⑤ AcwiewZZ i‡q‡Q	
10. mweK Rxeb hvÎvi gvb	① A‡bK ew× †c‡q‡Q ② ew× †c‡q‡Q ③ K‡g‡Q ④ A‡bK K‡g‡Q ⑤ AcwiewZZ i‡q‡Q	

11. gvivgwi/ MÛ‡Mvj	① A‡bK ew× †c‡q‡Q ② ew× †c‡q‡Q ③ K‡g‡Q ④ A‡bK K‡g‡Q ⑤ Acwiewe ZZ i‡q‡Q	
12. †eKviZ	① A‡bK ew× †c‡q‡Q ② ew× †c‡q‡Q ③ K‡g‡Q ④ A‡bK K‡g‡Q ⑤ Acwiewe ZZ i‡q‡Q	
13. Kwl Drcv`b	① A‡bK ew× †c‡q‡Q ② ew× †c‡q‡Q ③ Aebwe Z n‡q‡Q ④ AKvhKi n‡q c‡o‡Q ⑤ †hgb wQj †ZgbB Av‡Q	

viii. miKvix bxwZ I RbM‡Yi g‡bvfve msµvš Z_¨vejx

1. G AÂ‡j cv_i msMn Kiv nqÑ ① miKvix chv‡q ② †emiKvix chv‡q ③ miKvix-‡emiKvix Dfq chv‡q
2. ‡emiKvix chv‡q cv_i D‡Ëvj‡bi Rb¨ miKvi‡K wK †Kvb U¨v· †`lqv nq? ① bv ② n¨v
➢ DËi n¨v n‡j, U¨v· wK †i‡U †`lqv nq? .....
3. Avcwb wK g‡b K‡ib miKvi G AÂ‡ji cv_i m¤ú` †_‡K chvß ivR¯ cv‡"Q? ① bv ② n¨v
➢ DËi bv n‡j, †Kb cv‡"Q bv? ① miKvix bxwZ bv _vKvq ② ckvmwbK D`vmxbZv ③ e¨emvqx‡`i KvimvRx
④ `wqZcvß e¨w³‡`i Nl MnY ⑤ Ab¨vb¨ .....
4. Avcwb wK g‡b K‡ib GB AÂ‡j miKvix D‡`¨vM Mn‡Yi gva¨‡g cv_i m¤ú‡`i m‡ev"P mØ¨envi wbwðZ Kiv m¤e?
① bv ② n¨v
5. Avcbviv †h f-Mf¯ cv_i D‡Ëvjb K‡ib Gi Rb¨ miKv‡ii Abgw Z †bb wK? ① bv ② n¨v
6. cv_i D‡Ëvj‡b ¯vbxq ckvmb †Kvb evav †`q wK? ① bv ② n¨v
7. cv_i D‡Ëvjb Kiv AvBbMZ fv‡e ˆea wK? ① bv ② n¨v
➢ hw` bv nq, Zvicil wKfv‡e D‡Ëvjb Kiv nq? ① ¯vbxq ckvmb‡K Nl w`‡q ② ¯vbxq ckvm‡bi AÁv‡Z
③ Gg wc gš¿x‡`i mnvqZvq ④ Ab¨ wK fv‡e .....
8. fMf¯ †h †Kvb m¤ú` D‡Ëvj‡bi †¶‡Î miKvix wKQ bxwZgvjv I AvBb Av‡Q G¸‡jv m¤úÜ wKQ Rv‡bb wK? ① bv ② n¨v
➢ hw` n¨v nq, Z‡e †m¸wj wK GLv‡b gvbv nq? ① bv ② n¨v
9. Avcwb wK g‡b K‡ib GB AÂ‡ji cv_i D‡Ëvj‡bi Rb¨ mwbw`ó bxwZgvjv _vKv c‡qvRb? ① bv ② n¨v
10. GB AÂ‡ji fMf¯ cv_i D‡Ëvj‡bi gva¨‡g wK GB AÂ‡ji Av‡iv Dbqb m¤e? ① bv ② n¨v
➢ hw` n¨v nq, wKfv‡e?
    1. cv_i wfwËK wkí KviLvbv M‡o Z‡j
    2. cwiwgZ gvÎvq cv_i D‡Ëvjb K‡i Zvi m‡ev"P mØ¨envi wbwðZ K‡i
    3. cv_i weµ‡qi UvKv Ab¨ Kv‡R wewb‡qvM K‡i
    4. Ab¨vb¨.....
12. Avcwb wK f-Mf¯ cv_i Aev‡a D‡Ëvjb mg_b K‡ib? ① bv ② n¨v
13. wKfv‡e cv_i D‡Ëvj‡bi gva¨‡g m‡ev"P Av_Ñmvgw RK Dbq‡bi cvkvcwk cwi‡e‡ki ¶wZ mewbg chv‡q ivLv m¤e?

.....
.....

Avcbv‡K A‡kl ab¨ev`

Appendix-5
Observaion Report (In Bengali)

ch‡e¶Y cwZ‡e`b

[‡h ¯v‡b Z_¨ msMn Ki‡jb Zvi Av‡kcv‡ki ewn¨K cwi‡ek ch‡e¶b K‡i QKwU ciY Ki“b]

µwgK bs	ch‡e¶‡Yi welqe¯	gš¿e¨
1.	¯vbwU‡Z MvQcvjvi msL¨v †Kgb?	(1) LeKg (2) Kg (3) †gvUvgwU (4) †ewk (5) Le †ewk
2.	cv_i D‡Ëvj‡bi d‡j ¯vbwU wK A‡bK DP wbP?	(1) bv (2) n¨v
3.	¯vbwU hw` Avev`x Rwg nq †mLv‡b wK Avevi dmj djv‡bv m¤e ?	(1) bv (2) n¨v
4.	cv_i DË‡jv‡bi ci *Top Soil*-Gi Ae¯v wK?	(1) bó n‡q‡Q (2) evjgq (3) wVK Av‡Q (4) Av‡iv DbZ n‡q‡Q
5.	¯vbwU‡Z *Water body*-Gi msL¨v †Kgb?	(1) c‡qvR‡bi †P‡q †ewk (2) cwigvbgZ (3) LeB Kg
6.	Av‡k cv‡k eb R½j wbab K‡i cv_i D‡Ëvjb Kiv n‡”Q wK?	(1) bv (2) n¨v
7.	GjvKwU‡Z †hvMv‡hvM e¨e¯v †Kgb?	(1) Le fvj (2) fvj (3) †gvUvgwU fvj (4) Lvivc (5) LeB Lvivc
8.	¯vbwU‡Z †Kvb b`-b`x ev Lvj-wej cv_i D‡Ëv‡bi Kvi‡Y *affected* n‡q‡Q wK?	(1) bv (2) n¨v
9.	cwi‡ek `lY Z_v evq `lb, kã `lb BZ¨vw`i Rb¨ `vqx wewfb †gwkb cÎ e¨eüZ n‡”Q wK?	(1) bv (2) n¨v

Appendix-6
Questionnaire Schedule (For Key Informants In Bengali)

mv¶vrKvi AbmwP

Bbw÷wUDU Ae evsjv‡`k ÷wWR, ivRkvnx wekwe`¨vjq, ivRkvnx|

M‡elYv wk‡ivbvgt Socio-economic and Environmental Impact of Underground Stone Collection on the Community People of Panchagarh District in Bangladesh	Mvgt	AbmwP bs
	BDwbqbt	
	Dc‡Rjvt	mv¶vrKvi MnYKvixi bvgt
	ZwiLt	

[GB ckgvjvi Z_¨vejx ïagvÎ M‡elYvi Kv‡R e¨envi Kiv n‡e Ges Z‡_¨i †MvcbxqZv i¶v Kiv n‡e]

[¯vbxq †bZeM, ¯vbxq ckvmb cwi‡ekev`x msMVb, cwi‡ek m‡PZb D”P wkw¶Z e¨w³ cgL‡`i mv¶vrKvi Mn‡bi Rb¨]

1. GB GjvKvq ewbwR¨K fv‡e f-Mf¯ cv_i D‡Ëvjb ïi“ n‡q‡Q KZw`b Av‡M †_‡K?

2. f- Mf¯ cv_i D‡Ëvjb ïi“i c‡e GB AÂ‡ji RbM‡Yi Av_-mvgvwRK Ae¯v †Kgb wQj?

3. cv_i D‡Ëvjb ïi“i ci gvb‡li Rxeb hvÎvi wK †Kvb DbœZ n‡q‡Q?
(K) hw` DbœZ n‡q _v‡K Z‡e wK ai‡Yi?
(L) hw` DbœZ bv n‡q _v‡K Z‡e †Kb nqwb?

4. fMf¯ cv_i D‡Ëvj‡bi d‡j GB AÂ‡ji gvb‡li mgvR Rxe‡b †Kvb mgm¨v mwó n‡q‡Q wK?
➢ n‡q _vK‡j wK ai‡Yi?

5. GB AÂ‡ji cwi‡ek wK cv_i D‡Ëvj‡bi d‡j ¶wZM¯ n‡”Q?
➢ n‡q _vK‡j wKfv‡e?

6. cv_i D‡Ëvj‡bi Kvi‡Y GB AÂj wK †Kvb ai‡Yi cvKwZK `‡hv‡Mi m¤§Lxb n‡Z cv‡i?
➢ n‡j, †Kvb ai‡Yi?

7. cv_i D‡Ëvj‡bi d‡j mó cwi‡ekMZ mgm¨v mgvav‡bi Rb¨ GB AÂ‡j wK †Kvb mwsMVwbK c‡Póv i‡q‡Q?
➢ _vK‡j †Kvb †Kvb msMVb Ges Zv‡`i Kvhµg wK?

8. cÂMo †Rjvi cv_i‡K Kv‡R jwM‡q wK GB AÂ‡ji A_©bwZK Ae¯vi Dbqb mvab m¤e?
➢ hw` m¤e nq, wKfv‡e?

9. GB AÂ‡ji cv_i m¤ú‡`i mØenv‡ii Rb¨ miKvix †Kvb D‡Ï¨vM Av‡Q wK?
(K) _vK‡j wK ai‡Yi?
(L) bv _vK‡j wK Kvi‡Y †bB e‡j Avcbvi g‡b nq?

Z_¨`vZvi bvgt
†ckvt
wVKvbvt

Appendix-7
Selected Photographs of the Study Area

Picture 1: Process of Underground Stone Collection in Panchagarh District

Picture 2: Layer of Stone

Pictures used in this section were taken by the researcher during collection of data in 2010.

Picture 3: Layer of Stone

Picture 4: Elimination of Top Soil from the Land

Picture 5: Use of Machines for Removing Water from the Stone Quarry

Picture 6: Stone Crushing Activities and Dust Emission

Picture 7: Underground Stone Collection form Homestead

Picture 8: Underground Stone Collection from Bushes

Picture 9: Condition of Top Soil after Underground Stone Collection

Picture 10: Generation of Holes after Underground Stone Collection

Picture 11: Stone Collection Activities by the River Side

Picture 12: Abandoned Land after Underground Stone Collection