GEOGRAPHICAL SURVEY OF CEMENT FACTORY IN DIRE DAWA: THE CASE OF NATIONAL CEMENT FACTORY IN SABIYAN, DIRE DAWA ADMINISTRATION

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DEDICATION

I dedicated this thesis manuscript to my mother W/ro Wodassie Mariam Mezengata, my beloved wife Hana Shiferaw and to my dearly loved sons Melenawi Biniyam and Honaliyat Biniyam.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this Thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this Thesis. Any scholarly matter that is included in the Thesis has been given recognition through citation.

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ACRONYMS AND ABBREVIATIONS

CSA	Central Statistics Agency
DDAEB	Dire Dawa Administration Educational Bureau
DDAEPA	Dire Dawa Administration Environmental Protection Authority
DDAUPB	Dire Dawa Administration Urban Planning Bureau
DDAWMEO	Dire Dawa Administration Water, Mines, and Energy Office
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EU	European Union
ICM	International Council on Mining
ICR	International Cement Review
IDPDDA	Integrated Development Plan of Dire Dawa Administration
ILFS	Infrastructure Leasing and Financial Services
SPSS	Statistical Package for Social Sciences
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organization
WWDSE	Water Works Design and Supervision Enterprise

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Geographical Survey of Cement Factory in Dire Dawa: The Case of National Cement Factory in Sabiyan, Dire Dawa Administration

ABSTRACT

Dire Dawa is geologically conducive for cement production in which it is endowed with large limestone reserves. In terms of cement production, it is the historical centre of the Ethiopian cement factory. The objective of this study was to investigate and conceptualize the geographical survey of cement factory and determine the residents' perception towards the effects of cement factory on Sabiyan urban community residents in Dire Dawa Administration. Systematic random sampling and purposive non-probability sampling techniques were employed. The Data was collected through questionnaires, focus group discussions, and interviews. In the study, 366

sample respondents were selected targeting the heads of urban household. The collected data was analyzed by using SPSS software for Windows 19.0 to draw interpretations and conclusions. The major findings of the study showed that the establishment of cement factory presented socio-economic benefits to the surrounding community through creation of employment opportunities and provision of healthcare facilities were 17.76% and 20.77% respectively. However, local people and the factory blamed each other for the slow pace of development being realized. The impact of dust deposition is significantly high on the ground and human population as well as the wastewater discharge and liquid effluents create favorable conditions for the reproduction of water born diseases causing malaria which threat to human health. This was confirmed by 89% and 85.5% of the sampled households respectively. The findings also revealed that the oil, grease, diesel and gas leakages and high noise levels during limestone blasting in the quarry from where the raw material mined and cement production operation 75.7% and 80% were the major challenges to the urban community particularly, the residents who live and work in congested compounds around the factory site. Based on the findings of this study, it is recommended that the factory must adopt effective environmental management tools, use of improved and cleaner production technologies to control dust depositions to enhance wholesome benefits accrued by the local people. In order to improve the factory's waste management service, sewage treating station should be established in factory site to control the wastewater prior to discharge into the surrounding environment. This will significantly improve the life of the surrounding households. Moreover, the Dire Dawa City Administration, particularly its Health Office, Environmental Protection Authority and Urban Development and Management Office has to make efforts to closely monitor the operation of cement factory and take the necessary measures in the environmental protection in its endeavors to create a clean and healthy urban environment.

Key words: *Cement factory, urban community, limestone mining, environmental management*

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1. INTRODUCTION

1.1. Background of the Study

According to Assefa *et al.* (2014) stated that Ethiopia is one of the fastest growing economies in Africa. Major sectors of the economy are agriculture, industry and service sector contributing 4.9 percent, 13.6 percent, and 11.1 percent respectively (Geiger and Moller, 2013). The country aims to join the mid economy class countries by 2025 (Ethiopia Ministry of Finance and Economic Development, 2011). The country's growth and transformation plan (GTP) provides vital attention to the manufacturing sectors as the basic driving force of the economic growth. The cement manufacturing industry is one of the sectors that are expected to significantly contribute to the success of this plan (Ethiopia Ministry of Finance and Economic Development, 2011).

The geological characteristics of the country, the large limestone deposit, the fast growing infrastructural sector, and the massive demand for cement in the country incentivize the cement industry in Ethiopia. This also led to increase in cement production, expand capacity of the existing factories and attracted investors to establish new factories in the country (Geiger and Moller, 2013**)**. Moreover, an increasing of cement demands for real estate and other construction derived by an increasing population and the growth of businesses in the country. This situation has triggered to rapid development of new cement plants (Amin and Ali, 2010).

The Ethiopian government has planned to increase the cement production for domestic and foreign market in its five year GTP plan from the initial capacity of 2.7 million tons in 2009/10 to 27 million tons in 2014/15 and to meet annual cement per capita consumption of 300kgs (Ethiopia Ministry of Finance and Economic Development, 2011). The country's investment agency (2008) states that it has strengthened its effort towards the promotion and success of the GTP plan by motivating through several investment incentives for those who participate on potential cement raw material supply chain as well as for those who invest on new cement factories in the country. The International Finance Corporation (IFC, 2007) indicates that cement and lime manufacturing

projects result in air emissions, immense energy consumption, wastewater, solid waste generation, and noise and recommends cement plants to install pollution prevention and control techniques. Furthermore, Kumar and Rawani (2012) show that in cement production process, environmental impacts are substantial for the emission of greenhouse gases. Moreover, clinker production demands major energy input and raw materials, which is the major source of gas emission and toxic pollutants due to their physical and chemical reactions in the cement kiln system (EEA, 2009).

According to Assefa *et al*. (2014) investigated the environmental impacts of Messebo Cement Factory and identify the preparation of raw material and coal, and clinker productions at the factory are the major sources of environmental impacts. Additionally, most environmental impacts of the activities in the crushing and raw milling and coal and kiln processing units are substantial and affect the surrounding communities and local environment. They required more energy source and raw material, thereby released pollutants into the surrounding environment during their process.

In recent years, scholars such as Boakye (2010) and Florence (2009) have tried to analyze the correlation between environmental damage and the growth of industries particularly in developing countries where the growth has been phenomenal. According to Boakye (2010), the environmental impacts of the cement factories in the developing world have tended to be ignored. Although the promotion of such enterprises is seen as a way to provide employment and incomes, there is little evidence available on environmental impact and sustainability of such factories to guide decision makers. This view emphasizes how decisions and actions today can affects the future especially in relation to natural resource availability, environmental health, and destruction of local and global ecosystems and most importantly the livability of our cities.

As Zeyed (2011) noted, among the potential environmental impacts from the cement operation site to the surrounding urban communities are dust, noise, air pollution, wastewater discharge, and disposal of solid wastes, are the major ones. The mining operations at the quarry site generate dust during blasting, crushing, loading, and transporting of raw materials. Dust also generated by

moving vehicles and trucks particularly along the gravel road passing through the areas lies within the nearby local communities. In addition, the movements of heavy-duty vibrating equipments have also contributed to dust emissions and add fugitive dust to the area. The high dust generated from the surrounding cement factory and mining operation coupled with nature of the site location significantly attributes to the level of technology maintenance of the industry. If it is not removed efficiently before it exists into the atmosphere, it will create pollution problems in the surrounding urban environment (ILFS, 2009).

The aforementioned studies revealed that the entire process for cement production requires lots of energy and raw materials that usually accompanied with various forms of social, economic, and environmental impacts. Accordingly, it is important to look at the Dire Dawa scenario where cement production operation were the major challenges to the urban community residents who live and work constantly in congested compounds around the factory site.

1.2. Statement of the Problem

Dire Dawa is geologically conducive for cement production in which it is endowed with large limestone reserves. In terms of cement production, it is the historical centre of the Ethiopian cement industry. Dire Dawa Cement factory, the first cement plant in Ethiopia was opened in 1946 with a capacity of 60,000 tones per year. The Dire Dawa Cement Factory was acquired by the National Cement project in 2005, which changed the factory's name and upgraded the factory to 0.2 million tones per year. National Cement is due to bring a new 1.2 million tones per year project online in 2013. Planting the second cement plant near the old cement factory site. The opening of such a large capacity plant had a dramatic effect on the local market (Global Cement Magazine, 2014). According to the company's report, the factory expanded its capacity to satisfy the eastern Ethiopian market and also export to Djibouti and Somalia.

The establishment of the cement factory presented socio-economic benefits to the surrounding community through creation of employment opportunities and provision of healthcare facilities. However, the local people have been complaining about the impacts of dust deposition, the

wastewater discharge, and liquid effluents, which threat to human health, it fully concentrated on satisfying cement demands.

Dire Dawa Administration Investment Office (2008) stated that the demand for cement in Dire Dawa has been increasing. Based on this, many new cement-producing factories proposed to tackle the demand of cement at regional level. In addition to revitalizing the demand for cement, governments have also been instrumental in providing financial support to cement producers for capacity expansions. Due to the above-mentioned facts, the economic mineral resource of cement production is exposed in Sabiyan area. That is why, the cement factory in Dire Dawa has been selected based on an economic source of limestone being available in convenient deposits. Rather than considering the most important factors and significant environmental issues for any adverse impacts of the factory as well as the major challenges to the urban community and consequences prior to making the final decisions. Therefore, the decision to build cement factory has been called the most important land-use decision ever made in the city.

Several studies have been conducted related to the geological formation and geomorphologic settings of raw material for cement factory and anthropogenic impacts on groundwater resources in the study area and its surroundings. Previously studies and other related works have been performed for different purpose in the Dire Dawa region. There are also few follow-up studies on cement dust exposure and adverse respiratory health effects among cement factory workers (for example Mengesha and Bekele, 2007; Zeyed, 2011). Although these studies have primarily focused in a very specific part of the cement production system, studies that have emphasized in determine residents' perception towards the effects of cement factory on the socio-economic and environment with particular focus on urban community are underestimated. For instance, the possibilities for linkages between cement production and reducing environmental impacts by improving the production process are typically not highlighted. However, these studies conducted in the study area, which contribute a lot as valuable source of information to the objectives of the study. The data give enough background information to conceptualize the situation but more comprehensive work needs to be conducted.

Therefore, this study is intended to bridge this gap and the previous works done as well as to investigate and conceptualize the geographical survey of cement factory and determine residents' perception towards the effects of cement factory on the socio-economic and environment with particular focus in Sabiyan Dire Dawa Administration.

1.3. Objectives of the Study

The general objective of the study is to investigate the geographical survey of cement factory and determine the perception of the residents towards the effects of the cement factory in Sabiyan, Dire Dawa.

The specific objectives of the study are to:

1. Determine the residents' perception to the effects of the factory in Sabiyan area of Dire Dawa;
2. Examine the geographical distribution and contributing factors for cement factory and mining sites in the city; and
3. Assess the social, economic, and environmental effects of cement factory on the urban community of Sabiyan in Dire Dawa.

1.4. Research Questions

To investigate the geographical survey of cement factory and the perception of the residents towards the effects of the cement factory in Sabiyan, Dire Dawa, the investigator focuses on the following research questions are:

1. What are the perception and expectation of the residents' of urban community towards the existence of cement factory around the study area?
2. Which factors determined the geographical distribution of cement factory and mining sites in the city?
3. What are the impacts of the cement factory and how does it affect the urban community residents of Sabiyan in Dire Dawa?

1.5. Significance of the Study

The study is important in providing valuable information on cement factory and related facts to policy makers, urban planners, the environmentalists, concerned government officials, and its impacts on the socio-economic livelihood of the urban community residents in Dire Dawa. Therefore, the outcome of this study may serve as a source of information to understand the perception and problems that residents' of urban community confront while living around the cement factory and mining sites in Sabiyan area of Dire Dawa city.

1.6. Scope of the Study

This study was conducted in Sabiyan area of Dire Dawa city. The study encompasses the factory and mining operational sites. The scope of the study involves the mining area of raw material, the cement factory-processing site, and the residents of the urban community of Sabiyan in Dire Dawa Administration.

The Dire Dawa Administration has both urban and rural areas, however; the focus of this study is on the urban area of the city where the socio-economic and environmental challenges from the established cement factory as well as the quarry from where the raw material mined are very high and frequent. Therefore, Sabiyan area has been selected as study area in Dire Dawa city not only because it is located within the city but also because of the primary place and the center of intense activities. In this regard, the objective of this study is to investigate the geographical survey of cement factory in Sabiyan, Dire Dawa. It is also to determine the residents' perception towards the effects of the factory.

1.7. Limitations of the study

The study is limited to only one factory is being studied; this is the weakness that unable to compare with others. This generally limits the comprehensiveness of the study. Other than these,

some household respondents were never to provide genuine information on their awareness and perception towards the effects of the factory.

1.8. Definition of key Terms

Urban kebele: - It is the lowest administrative unit in urban areas of Ethiopia; urban *kebele* (Amharic "neighborhood") is the administrative structure of the local government in Ethiopia similar to a neighborhood or a localized and delimited group of people (Addis, 2006).

Urban settlement: - refers to town or city settlement, In Ethiopia, a settlement is designated as urban if the number of inhabitants equals or exceeds 2000, and if most of them are engaged in non-agricultural activities. Another defining characteristic is the area is an officially municipality (CSA, 2008).

Kebele: - It is the smallest administrative unit in Ethiopia (urban and rural), equivalent to a neighborhood association. *Kebeles* are accountable to the *woreda* (district), sub city, or the city administrations (IDPDDA, 2006).

1.9. Organization of the Paper

This thesis organized into five chapters. Chapter one presents the introduction of the study which include the background and statement of the problem, the objectives, research questions, the significance, the scope, limitations of the study, and definition of key terms. The remaining parts of the thesis are organized as follows: Chapter two deals about the review of related literature and presents the theoretical and empirical reviews insight regarding the cement factory. Chapter three focuses on the description of the study area and the research methodology including the location, the socio-economic, environmental, and demographic characteristics of the population as well as the research design, sampling, the type of data, the data collection methods, and the methods of

data analysis. Chapter four and five deals about the major features and status of the factory and reveal the results obtained from the discussions as well as based on the findings, the conclusions, recommendations, possible research and policy implications are made respectively. Besides these, the references include lists of all works cited in the thesis. The appendices are part of the thesis presents the questionnaires, interviews, and focus group discussion guidelines to the study.

2. REVIEW OF RELATED LITERATURE

2.1. Conceptual Definitions of Sustainable Development and Cement Industry Framework

According to Rowan *et al*. (2005), sustainable development has no precise legal meaning. It is a policy goal. The essence of sustainability is that the future should not be sacrificed for short-term advantages. To quote the UN (2008), all our needs should be met in a way which does not compromise the ability of future generations to meet their own needs. This view emphasizes how decisions and actions today can affects the future especially in relation to natural resource availability, environmental health, and destruction of local and global ecosystems and most importantly the livability of our cities.

A commitment to practice sustainable development is critical for a cement industry to gain and maintain its "social licence to operate" in the community. According to Siamak and Alireza (2009), Sustainable Development in cement mining, series integrate in the environmental, economic, and social aspects through all phases of the mineral production from exploration through construction, operation, and mine-site closure. The concept of practicing sustainable development is simply the best way of doing things for a given site. As new challenges emerge and new solutions are developed, or better solutions are devised for existing issues.

The International Council on Mining (2007), the definition of sustainable development for the mining sector means that investments should be technically appropriate; environmentally sound; financially profitable; and socially responsible. The Minerals Industry Framework for Sustainable Development provides guidance for operational level implementation of the mining industry. Furthermore, the resulting frameworks are designed to assist all sectors of the mining industry to

reduce the negative impacts of the mining activities on the community and the environment (Diborah, 2008).

2.2. Environmental Challenges of Cement Factory

According to Aribigbola *et al*. (2012), one of the often-touted solutions to the problems impeding development in the third world countries is the emphasis on industrial enterprises. The intention behind the encouragement of the industries, according to Ofori-Cudjoe (2009), Endashaw (2009) and Boakye (2010), lies in the development of a diversified economy that could propel the achievement of sustainable societies, since the agricultural sector, the main economic activity in African countries cannot provide enough employment and income to the growing population. Consequently, several large scale industries were built by the various levels of governments and individual that was desirous of quick industrialization. One of such industries is the Cement factory. However, industrialization like every phenomenon just as it has benefits it also has negative consequences. In an attempt to maximize the benefits and cost in term of environmental crisis minimize the cost, governments all over the world have come up with standards which industrial plants especially pollution intensive ones must comply with the requirements of Environmental Impact Assessment before such industries are approved and established.

In his investigation of impacts of the industries in urban environment, Davey (2008) asserts that although many firms are resourceful in many respects they can also be very environmentally problematic. When engaged in the industrial activities they create more pollution per unit of investment because they are operate in the poorer, more populous neighborhoods, this pollution can have more disastrous consequences. May also create negative environmental consequences especially when heavy polluters dominate the area. Large sections of towns such as Kashur have been seriously damaged by the proliferation of tanneries in the core of the city, which created significant health problems. Oyelakin (2009) supported this assertion in his study of industrial

clusters of Nnewi in Nigeria, where heavy industrial polluters have changed the landscape of the town.

According to Pintz (2009), noted that large-scale industries "often pollute more per unit of output in their process of operating." This has variously been attributed to their failure to employ more efficient, updated technology; the difficulty of monitoring their compliance with regulations; their inability to safely dispose of the waste they produce; and their limited awareness of the potentially harmful effects of their activities. The question often asked by the scholars is- should policy makers be concerned about the environmental costs associated with measures to promote large-scale industries? Are they right in believing that the poor are overrepresented in this sector? Is their concern that regulation aimed at attenuating environmental costs would come at the price of exacerbating poverty? This provides evidence for the national policy in regulating large-scale industries.

2.3. Factors Affecting Location of Cement Industry

According to Gupta and Kirit (1976), decisions regarding in the industrial location have a unique place in the fields of industrial management and regional planning because such decisions have long-term implications for the health and well-being of the society, the environment, as well as the economy, because they are almost irreversible. Most industries involve huge investments; history testifies that the success of an industry depends significantly upon the appropriateness of its location. High cost of transfer of heavy machines and the impossibility of adjustments in already established fixed capital such as land and buildings make location decisions irreversible in most industries (Gupta and Kirit, 1976; Jaccard and Willis, 2009).

Wei *et al.* (2010), in his research on urban strategies, indicated that the optimum location of an industry depends upon demand in relation to supply, availability of raw material, production cost, transport cost, prospects for profit, managements' regional interest and government policy concerning regional development. It should be pointed out that not all these factors are mutually exclusive. However, in practice we do not find all factors in favor of a particular location. In the

real world, while some factors make a particular location favorable while other factors make it unfavorable. This makes location decisions difficult and significant (Wei *et al.,* 2010). Moreover, some determinants of locational advantage may have conflicting demands in themselves. For example, government policy regarding location is governed by the twin objectives of balanced regional development and the optimum utilization of natural resources, and these too are often conflicting. The regional planners endeavour to influence industrial location to be equitable to the backward regions in the short-run and to maximize social welfare in the long run. In contrast to this, individual entrepreneurs may be guided by the profitability criterion in their locational decisions (Florence, 2009).

2.3.1. Regional demand and supply

According to International Council on Mining (2007), the current annual cement consumption worldwide stands at approximately 2,800 million tons. For instance, China, India, and the US are the world's largest producers and consumers of cement. China produces almost eight times more than any of its counterparts, approximately equivalent to the combined production of the rest of the world. Riding on its overall economic growth strategy, China also led the world in cement consumption with 1,390 million tons during 2008, rising of 10.5% from 511 million tons in 1998 (ICM, 2007).

As per World Business Council for Sustainable Development (2008), the performance of the cement industry is closely related to the infrastructure investments. Therefore, Infrastructure investment was the key driver of economic growth in developing countries, especially in Asia and Africa. Another key phenomenon seen in the Africa's cement industry was the increase in the foreign ownership from 22% in 1980 to more than 61% by 2003, because the industry is underdeveloped and is unable to meet domestic demand. Country-wise, Egypt is likely to top the African countries in production capacity by 2012 with 61.8 million tons per annum as against 43.3 million tons per annum in 2008, adding around 18.5 million tons (Sultan, 2010).

According to Dire Dawa Administration Investment Office (2008), Dire Dawa was the leading regional state in cement production. In the latest year for which the data are available, indicate that demand is in excess of supply in the region. An examination of the past data indicated that this trend has been prevailing for long. Thus, the market criterion alone would argue for expansion of cement factory in the region. As a result, most cement-manufacturing units are established within a radius of 1.5 to 6 kilometers of limestone deposits in close proximity to the urban community. Furthermore, the availability of raw materials in good quantities throughout in the region may not affect location for its requirement, because the limestone deposits, gypsum, and clay are available in large quantities all over the region. However, Greater prospects for the profit, the lower transport cost, and greater favor from management's regional interest and greater encouragement from government are the important consideration that exerts significant influence on locational decisions, thus, at present cement factory has more concentration in the city than elsewhere. Therefore, the location of cement factories should be far from cities, and should be strictly controlled such that the menace of noise, vibrations, dust, and heavy vehicles movement will be brought under control (Tesfaye, 2009).

2.3.2. Government policy

Quarrying of limestone for the cement factory to a certain extent depends on the government policy in a particular region. Therefore, the encouragement and facilities or discouragement and hindrance from the government do exert their influence on location. Recently, the governments have evinced keener interest in developing the cement factory in industrially backward states. This is facilitated through the policy of freight equalization. Under this policy, cement is sold at uniform price at all regions in the country. Consequently, the government has decided to grant subsidies even for transportation infrastructure to districts having poor road and rail links (Gupta and Kirit, 1976; Sisay, 2008).

Discussing on the renewal efforts of the city, Global Cement Magazine (2014) describes that, the present location of the cement factory in Dire Dawa, in particular, the recent changes has indicated that the cement factory in the region is inconsistent with the optimum location and that

is changing towards greater concentration, In particular, the concentration is increasing significantly over time in Sabiyan and Melkajubdu urban areas. This change in location seems to have been influenced and speed up by various determinants of location, such as profitability, tax incentives. Over the years, the region has witnessed rapid growth in infrastructure projects, industrial capacity expansion, and residential construction, leading to tremendous growth in demand for cement.

2.4. Location Decision of Foreign Investment in Urban Environment

Ethiopia experienced three fundamental changes since the late 1990_S.the decentralization of power to local states, the transition from a command economy to market oriented and the transformation from a closed economy to an open economy. Under such transformation and changes significantly affecting the location choice and decision of foreign investment in industries, first, decentralization has granted local governments more power, authority, and responsibility in providing incentives to attract foreign investment and develop local economies. Furthermore, decentralization has enabled local states to intensify place promotion to influence location decision of foreign investors (Ethiopia Ministry of Finance and Economic Development, 2011). The capacity of government agencies to analyze and evaluate the impact of location based investment incentives on the local urban community by granting exclusive rights to use the community resources around the city have been shown to result in the urban environmental mismanagement (Wei *et al.,* 2010).

According to Kassaye (2009), noted that the devolution of power to the regional governments, implementations of economic policies and development programs have largely been shifted from the center to the regions. By way of ensuring their autonomy on resources to the lowest districts and *kebeles* become the center of socio-economic development. Decentralization increases the decision power of district administration in developmental projects and allow interaction with the urban communities. Consequently, as the government seeks to implement these decentralization

efforts in regions, it faces immense institutional challenges, because technical capacity limitation believed to be the major constraint in the course of implementing the decentralization process. This is obviously a challenging and difficult process, not least because of the limitations in the possibility of getting trained work force at the district and *kebele* level. Therefore, Government officials should be considered the impact of their decision-making on the well-being of their community. Thus, decisions made today will have an enormous influence on the future lives of the communities, and we humans ourselves, simultaneously, the threat to, and the caretakers of the earthly life, will be among the greatest beneficiaries (Addis, 2006).

Second, marketization has intensified local efforts to fully exploit and use the local advantages, the Local governments also have to sell the local places and the communities resources to the potential foreign investors (Addis, 2006; Wei *et al.,* 2010). Last, foreign investment is grounded in specific site and places in cities with preferential government policies. Consequently, foreign investment in developing countries is concentrated in core city regions. The extent of diffusion of foreign capital to the periphery is limited. This is because these regions have advantages in labor market conditions, access to domestic markets, preferential policy treatment, and infrastructure. Therefore, the core city regions are the most globalized places and the focus of foreign investment in developing countries (Florence, 2009; Wei *et al.,* 2010).

As Anilkumar and Arnab (2006) noted place-based investment incentives have become the most powerful instrument in the competition for global capital. Beside this, governments have created many special economic zones located in specific places in the cities with preferential government policies and the advantages of natural resources. Furthermore, Government policies regarding industrial development is encourage in some areas and restricted in others. Industries that are located in depressed areas may receive financial incentives from the government in the form of low rent, however, reduced tax rate for extensive land users industries in urban areas combined with lack of commitment by local government officials to take environmental responsibilities, less transparent and less professional are the major challenges to the urban community.

2.4.1. Role of local states in the location of industries

As Davey (2008) reminds us, all location factors exerted a certain influence on the decision to invest in the specific location within the city. The most important factors influencing location decision to invest are better investment incentives, government attitude, advantages of natural resources, the labor cost, market potentials, the land cost, transportation facilities, industrial infrastructure, government policies, and services. First, foreign investors in determining location, considered better investment incentives as the most important factor. Thus, location decisions are heavily influenced by government policies and services. Second, better industrial infrastructure can save the production cost, land, and transportation costs are important to foreign investors. Therefore, specific location is an important factor for the foreign investors in deciding whether and where to invest (Wei *et al.,* 2010). Thus, the purpose of the government urban environmental policy process is to ensure decision maker is fully informed about the urban environmental aspects and consequences prior to making final decision. In addition to this, There must be positive relationship between foreign investors and the local governments in order to further improve investment environment, especially, simplifying and clarifying the policies, improving the performance of the government officials, strengthening the law implementation, reducing corruption, improvement of investment approval process and services (Tesfaye, 2009).

Anilkumar and Arnab (2006) suggested that integrated the urban resource management is an essential approach that needs to be practiced to a full extent, to prevent industrial hazards. It promotes the integration of cross-functional teams in the planning and implementation of urban land use policies and a participatory approach to urban management, including a representative range of the stakeholders in to the decision making process. It is therefore important that urban centers of the country should be effectively protected from the potential and recurrent industrial hazards through various preventive measures, beside this compliance with the requirements of EIA should be given serious attention.

According to Arimoro (2011) indicated that it is equally important to undertake the strategic environmental analysis and environmental auditing for the projects that are already operating. In

this regard, making EIA of projects open for the public discussions would not only make the system more transparent and efficient, but also contribute to sustainability of the development projects and the environment at large. Moreover, if development intervention is necessary in the city, there should be appropriate and effective environmental impact assessment, followed by sound environmental auditing measures.

2.4.2. Inadequate policy framework

Ethiopia has ratified several policies on various aspects of the environment, most of which were proclaimed over a decade ago. However, several studies have confirmed that these policies are not translated in to laws and directives, as a result, sensitive ecosystems, the urban environmental conservation, the underground water resources, etc, are not strictly protected (Tesfaye, 2009). Most importantly, the policies pertaining to the threat of industrial hazards and climate change in the country and efforts to combat the emerging problems of industrial hazards of cement factory in particular lack the policy ground (Dire Dawa Policy Study and Plan Department, 2006).

Dietz (2011) asserted that some specific land uses are sensitive to industrial pollution, such sensitive areas include, the public water supply areas from ground water reserves, biosphere reserves, urban settlements, the surface water bodies, etc., therefore, the regional state and the central governments are required to identify such areas on a priority basis. According to Ramroth (2012), the Forest Conservation Act of the 1980 stated that, in any particular selected site, the following factors must also be recognized:-

- No forestland shall be converted into non-forest activity for sustenance of the industry
- Land acquired shall be sufficiently large to provide space for appropriate boundary limit of the industry
- Layout of the industry that may come up in the area must conform to the landscape of the area without affecting the scenic features of that place
- No prime agricultural land shall be converted into industrial site

2.4.3. Area preferably to be avoided

In 2009, Siamak and Alireza published a data based review on research examining the location of industry. They noted that in siting industries, care should be taken to minimize the adverse impact of the industries on the immediate neighborhood as well as distant places. With a view to protect the urban environment, the industries may maintain the following distances, as far as possible. At the time of siting of the industries, if the major settlement 300,000 populations are found within 50 km from the project boundary, the spatial direction of growth of the settlement for at least a decade must be assessed. Subsequently, the industry may be sited at least 25 km from the boundary of the major settlement. However, the less attention given to the urban environmental problems in the area and lacked sense of ownership on the development process are also the major problems on the part of the local governments in turn aggravated the urban community problems (ILFS, 2009; WHO, 2012).

2.5. Environmental Impacts of the Mining Section of Cement Industry

The process of mining is usually an open cast method. This simply means that extensive virgin of lands will have to be cleared and tilted before graders and loaders will be used to load and transport the limestone to the cement factory site. Aside from these, In Dire Dawa, The major component of the raw material, the limestone, is usually extracted from an open-face quarry very close to the cement factory. More than 1.5 tons of raw materials are required to produce one ton of cement. This process often leads to serious environmental problems (Mengesha and Bekele, 2007; Zeyede, 2011; Anuradha, 2016).

According to the information obtain from Noor and Faridah (2009) stated that Limestone mining in the town has resulted in the conversion of urban lands into quarry sites. One very important impact of the quarry is deforestation. This simply means the loss of the vegetation cover and removal of the topsoil because of blasting of the limestone. In the course of using the quarry, resulting into a large expanse of land exposed to rainwater and wind. Another factor that has

contributed to the poor environment at the quarry site is the rising of dust during blasting and transporting, which has remained a serious threat to many peoples, and the workers including those involved in the drilling, and quarrying. In this case, the health concerns of the community residents come to the fore (Aribigbola *et al.,* 2012). In accordance with the WHO report (2012), Diseases associated with the inhalation of silica-containing dust include silicosis, chronic airways obstruction and bronchitis, tuberculosis and lung cancer. Many peoples and community including those in high-risk settings are exposed to dust. Empirical observation reveals that most of the residents in the community are exposed to the dust during the process of mining. The exposure of man to dust can lead to a wide variety of respiratory diseases. Particles can cause irritation to the eyes, nose, and throat. Thus, the incidence of dust pollution has substantially increased. It must be noted that this used to constitute a major problem to the community. Aside from this, WHO reported in 2012 that, the level of vibration and noise generation by various machineries and earthmovers such as the drilling machine, scrapper, pay loader, bulldozer, dumper etc at quarries are supposed to be the major problems for the residents of the urban community. The noise levels emitted in cement factories are known to vary from 89 to 118db (decibels). The standard of noise level prescribed for Ethiopia's industries are 90 to 115db. It is worthy to know that 90db is the maximum noise level human beings can tolerate. However, the noise level is still above the minimum for the residents of the community (Taye, 2010).

2.6. Appropriate Mitigation Measures

These effects are normally reduced by applying appropriate mitigating actions such as massive reclamation of the mined areas using new overburden materials and a forestation programme that involve planting of varieties of trees that have ornamental values, can hold the soil structure well and could cover the exposed land well. Moreover, the soils in blasted areas that are refilled and regenerated are allowed to fallow for a few years for the full yield to be achievable on such soil (ILFS, 2009). Beside this, Long-lasting, high-intensity sounds are the most damaging to hearing and produce the most stress in humans. The level of vibration and noise at quarries are supposed to be kept under control at least to fall within the limit allowed by the Environmental Protection Authority. The empirical investigation by Ramroth (2012) reveals that proper stemming of the

explosives which are dangerous in themselves, in the dug holes is supposed to be encouraged to avoid surface stemming. Burying of the explosives at the appropriate depth ensures reduced the noise and controlled the blasting, particularly in industrial working areas; planting vegetation to absorb and screen out the noise pollution; and zoning the urban areas to maintain a separation between residential areas and zones of excessive noise. Moreover, the government, the industry, and the community should be encouraged to be the partners in progress. They can jointly be involved in monitoring environmental resources depletion, especially the compliance level of the factory to minimum standards for sustainable and pollution free society (Javed *et al.*, 2012).

2.7. Challenges and Achievements of the Industry in the Environmental Arena

At the United Nations World Summit on the Sustainable Development held in Johannesburg in 2002, the ten leading global cement companies agreed that sustainable development was central to "creating efficient, effective environmental practices in the 21st century". The ICM (2007) supports this view. Our priority for the cement industry is to ensure sustainable environmental practices and continuously working to incorporate environmental factors into planning decisions, improve their environmental performance, monitor the activities that affecting the surrounding environment, comply with environmental laws and regulations, and rehabilitate the environment affected by their activities (International Council on Mining, 2007).

2.7.1. Rehabilitation of the land

A cement-mining site has many stages in its lifetime from the exploration and development to continuous operation. Therefore, the cement manufacturing companies should be committed to the restoration and rehabilitation of sites once the mining and cement manufacturing activities have ended. All cement related mines are required by local authorities to have up-to-date mine operation plans, which specifically include site rehabilitation. Wherever possible rehabilitation activities are integrated into the ongoing operational activities at the site (Infrastructure Leasing and Financial Services, 2009).

2.7.2. Site rehabilitation

According to UN Report (2008), Australian cement companies have closed several production sites in the last decade. In 1998, Queensland Cement Factory ceased cement-manufacturing facility after 80 years of continuous operation. After extensive remediation, part of the mining site is now a modern and vibrant commercial and industrial area, named Queensland Cement Factory Industrial Park. A quiet and l**eafy** residential estate has also been developed on the site in November 2003. The other important measures taken with the objective of creating sustainable urban environment, for instance, after 110 years of operation, Geelong Cement plant located at Fyansford was closed in June 2001. An extensive environmental assessment was conducted to identify areas where fuel storage, waste disposal, and built up areas might have had an impact on the soil and groundwater. Remediation and site improvement is continuing, with part of the long-term benefits, the restoration focus also extends to the enhancement of the biodiversity habitats of the industry's existing sites. Australian cement companies have undertaken many different rehabilitation projects including buffer sites and community biodiversity projects. The quality of these projects has been recognized through various awards for excellence (International Council on Mining, 2007).

2.7.3. Water savings

According to Diborah (2008), Most of the water in the slurry is evaporated during the cement production process but the remaining water is discharged in to the surrounding environment from these wet process cement plants. All the cement manufacture and handling facilities should be designed to control, separate, and treat any surface water, so that there is minimal impact from the discharge of excess water into the local environment. The pollutants initially contained in the water are mainly dissolved and suspended solids. Control methods including settling ponds, closed circuit water cycles and careful monitoring practices, ensure the discharged water is of an equal or higher quality than the water in the local environment. For example, The Gladstone cement plant achieved a reduction in water consumption of an estimated 25 to 30 percent of normal usage. All the available water collected on site was recycled for dedusting purposes. The focus on water

resource issues has also prompted a review of the plant's water management systems. A significant upgrade to waste water facilities will have the dual benefits of reducing the wastewater released to the environment as well as further minimizing use of water resources (Boudaghpour *et al*., 2007).

2.8. Sustainable Development Program in Mining Industry

As Wright (2012) describes that, the Sustainable Development Program in the mining industry aims to identify the key issues affecting the mining industry and provide information and case studies to illustrate a more sustainable basis for the mining industry. Which are relevant to all stages of the mine's life-exploration, feasibility, design, construction, and operation, closure and rehabilitation. Therefore, this requires the mining industry to integrate, and implement the social, environmental, and economic sustainability. In addition to these, work with key stakeholders in practical implementation of the Principle. Enduring Value Principle 4: Implement management strategies based on valid data and sound science.

- Consult with the interested and affected parties in the identification, assessment, and management of all significant social, health, safety, environmental and economic impacts associated with mining activities.
- Ensure regular review and updating of risk management systems.
- Inform potentially affected parties of significant impacts from mining operation and the measures that will be taken to manage the potential impacts effectively.
- Develop, maintain, and test effective emergence response procedures in the collaboration with potentially affected parties.

2.9. Precautionary Principle

According to the 1992 Rio Declaration on Environment and Development provides the following definition:"Where there are threats of serious or irreversible environmental damages, lack of full scientific certainty shall not be used as a reason for postponing the cost-effective measures to prevent environmental degradation" (Moes, 2010). Although the precautionary principle was

originally framed in the context of preventing environmental harm, it is now widely accepted as applying broadly, where there is threat of harm to human, animal or plant health, as well as in situations where there is a threat of environmental damages. However, Policy guidelines are needed to indicate when the Precautionary Principle should be invoked, how an impact-based approach can continue to be followed when the scientific uncertainty is such that cannot in itself determine the level of risk, and how the decisions should be made on appropriate precautionary measures. The purpose of the Precautionary Principle is to create an impetus to take a decision notwithstanding scientific uncertainty about the nature and extent of the impact; that is, to avoid 'paralysis by analysis' by removing excuses for inaction on the grounds of scientific uncertainty (Boakye, 2010). The African continent has extensive mineral and natural resources hence, developmental projects are being proposed and executed on a daily basis, many of which involve large-scale alteration of human, animal and plant ecosystems. For many of these projects, there are hardly any genuine Environmental Impact Assessment studies carried out (Arimoro, 2011). The exploitation of these resources over the past few decades has left a vast wasteland of environmental problems. Because the socio economic development of any nation depends on the exploitation of their natural resources (International Environmental Management Authority, 2012), many therefore believe that these resources should be quickly exploited in order to develop and improve the under-nourished economy. In the face of accelerated development, many projects are carried out to extensive scales and for extended periods, with little or no concern for the environment. The need to reform the resources development practices worldwide has recently become a key environmental issue in the efforts to establish a more "harmonious relationship between people and nature" (Noss and Cooperrider, 2009).

According to Pope *et al*. (2013), in the past, international sustainability policies (such as Agenda 21) clamoured for the adoption of integrated approaches to planning and management of land and related natural resources. Specifically, some of the relevant objectives were to "review and develop policies to support the best possible use of land and the sustainable management of land resources, by not later than 1996", and to "create mechanisms to facilitate the active involvement and participation of all concerned, particularly communities and people at the local level, in decision-making on land use and management". In sustainability assessment, integrated impacts

appraisals are designed to consider environmental, social, and economic implications of projects, and examine the interrelations between these three pillars (Pope *et al*., 2013). Therefore, it is hoped that the disaggregation of these pillars would be more helpful in offering detailed insight into the impacts of existing resource utilization systems.

2.10. Conceptual Framework of the Geographical Survey of Cement Factory in Dire Dawa

This study is an attempt to create a conceptual framework for investigating the geographical survey of cement factory and resident's perception towards the effect of cement factory. Several studies have been conducted related to the geological formation and geomorphologic settings of raw material for cement factory and anthropogenic impacts on groundwater resources in the study area and its surroundings. Most of studies have been conducted by the Federal sector organization of Addis Ababa and Dire Dawa Administration i.e. Ministry of Mines and Energy, Ministry of Water Resources, Geological Survey of Ethiopia, Water Work Design Supervision Enterprise (WWDSE) and Dire Dawa Administration of Water Mines and Energy office and Environmental Protection Authority. The previously studies and other related works have been performed for different purpose in the Dire Dawa region. There are also few follow-up studies on cement dust exposure and adverse respiratory health effects among cement factory workers (for example Mengesha and Bekele, 2007; Zeyed, 2011). Although these studies have primarily focused in a very specific part of the cement production system, studies that have emphasized in determine residents' perception towards the effects of cement factory on the socio-economic and environment with particular focus on the urban community are underestimated. For instance, the possibilities for linkages between cement production and reducing environmental impacts by improving the production process are typically not highlighted.

These studies and assessments performed in different sections of cement factories focus on cement dust exposure and adverse respiratory health effects among cement factory production workers in Dire Dawa, Mugher and Messebo cement factory. Paper I is based on a questionnaire survey on acute respiratory symptoms and personal total dust exposure measurements in Dire Dawa cement factory. The second paper describes repeated measurements of total and respirable

dust among selected workers in Dire Dawa, Mugher and Messebo cement factories. In paper III, one-year follow up study was carried out in the same factories as in paper II. Chronic respiratory symptoms, lung function, and measurement of personal total dust exposure were conducted at baseline in 2009 and follow up in 2010.This study has shown increased the prevalence of respiratory symptoms among the dust exposed cement production workers and excessively exposed cleaners than among the less exposed controls. It is likely that the adverse respiratory health effects are related to the dust exposure. The previous studies were studying machine attendants, process operators, and cement cleaning workers only. This implies that studies on the overall consequences of cement factories on the urban community who live and work in congested compounds around the factory site are largely missing. Therefore, in Dire Dawa, information on the geographical survey of cement factory and to determine residents' perception of the effects of cement factory is clearly needed. However, those institutions and individuals have conducted these studies for different purposes in the study area, which contribute a lot as valuable source of information to the objectives of the study. The data give enough background information to conceptualize the situation but more comprehensive work needs to be conducted.

Therefore, this study is intended to bridge this gap and the previous works done as well as to investigate and conceptualize the geographical survey of cement factory and determine residents' perception towards the effects of cement factory on the socio-economic and environment with particular focus on Cement Factory by analysis of primary and secondary source data, surveys of household heads and key informants in Sabiyan Dire Dawa Administration. This is elaborated below in figure (1) with its influencing variables.

Figure 1: Conceptual flow of the Geographical survey of cement factory in Dire Dawa.

3. RESEARCH METHODOLOGY

3.1. Description of the Study Area

3.1.1. Area and Location

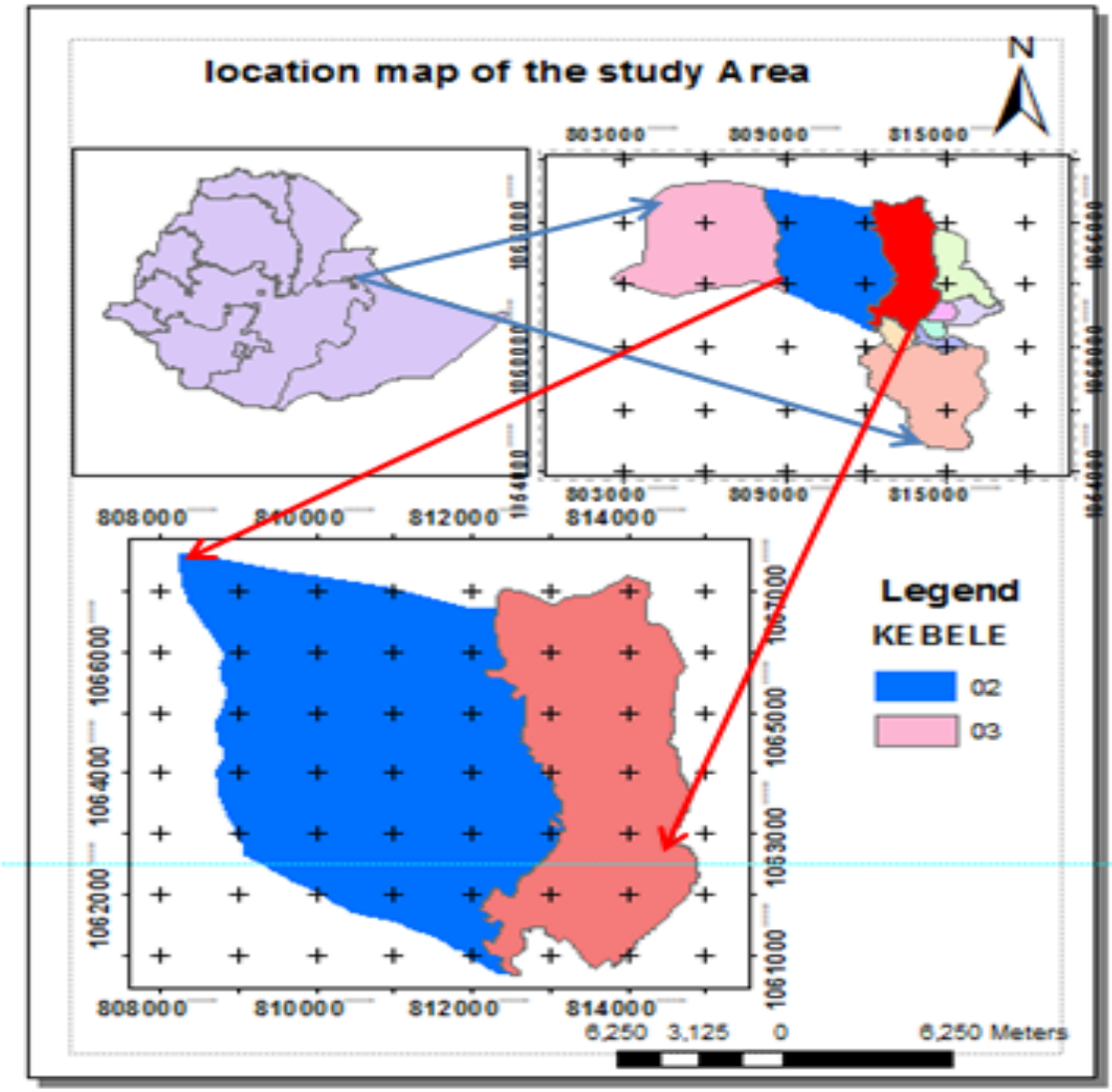

Figure 2: Map of Dire Dawa Administration and the Study Area

Dire Dawa Administration is located in the eastern part of Ethiopia and covers approximately 1332.62 km^2. It is bounded by the Oromiya Regional State to the north and west and the Somali Regional State to the south and east. Geographically, it is located between 09^0 28' N to 09^0 49' N latitude and 41^0 38' E to 42^0 19' E longitude (Water Work Design and Supervision Enterprise,

2009). The study area covers over a total area of about 48.6km^2, the Sabiyan urban area is located 09^0 25' N to 09^0 28' N latitude and 41^0 42' E to 41^0 47' E longitude. Both the Cement factory and the Sabiyan urban community are situated in the City of Dire Dawa with altitude between 1300 to 2300 m above mean sea level (Figure.2).

3.1.2. History of the cement factory

According to Land Cover Mapping Units of Dire Dawa Administration (2011), the Dire Dawa city is the historical centre of the Ethiopian cement factory and remains very important for the sector. Dire Dawa Cement factory, the first cement plant in Ethiopia was opened in 1946 with a capacity of 60,000 tones per year and run by Italians. The Dire Dawa Cement Factory was acquired by the Cement project in 2005, which changed and upgraded the factory to 0.2 million tones per year. Cement factory is due to bring a new 1.2 million tones per year project online 3km from Dire Dawa in 2013. Planting the second cement plant near the old cement factory site. The company expects to rely on the eastern Ethiopian market and will also export to Djibouti and Somalia. The opening of such a large capacity plant had a dramatic effect on the local market. By February 2012, it was reported that the company imported Volvo trucks in order to assist with its distribution requirements, helping to stabilize the price of cement in the local market (Global Cement Magazine, 2014).

Cement Company involves the mining of raw materials, construction, and operation of cement factory at Sabiyan in Dire Dawa Administration. The site has been selected based on an economic source of the limestone being available in convenient location and considering on the access to water and transportation facilities (Development Bank of Ethiopia, 2011).

3.1.3. Climate

According to the Dire Dawa Administration Environmental Protection Authority (2010), Dire Dawa is situated in *Kola* agro-climatic region; temperature is hot throughout the year with minor seasonal variations. The temperature progressively increases northward from *Woina-Dega* type along the mountaintops that ranges to the southern border and the low alluvial plains in the northwestern margin experience the lowest and the highest temperature recordings respectively in the region. As per Koppen classification, the Dire Dawa Administration is characterized as Hot Semi-Arid Zone; whereas the Eastern part of the Administration is classified as Warm Temperate Climate Zone, which is characterized by the mean annual temperature in the coldest month of less than 18^0 c. In the Hot Semi-Arid Climate Zone (the western, northwestern and southwestern part), the mean annual temperature lies between 17^0 C and 27^0 C (Refer Figure. 3).

Figure 3: Annual Maximum and Minimum Temperature Trend of Dire Dawa (1981-2009)

Source: DDAEPA, 2010

The seasonal rainfall has a bimodal distribution with peak in April and August. The two seasons are *'Meher'* and '*Belg'* and they receive about 80% of the annual rainfall separated by a short dry in June. The total mean annual rainfall is 657mm and mean monthly values varies between 5.7mm (December) and 136mm (August), which indicate poor temporal distribution of rainfall.

The climate of the study region is influenced by various inter-related factors, but the main factors are its equatorial location and the altitude. The year is divided into three seasons: a main rainy season *(Kiremt)* from July to mid - September, a dry season *(Bega)* from October to February, and finally a "small rainy" season *(Belg)* in March and April. The small rain originated from the Indian Ocean and is brought by north-west winds; while the heavy rains in the wet season come from the Atlantic Ocean with northeast winds (Water Work Design and Supervision Enterprise, 2009). (Refer Figure.4).

Figure 4: Rainfall distribution of Dire Dawa, 2009

Source: WWDSE, 2009

3.1.4. Relief

The physiography of Dire Dawa could be classified into mountain ranges, hills, valley bottoms, river terraces, and the flat plains. The mountain ranges possess the slopes exceeding 45%. Hills, scattered all over the region have slopes ranging between 16% and 30%. In most part of the areas of the hills and mountains, the natural vegetation is already depleted, the bedrocks are exposed, and the soils are washed away. The valley bottoms and the flat plains, however, have deep and fertile soils (DDAWMEO, 2006).

3.1.5. Soils

Soil data was obtained from Integrated Development Plan of Dire Dawa Administration (2006) Report and based on the FAO-UNESCO Soil Classification System (Yohaness GebreSilassie, 2007), Thirteen (13) different soil types were identified in the Dire Dawa Administration. These are Calcaric Arenesols, Calcaric Cambisols, Vert-calcaric Cambisols, Calcaric Fluvisols, Calcari-sodic Fluvisols, Arenic Fluvisols, Haplic Luvisols, Calcaric Leptosols, Eutric Leptosols, Calcaric Regosols, Lepti-calcaric Regosols, Calcic Solonetz, and Mazi-calcic Vertisols. These soil types are found at different areas within the project area and the largest portion is covered by Leptosol type, which covers almost all the hilly and mountainous landscape of the south middle and some eastern part of the Dire Dawa Administration. The smallest soil unit is the Vertisol, which is occurring along the track towards Melka Jebdu.

3.1.6. Geological formation and geomorphologic settings of Dire Dawa

According to Eyilachew (2010), the geomorphology of the area can be classified into three major features: the escarpment, the transitional region, and the alluvial plains. Small outcrops of sedimentary rocks, basalts and some recent coarse alluvial sediment mainly characterize the

transitional areas. In this area, the topography is gentle and the bedrocks are close to the surface. The alluvial plains are characterized by a gentle to flat topography. Except for some volcanic hills of younger age, the Mesozoic and the Tertiary rocks are buried deep inside the sediments in the lower basin.

Geologically, the area comprises of Precambrian with high-grade metamorphic rocks (gneiss, pegmatite and granodiorite), Jurassic Adigrat sandstone and Hamaliei limestone with varies thicknesses and compositions which are located in the upper most part of the area. Cretaceous upper sandstone and Tertiary basalts outcrops have observed in the transitional part of the area. The Alluvial sediment deposits dominantly cover the downstream area. The upper sandstone and Hamanlei limestone are the most productive aquifers in the area (Eyilachew, 2010).

Based on the stratigraphy and tectonic activities, the Dire Dawa area can be classified in to four main geological units and the geological events are summarized in these units are:

a. Basement complex rocks: This is mainly composed of gneiss, pegmatite, and granodiorite of metamorphic rocks, which covered in the upper part of the Dire Dawa Basin.
b. Mesozoic sediments (lower & upper sandstones and the limestone unite): This formation mainly located in the transitional zone.
    - Jurassic Adigrat sandstones overlie the basement complex with a thickness of not more than 20 meters.
    - Jurassic Hamanlei limestone (middle) varies in thickness up to 200 meters and its lower part is interbeded with shales overlain with limestone. This formation together with upper sandstone makes the main sources of raw material in the area.
    - Cretaceous Amba-aradam sandstones: mainly composed of the quartzes sand stone, thickness from 150 to 200 meters at some places interbeded with basaltic flows (lava flows within the sediments or sills) and limestone intercalations.
c. Tertiary volcanoes: Alaji formation (Acidic, lower trap basalts) predominantly basalts, the Alaji formation overlies on the upper sandstone. It has a wide spread area coverage.
d. Quaternary formation: All rivers and streams descending from the escarpment have built large areas extended and thick alluvial deposits. These deposits consist of the cobbles and coarse-grained sediments near the escarpment, while they consist of the fine detrital

sediments in the plain area. Therefore, Most of the basic raw materials needed for the manufacture of cement are available in Dire Dawa (Wondafrash *et al*., 2009).

3.1.7. Drainage and water resource

As there is no perennial river, the whole drainage system in the Dire Dawa Administration is intermittent streams (i.e. carrying water only after heavy rain events). The main rivers of the Administration are *Kelaad, Dechatu, Lege Oda* and *Kalcha.* All the above rivers and their tributaries are draining towards the Awash River and are sub-basins. Integrated Development Plan of Dire Dawa Administration (2006) has estimated for the entire watersheds as well as the surface runoff potential in the Administration. Accordingly, the total surface water potential of all the watersheds is estimated at 211.2 mm^3 per annum.

It is important to note that in some of the watersheds, particularly those on the western part of the administration; most of the runoff comes from parts of the watersheds, which lie outside the boundary of the administration in the south. The existing annual recharging is estimated to be about 38.8 mm^3 per year (1233 Lt/sec). The administration is also endowed with groundwater resources abstracted mainly from upper sandstone and limestone aquifers that act as the major reservoir of the groundwater of the Administration and it is essential for the urban supply of Dire Dawa (Sabiyan groundwater field) and Harari (Water Work Design and Supervision Enterprise, 2009).

3.1.8. Vegetation

The Dire Dawa Administration vegetation cover is categorized as vegetation of arid and semi arid lands. The main types of species that the shrub land comprises are semi-arid Succulents that include Euphorbia, Aloe, and Dracaena with scattered Acacia shrubs such as Blanites aegypitiaca and Moraceae, Cactus (Opuntia), thorn scrub, and sparse grasses formations. There is no climatic climax forest in the administration except patches of few junipers remnants in the upper parts and

some acacia trees in the low lands. The vegetation in the Administration is not found in the contiguous form covering large area rather it is seen as fragmented patches of bush land, shrub land, and the trees in agricultural sites and hillsides.

The natural vegetations has been cleared to satisfy the demands of the ever-increasing population such as the construction material, fuel wood, fodder, and the agricultural and urban expansion. The remaining forests cover less than 1% while the majority of the landmass is covered with the shrub lands. According to the Land Cover Mapping Units of Dire Dawa Administration (2011), about 12.79% of the total land area of the region is covered by physiognomic vegetation, 8.93% prosopis Juliflora plantation, 7.87% open shrub land and 0.98% dense shrub land. Whereas, the vast area of the region, 69.43%, is an exposed soil, sand or rock with scrubs and grasses.

3.1.9. Population

According to the 2008 census result, Dire Dawa Administration had a total population of 342 thousands during the census period and in the year 2010; the population of the region has reached 380 thousands. On the other hand, the average annual growth rate of the population was 2.5% for the region is estimated to reach 450 thousands by the year 2015 and projected to reach 775 thousands by the year 2030 (CSA, 2008). Similarly, the Sabiyan urban area occupy the greatest number of settlers accounting 13.11% (45 613) of the total urban population of the Dire Dawa Administration. The overwhelming disparity has been caused by the pulling factors like the job opportunities and trade activities. As a result, the Sabiyan area is highly overcrowded with the density of 1097 persons per km^2. The figure is the highest as compared to the region's density 328 persons per km^2 (Dire Dawa Administration Urban Development Program, 2011).

3.1.10. Transportation, trade and manufacturing

The Dire Dawa Administration is accessed by road to Addis Ababa for 515 km and with link road to Harar with 55 km. It is also connected to Djibouti with an all weather gravel link road for 313 km is bordering the Administration. The Dire Dawa – Dewele with satisfactory all weather gravel

road on the way to Djibouti passing through Somali Regional State was upgraded to the asphalt concrete by the Road Sector Development Program for a total length of 214 km (Dire Dawa Administration Road Authority, 2013).

According to the Dire Dawa Administration Finance and Economic Development Bureau (2011), looking into the structure of the economy, the percentage share of occupations under trade and service sales account about 43% share of the total urban economic engagements. About 57% of the engagements were micro-business activities. Foreign trade is also an important component in trade sector. Owing to its strategic location and relatively better transport network, agricultural products such as coffee, livestock, fruits, vegetables, and chat grown on the eastern part of the country are some of the major export items to Djibouti and Somalia.

Dire Dawa constitutes nearly 11% share in the total export that the country performs each year. Major industrial establishments and mining accounts 19% share out of the total created economic engagements in the Dire Dawa city while small manufacturing enterprises, like handicrafts, and the construction engagements (micro-sector engagement) account 27% share of the total urban economic engagements. At present, Dire Dawa assumes a renaissance in industrial development. Private investment in the industrial sector is relatively increasing including the establishment of large factories. Municipality, Small and Micro Scale Enterprise, and Housing Agency are among the newly emerged offices trying to create more temporary employment opportunity in their construction and business activities that have impact on reducing household poverty (Dire Dawa Administration Investment Office, 2008).

3.2. Research Design

This study followed a descriptive survey research design**.** Since the aim is to obtain an accurate description of a situation and considering many different aspects of a problem in the study. According to Limb and Dawyer (2008) studies concerned with specific prediction, as well as, narration of different facts of a problem as it exist as present and portray accurately the characteristics concerning a particular individual, group, community or situation such studies with

this objectives is descriptive research studies, Furthermore, to gain a general impression of the communities or the companies and in order to enable people to explain their thoughts, perceptions, feelings, or beliefs in detail. Based on the above important points, this study focus and relied on the designing of the descriptive research.

3.3. Sample Design

A probability systematic random sampling design was employed to specify the probability of each sampling units being included in the sample. In connection with this, systematic sampling is more convenient than simple random sampling is that, it is much simpler to construct to select every k^{th} persons from a list than to have to use a table of random digits and more amenable for use with very large population or when large samples are to be selected (Fox *et al*., 2009).

In order to make reasonable comparison, the concerned local government officials, stakeholders, factory workers, as well as the representatives of the urban community were purposively included in the sample, because, the samples to be selected are assumed rich in possessing the information required and based on their accessibility small in number. In these cases, the method of sampling employed was purposive non-probability sampling (William, 2009).

3.4. Procedures of Sample Site Selection

The Dire Dawa city, which consists of the Sabiyan area was the site, selected for the purpose of this study based on the following important points. That is, the site is the source of industrial raw materials for the production of cement, the existence of cement factory in the city and the area where the mining quarry is often exercised in the surrounding residents of the urban community. Besides, there has been growing pressure of population settlement on the part of the mining site and cement production operations. In accordance with the expansion of continued self-initiated informal human settlements near the mining site of the factory, the site has experienced relatively serious environmental degradation (Dire Dawa Administration Water Mines and Energy Office, 2006). For these reasons, this study has selected Sabiyan as a representative sample from the

urban areas in the city. The areas left out in this study are mainly areas with almost no investment on cement factory.

3.5. Sampling Procedures and Sample Size

According to the 2015 projection the total population of Dire Dawa was 457 694, out of the total urban population of 347 805 (75.99%), the population of Sabiyan was 45 613 (13.11 %). For this study, the target population was the urban community of Sabiyan in Dire Dawa City. These were key elements of the study area since their views were being solicited on the benefits and problems being presented by the cement factory. Therefore, the total number of urban residents and households at Sabiyan are 45 613 and 11 529 respectively. From the sources of population of 11 529 urban households, a sample of 366 households are selected through statistical calculation and sample size is determined by using the following formula (Fox *et al*., 2009).

$$n = \frac{Z^2 p (1 - p)}{d^2}$$

$$= \frac{(1.96)^2 (0.5) (1 - 0.5)}{(0.05)^2}$$

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

$$= 384.16$$

Where n = sample size

Z = confidence interval at 95% = 1.96

p = prevalence 0.5

d = margin of random error (Standard Error) 0.05

According to Moser and Kolton (2010) stated that the source of population is less than 10,000. Therefore, the correction factor is used to calculate the final sample size is;

Where = final sample size

= calculated sample= 384

= source of population=11 519

For this case the sample size of the urban household is 366.

3.6. Sources of Data

This study needs a significant amount of primary and secondary data sources in order to investigate and understand the existing urban environmental scenario of the study area. For this reasons, the primary data were gathered from a survey of urban households, representatives of urban community discussions, consultation with relevant informants such as workers, head of local elders, Kebele chairperson, the production manager, and the heads of households. On the other hand, the secondary data were drawn from officially published sources, such as policy documents, firm reports, government proposal documents and environmental policy related to the mining site and cement factory were used as background information. Medical records were also obtained from hospital and Dire Dawa health office, Environmental Protection Officer to investigate pattern of diseases. Lastly but not least, different related books, international organization publications, research reports, journals and internet web sites were explored to tap more information (Limb and Dawyer, 2008).

3.7. Methods of Data Collection

According to Freedman *et al.* (2007), the most desirable approach with regard to the selection of the method depends on the nature of the particular problem and resources available along with the desired degree of accuracy. In this context, the methods of data collection used for this study were questionnaires, focus group discussions, and interviews. In this study, qualitative approach was used to collect the primary source of data through questionnaires, interviews and focus group discussions with residents of urban community. Especially, the areas where the cement factory

and mining site are located, the people living and working in and around the cement factory permanently are the major target population of the problem under study directly or indirectly.

3.7.1. Questionnaire

Questionnaires were used to collect primary data from the selected sample households which were involved semi-structured questionnaires filled by the selected samples for making analysis related to the current status of the problems. As far as the form of a questionnaire is concerned, open-ended questions were followed by closed-ended questions to obtain more clarification about the responses of the selected samples. Closed-ended questions were employed to have the advantages of easily handling, simple to answer, and they are most amendable and quick to statistical analysis. Similarly, open-ended questions were designed to permit a free response from the respondents and provide a more complete picture of the respondent's perception and attitude (Dawit and Alemayehu, 2002). Questionnaires were self administered so as to enhance return rate and clarify questions which were written in English and translated into the local language Amharic.

3.7.2. Focus group discussion

Moser and Kalton (2010) noted that, if we wish to find out the perception of people and interested in opinions about a given social reality, experiences, perspectives or situation, a focus group discussion provide us with efficient results and capable of providing valuable data. Due to the above-mentioned facts, the method of focus group discussion was held to gather qualitative data about the situation of the locality and urban community living around the area. The focus group discussion consisted of eight individuals was conducted with involvement of the local elders and representatives of urban community household heads. Elders are involved in the discussion because they have a wealth of information about the environmental phenomenon in the study area. The focus group discussion was undertaken in collaboration with Sabiyan Urban Administration and respective sectoral offices such as Kebele chairperson, the health office Urban Environmental

Protection Officer, the factory production, and the medical staffs about the issues and problems related to the factory and the quarry site in the study area.

3.7.3. Interview

The Interview is one of the main data collection tools in qualitative data, it is good way of accessing people's perceptions and constructions of reality (William, 2009). In-depth interviews were conducted with eight purposively selected key informants such as the Urban Environmental Protection, head of kebele and the local elders, the medical staffs, and the urban household heads with the aim of obtaining information on the location of cement factory, disposal of wastes, the role of local government in decision making processes to resolve urban environmental problems, corrective measures and approaches to control and reduce the impacts of the factory on the surrounding community. The medical staff and Health officer were interviewed on prevalence of diseases and accidents in the surrounding community related to operations of the factory and how they were assisting the local people to have the healthy lives. Besides to gather feedback on the survey findings. The interviews were consisted semi-structured questions.

3.8. Methods of Data Analysis

In this study, both quantitative and qualitative data analysis techniques were employed. The data gathered through questionnaire from sample households' were analyzed using graphs, figures tables, percentages, multiple response (frequency, mean and cross tabulation), and descriptive statistics (frequency and cross tabulation) using the Statistical Package for Social Sciences (SPSS) for Windows 19.0. The data collected through group discussion and interviews were processed (coded, edited, ordered and organized) to generate relevant information. The data collected through group discussion and interviews were analyzed qualitatively through narration. Finally all the data that were collected were interpreted.

4. RESULTS AND DISCUSSIONS

This chapter of the study deals about the socio-economic and demographic description, data presentation and discusses major research findings on the geographical survey of cement factory and the perception of the residents towards the effects of the cement factory in Sabiyan.

4.1. Demographic and Socio-Economic Composition of Respondents

Based on the characteristics of the respondents sex-age distribution Table 1 shows that 67.48% of the samples were males and 32.52% were female respondents respectively. In addition, across all age categories in the sampled community, most of the respondents (63.4%) were aged between 31 and 60 years. This group was composed of economically productive people. Their presence in the area was to expand their livelihood options as wide range of business activities occurred in and around the factory hence increasing income for the local people. This show they have valuable information to perceive the impacts of the factory. Moreover, most of these people were reported that they failed to secure employment in the factory; this concurs with statistics of unemployment currently above 49% in the Dire Dawa Administration (Micro and Small Enterprises Development Agency, 2011).

Meanwhile, the respondents between the age of 18 and 30 years were constituted 28.2% of the sampled respondents. This category was characterized by household of young. Only 8.4% of the sampled households were headed by people above the age of 61 (Table 1). This showed that as people become old, they were not longer energetic or had limited labor force to work in the factory. According to the administration officer informed that elderly people declined to be employed in the factory. This supports the works of Samuel (2009) which state most jobs generated by the cement manufacturing companies were for skilled persons and unskilled jobs in the company were occupied by manual laborers who have strong work power.

Table 1: Demographic and socio-economic characteristics of the respondents

Variables	**Categories**	**Frequencies**	**Percentage %**
Sex	Male	247	67.48
	Female	119	32.52
Total		**366**	**100**
Age	18-30 years	103	28.2
	31-60 years	232	63.4
	≥ 61 years	31	8.4
Total		**366**	**100**
Educational qualification	Non-formal education	54	14.7
	Primary education	179	48.9
	Secondary education	98	26.8
	Tertiary education	35	9.6
Total		**366**	**100**
	Manual Laborers	37	10

Occupational status of respondents	Traders Wage Earners Craft Workers Others	168 33 44 84	46 9 12 23
Total		**366**	**100**

Source: Field Survey, 2015

As it could be inferred from Table 1, the educational status of respondents reveal that about 14.7% of the respondents did not attend any formal educational institution, while the primary and secondary educational attainment is about 48.9% and 26.8% respectively. For tertiary education, the attainment level is 9.6%. Education (literacy) is an index that is often incorporated in measuring the well-being and level of development of a population (Lioyd, 2010). Thus, more than 80% of the respondents are account the largest share of the respondent's level education. The reason is not farfetched as the study community is located close to the city, which has the highest number of the secondary and the tertiary educational facilities within the Administration (DDAEB, 2012). This shows that the local community living around the cement factory has better understanding, perceives, and expresses their concerns regarding the possible impact of the factory.

The occupational status of the respondents in Figure 5 shows that there are more traders (46%) within the sampled community than any other livelihood activity with the wage earners or paid employments including those working at the factory and the Local Government establishments, which accounts to 9% being the least source of livelihood for community members.

Figure 5: Percentage distribution of occupational status of respondents

Source: Field Survey, 2015

The 'Others' category is defined to include students, the unemployed and other service-related jobs which account 23%. Further inquiries revealed that there has been very minimal increment in the jobs opportunities from the cement factory even to the study community. However, responses indicate an increase in the non-formal services work opportunities such as craft workers, cobblestones, manual laborers, bar tenders, restaurants, beauty salons, shops, retailers of consumables goods, especially at Sabiyan, which is closest to the cement factory (Dire Dawa Administration Urban Development Program, 2011).

4.2. Major Features and Status of the Factory

4.2.1. The number classified by level of education

As it is shown in the Table 2 below, the factory runs its operation by a total of about 1577 employees of which 245 are females and 1332 are males. Out of these, about 25.56% are professionals and semi-professionals. It has trained and skilled professionals in the field of cement technology. Responding to interview questions, pointed out that most of the professionals working in quarry operation, production, human resource management, finance, marketing, legal activities, and other work units are skilled to meet professional requirement of the factory.

Table 2: Percentage distribution of classified by level of education

No	Level of Education	Male	Female	Total	Percentage %
1	Degree (Professional)	133	22	155	9.83
2	Diploma (Semi professional)	187	61	248	15.73

3	Technical school Diploma	131	46	177	11.22
4	Grade 9 **th**-10 **th**	379	59	438	27.77
5	Grade 7 th-8 th	144	20	164	10.40
6	Grade 1 th-6 th	358	37	395	25.05
	Total	**1332**	**245**	**1577**	**100**
	Percentage %	**84.46**	**15.54**	**100**	**100**

Source: Field Survey, 2015

4.2.2. Raw and auxiliary materials

The raw and auxiliary materials requirements of the factory are indicated in Table 3. Thus, the natural materials are required in the production of cement are calcareous is very rich in calcium compounds such as limestone (57.34%) and argillaceous is rich in silica such as clay (22.36%). This implies these two groups of raw materials are used in significant large amount while other raw materials such as Pumice and Gypsum are used in small amount. In addition, few amounts of sandstone, bauxite, and iron ore are added to regulate the setting time of cement (Roozbeh, 2014; Cement Factory, 2015).

Table 3: Annual raw and auxiliary materials requirement

No	**Description**	**Unit**	**Quantity**	**Annual raw material consumption Percentage (%)**
1	Calcareous 1.1. Limestone	Tones	1,146,087	57.34
2	Argillaceous 2.1. Clay	Tones	446,976	22.36

3	3.1. Pumice 3.2. Gypsum	Tones	296,711 78,064	14.85 3.90
4	Others 4.1. Sandstone 4.2. Bauxite 4.3. Iron ore	Tones	 12,050 10,000 9,014	 0.60 0.50 0.45
Total			**1,998,902**	**100**
5	Paper Bag (50kg Capacity)	Pcs	6,000,000	

Source; Field Survey, 2015

The major auxiliary material required for the production of cement is paper bag used for packing cement. Unlike other types of paper sacks that are made up of plastic materials, the paper made sack could easily decompose in the soil after use and, hence, are environment friendly products.

4.2.3. Utilities required for various purposes in the factory

According to the information indicated in Table 4. Cement is produced by heating and burning of a mixture of limestone, clay, pumice, and gypsum. It requires utilities such as electric power or fuel for the machines, each tone of cement produced requires approximately 104KWh of electricity. Thus, the factory consume large amount of electric power from the national grid for production of cement and other heavy-duty machines. The factory also used a diesel generator as the emergency supply. The International Finance Corporation (IFC, 2007) indicates that cement and limestone manufacturing projects result in the air emissions, immense energy consumption, and wastewater generation and recommends the cement plants to install pollution prevention and control techniques.

Table 4: Requires utilities for the production of cement

No.	Description	Unit	Total quantity
1.	Electricity • General electrical consumption of cement production per tone (3836 tones per day) • Annual overall electrical consumption • Diesel generator	104 kWh/ tone kWh kW	398,944 1,200,000 800
2.	Water consumption	m^3/day	1995
3.	Fuel oil consumption	Liter /year	3,370

Source: Field Survey, 2015

Water is also another utility required for various purposes. Drawn from the above table, the total water consumption of the factory is for domestic use and production system. The Dire Dawa Administration Water Supply and Sewerage Authority Hydro Geology study (2012) reviled that the area is endowed with potential ground water resource. Therefore, abstraction of water was a good opportunity to satisfay the water consumption of the factory. In line with this, Most of the water is evaporated during the cement production process but the remaining water is discharged in to the surrounding environment. This reflects the absence of intention to the discharged water of the factory. Therefore, the cement manufacture and handling facilities should be designed to control and treat any surface water, so that there is minimal impact from the discharge of excess water into the local environment (Diborah, 2008).

4.2.4. Production capacity of the cement factory

As it is shown in Table 5, the annual production capacity of factory in 1946 was about 60,000 tones of cement. In 2005 improved and upgraded the factory performance it has operated at a capacity of 0.2 million tones of cement per year. However, due to bring a new 1.2 million tones per year project in 2013, the factory have a combined production capacity of 1.4 million tones per year.

Table 5: Production capacity trend of the cement factory (1946-2013)

Year of production	Production capacity (tones per year)	Description of the factory
1946	60,000 tones	The first and the old cement factory
2005	0.2 million tones	Improved the factory performance
2013	1.2 million tones	Second cement factory
Combined production capacity	1.4 million tones	Existing capacity

Source; Field Survey, 2015

Based on the data presented in Table 5 shows that production of cement is characterized by a growth trend. Over the years period covered by the data set (2005-2013) the production was relatively growing. According to the interview result the main reason for this underlined that following increased construction activity over the region, demand for cement is currently at increasing rate. Presently, the factory is working shifts per day. There is large market demanding cement in the Somali region, Harar and Afar areas. Therefore, it is quite reasonable to think of additional new cement factories and expand the existing factory to raise its production to supply this large market.

4.2.5. Cement production process

According to the report, the raw materials used in the cement production process are usually mined in nearby quarries site requires the use of drilling and blasting techniques. The raw materials are loaded into trucks for transportation to the crushing plant. The cement production process takes place in factory and involves crushing and grinding the raw materials, blending the raw materials in the correct proportions, burning the prepared mix in a kiln, and grinding the burned product together with gypsum (Figure 6).

The raw materials are first crushed in the crusher then proportioning of the chemical composition required for the particular cement is obtained by controlling the raw material fed to the crushing and grinding machines. In the cement factory, the wet manufacturing process water is added to the raw materials to form slurry. The slurry is the mixed, blended to the correct chemical composition, and pumped to the kiln for burning (Zeyed, 2011; Assefa *et al*., 2014; Roozbeh, 2014).

Cement production is energy-consuming process, the temperature at the firing ranges from about 1,350 to 1,550 °C, depending on the raw materials being burned (Nordby *et al.*, 2011). The burned products pass into coolers, where the product is cooled by cold incoming air and water immediately stored in stockpiles for later use. The material pass straight through the cement mill and coarser material separated from the ground product and returned to the cement mill for further grinding. Finally, finished cement is pumped pneumatically to storage silos from which it is later drawn for packing in paper bags.

Figure 6: Cement production process flow chart

Source; Field Survey, 2015

Cement production requires lots of energy and materials that is usually accompanied with the various forms of environmental impacts. Therefore, cement production is among the greatest sources of human-induced greenhouse gas emissions and the cement industry is under increasing pressures to reduce its Carbon dioxide emissions and search for ways to decrease the environmental impacts associated with the cement production (European Environment Agency, 2009; Amin and Ali, 2010; Roozbeh, 2014; Anuradha, 2016).

4.2.6. Product description and application

In construction works, among the cementing materials, the widely used product in construction works is the Portland cement (Nordby *et al*., 2011; Global Cement Magazine, 2014). Similarly, the Portland cement is produced by burning mixture of limestone and clay materials and grinding to a fine powder, usually with few portions of gypsum, pumice, and sand. Other cements of vital importance in construction works can be produced by using the Portland cement as a base material.

- Ordinary Portland cement
- Portland Pozzolana cement
- Portland limestone cement
- Low heat of hydration cement based on customer order
- Paper sacks
- Gypsum
- Pure limestone

d.3. Environmental, Socio-Economic and Health Impacts of the Factory

The environmental, socio-economic and health impacts associated with the activities of mining and cement production is carried out to extract information from key informants within study area. The study identified the likely impacts of limestone mining and cement production using the Likert format of questions. The sample respondents at the urban community responded to the likelihood of these listed impacts.

According to the results obtained from the Table 6, 67.8% of the respondents strongly believed that there is removal of vegetation cover due to limestone mining in the area. This may be attributed to the fact that limestone mining in the study area has resulted into the conversion of urban lands into quarry sites. Yet, from the interviewed residents of the study area, almost more than 71% of them mentioned that one very important impact of the quarry is indiscriminate clearing of vegetation. This simply means that large area of lands have cleared by graders and

loaders to load and transport limestone to the factory site. This result supports the findings of Noor and Faridah (2009) and Busuyi, *et al.* (2010) that reported in the course of using the quarry, the cutting and clearing of the trees continued, resulting into a large expanse of land exposed to rainwater and wind, thereby worsening the problem of soil erosion.

According to the information obtained from the urban community of the local elders in the surrounding sites, there were various vegetation species in the area of the mining site. At present, the initial vegetation cover reduced. This is mainly due to continuous stress on the area for extraction of industrial raw materials, removal of soil by mining activities, and urban expansion.

Table 6: Perceived impacts on the environmental and socio- economic condition of the residents

Perceived impacts associated with the activities of mining and cement production	Response option						
	Strongly Agree		Not sure		Strongly Disagree		Total
	Freq.	%	Freq.	%	Freq	%	No
Removal of vegetation cover due to limestone mining	248	67.8	41	11.2	77	21	366
High noise levels during limestone blasting and cement production operation	293	80	12	3.3	61	16.7	366

Source: Field Survey, 2015

Another key phenomenon seen in the factory and mining activities was the level of vibration and noise generation by various heavy machineries as well as the explosion and blasting works. Based on the result in Table 6, the majority of respondents, which accounts for 80% agreed to the statement that say, “There is high noise levels during limestone blasting and cement production”. Additional evidence to support this assertion is the explanation given during focus group discussions while this is substantially complied with in the cement factory workers; the noise level is still above the minimum for the residents of the community. It must be noted that this used to constitute a major problem to the community in the area.

The empirical investigation by Wright (2012) reveals that in recent years, particularly in the developing countries most of the cement factories does not yet meet the standards allowed for noise level set by the Environmental Standards for Cement Manufacturing Industries. This is because many of the respective Environmental Protection Authority of the countries across the region was not involved in monitoring and supervising the activities of the factory, the standards did not apply. Thereby exposing residents to avoidable inconveniences. There are several studies on the noise exposure among communities of the cement affected areas shows that higher noise exposure has been reported in developing countries This difference caused by established regulatory actions and more advanced technical control measures in the cement industry in industrialized countries than in developing countries (Javed *et al.*, 2012).

4.4. Perceived Impacts Associated with Wastewater Discharge and Liquid Effluents

Regarding the perceptions of wastewater discharge and liquid effluents, most of the respondents (83.6%) were strongly agreed to the statement "Impacts associated with discharge of wastewater (water, sewage, cooling water)" (Table 7). A recent survey carried out by the Health Bureau in 2013 shows that the present practice of sullage (grey water) disposal in the city is mainly wastewater discharge from the factories (65%), the liquid waste from the villagers (31%) and other (septic tanks, pit latrines, 4%). Nevertheless, the main challenge is that all the waste components (solid and liquid wastes) are disposed at the zone of groundwater potential areas and may easily contaminate the water sources. Thus, it is convenient to say that according to the above result, the poor sanitation condition together with the lack of proper waste disposal mechanisms were contributing factors to pollution of water resources of the area.

Table 7: Impacts associated with wastewater discharge and liquid effluents

Perceptions of respondents on waste water discharge and liquid effluents	Response option			
	Strongly Agree	Not sure	Strongly Disagree	Total

	Freq.	%	Freq.	%	Freq	%	No
Impacts associated with waste water discharge	306	83.6	26	7.1	34	9.3	366
Impacts of liquid effluents associated with lubricating oil, grease, diesel, and gas leakages	277	75.7	31	8.4	58	15.9	366

Source: Field Survey, 2015

Based on analysis of responses in Table 7 above, another important impact of the activity is lubricating oil and gas leakages. This was confirmed by 75.7% of respondents. The respondents further explained that this comes from the factory workshop sites, garages and oil tank sites through leakages. Similarly, a related study conducted by Taye (2010) also stated that the main sources of pollution are linear source pollution of industrial liquid waste disposal directly into the open ditches and sandy streams. Therefore, it is believed that this can have quite an impact if it finds its way into water drainage outside the factory. Furthermore, it can also lead to quite an ugly site if allowed to accumulate on a given site. This indicates that they need critical attention to prevent and control.

4.5. Perceived Impacts Associated with Social Health

According to the results in Table 8 indicate that the major diseases causing the highest mortality among the population are mostly related to communicable diseases, such as malarias, diarrhea intestinal parasites, typhoid fever, respiratory tract infections, pulmonary and tuberculosis is widely spreading and causes of deaths linked to the inadequacy of sanitation and water supply.

Table 8: Top ten diseases in Dire Dawa Administration

Types of disease	Patients m^3/day percent	
	Number	**Percent**
Upper Respiratory Tract Infections (URTI)	4524	17.5
Pneumonia	4522	17.5
Tuberculosis	3417	13.2
Malaria	3001	11.6
Acute Febrile Illness (AFI)	2464	9.5
Dysentery	2007	7.8

Gastrio-duodenitis	1975	7.6
Urinary Tract Infection (UTI)	1343	5.1
Skin infection	1318	5.1
Sexually transmitted infection HIV/AIDS	1297	5.0
Total	25868	100

Source: Hospital out patient department, 2013

According to the information from Sanitary Department of the Dire Dawa Administration (2013), there are reports and water sample results that show the overwhelming health problems are diseases resulting from poor environmental sanitation, inadequacy of save water supply and malnutrition compounded by poverty and ignorance. The prevailing environmental health problems include the industrial wastes disposals, unhygienic domestic waste disposal, inadequate and unsafe water supply, poor housing conditions, and poor personal hygiene in homes and in public establishments. (DDA water supply and sewerage authority, 2012)

In order to assess the possibility of increased water born diseases, the results in Table 9 indicate that majority of the respondents (85.5%) in the study area strongly agree with possibility of creation of breeding grounds due to stagnant water. Stagnant water is a breeding spot for pathogens such as mosquito, which causes malaria (Hnizdo *et al*., 2011). This implies the local

community is worried about the consequences of stagnant water from that might affect their health.

Table 9: Perceived Impacts associated with water born diseases and dust deposition

Perceived impacts associated with social health	Response option						
	Strongly Agree		Not sure		Strongly Disagree		Total
	Freq.	%	Freq.	%	Freq	%	No
Impacts associated with increased water born diseases	313	85.5	6	1.6	47	12.9	366
Impact of dust deposition on the ground and human population	326	89	17	4.7	23	6.3	366

Source: Field Survey, 2015

This result supports the findings of Ministry of Health (2009) shows that the average percentage of people infected with Malaria in Dire Dawa Administration is 5.7% higher than the national average. Generally, the level of Malaria prevalence is higher amongst the population living in or around urban centers. Focus group discussions with the representative of the household heads revealed that due to the remaining mined out area during the rainy seasons, resulting in the formation of water pools. These water pools with their subsequent solid debris as well as the people who live in congested compound in the factory used these pits as temporary garbage to dump their liquid and solid wastes. The above results are liable to changes the physical, biological, and chemical properties of the ground water.

According to the result in Table 9, indicate that majority (89%) of the respondents perceived the impacts of dust from the activities of cement production on human and plant populations within the community. Additional evidence from field observations showed cement dust deposited on the ground. Furthermore, the interviews with key informants also explained that people residing in the

area complained the severe impacts of dust. it was clearly stated that the residential roofs and adjoining community houses are thickly dusty. This signifies a health problem, which needed attention in order to protect the local people. This is consistent with findings from similar research works on effects of cement dust on human health (Ambasht, 2010: Sultan, 2010; Sabah and Abdul, 2011; Assefa *et al*., 2014).

This may be due to the fact that, these households were located in proximity of the factory. This situation coincide with Ambasht (2010) findings cement production had serious detrimental impacts on community health. During group discussions with key informants, it was clearly stated the underlying cause for diseases are mostly respiratory and airborne diseases. In addition to the fact that cement dust is capable of reaching all organs of body thereby affecting the different tissues such as heart, liver, spleen, bone, muscles and hairs and ultimately affecting their micro-structure and physiological performance.

4.6. Social Impacts Associated With the Activities of Cement Production

According to the result in Table 10 indicate that majority of the respondents (69.3%) were expressed their strong belief that social tension due to unprecedented influx of people in search of employment and market speculators during the operation of the factory. According to the interviews result with representatives of the residents reveals that due to the increasing number of day laborers, long-distance truck drivers, female sex workers, construction workers, informal street traders, and unemployed youths in the area might bring diseases that are not common in the area as a critical problem. That is a negative signal that communities are less satisfied with it. Moreover, truck drivers who transported were blamed for spreading HIV/AIDS.

The interviews with HIV/AIDS prevention and control officer explained that the frequently cited most-at-risk population groups in Ethiopia include female sex workers, youths (14 to 24 years), the truck drivers, migrant workers, and day laborers. Dire Dawa is the hometown for many foreigners and tourists from neighboring Djibouti and Somalia. Furthermore, there are a number

of female sex workers, truck drivers, cross-border businesspersons, traders, day laborers and unemployed youths are believed to increase the risk of HIV transmission (Deribew, 2009).

Table 10: Social tension and road traffic accidents

Social impacts associated with the activities	Response option						
	Strongly Agree		Not sure		Strongly Disagree		Total
	Freq.	%	Freq.	%	Freq	%	No
Social tension due to increased population	254	69.3	21	5.8	91	24.9	366
Increased road traffic accidents due to truck/vehicle movement	288	78.7	49	13.4	29	7.9	366

Source: Field Survey, 2015

According to the results from Table 10, 78.7% of the respondents perceived and specify the safety problems of local people from the increasing number of big trucks. There is also evidence that shows there are trucks consistently travel through the area daily for transportation of raw materials up to the discharge site and products shipped out from the factory. Based on the analysis of the records shows that majority of the accidents affecting the people are injury from traffic crashes. In addition, this result supports the finding of Abdurrahman (2012) stated that risk of accidental injuries due to vehicular traffic approximately 1000 truck/vehicle movements per day used for transportation increase the rate of exposure to accidents. In the same way, the Road Authority (2013) identified that the area by virtue of its size and location as a trading and industrial center has high road density that they had low capacity to accommodate traffic. The local community also confirmed this during group discussions that increase accidents and injury

from traffic crashes on the major highway. Furthermore, the people were frustrated and developed sense of insecurity where the accidents mainly from the movement of Dum trucks are beyond the acceptable limits. The analysis here indicated that increase in traffic might increase the rate of exposure to accidents (Braden and Leys, 2010).

4.7. Residents' Perception of the Environmental Impacts of the Operation

As it can be observed from Table 11, Air (88.25%) and Water (70.77%) are the major pollutions perceived by majority of the respondents respectively. Thus, from the result, it is quite obvious that air pollution is the major environmental problem experienced in the community. This is not unexpected being in mind that majority of the respondents live within less than 2km to the factory site and having noxious effect in community.

Table 11: Common source of pollution perceived

Source of pollution	Yes		No		No Response		**Total**
	Freq.	Percentage (%)	Freq.	Percentage (%)	Freq.	Percentage (%)	

Soil contamination	164	44.80	199	54.38	3	0.82	366
Water pollution	259	70.77	106	28.96	1	0.27	366
Air pollution	323	88.25	42	11.48	1	0.27	366
Noise Pollution	233	63.66	131	35.79	2	0.55	366

Source: Field Survey, 2015

Additional evidence to support this assumption is the case of Addis Ababa Cement Factory. However, following the obsolescence of the machinery and increase in the dust emission level, which brought about pollution in the surroundings, the plant has been forced to stop production of cement in 1996 as proven in other studies by Geological Survey of Ethiopia (2009) and Yirgalem (2011).

4.8. Distance of Residence to the Cement Factory

According to the result in Table 12 shows that the majority of the respondents (257) representing 70.21% of the respondents lived within 2km away from the factory; this means they are under the influence of pollution resulting from the operation of the factory. In addition, this supported that fugitive particulate emission from a cement plant impacts to a nearby community (Sabah and Abdul, 2011; Anuradha, 2016).

Table 12: Distance between individual houses

Distance (Kilometer)	**Frequency**	**Percentage (%)**
Less than 1	118	32.24
1-2	139	37.97
2-3	74	20.22
Above 3	35	9.57
Total	366	100

Source: Field Survey, 2015

4.9. How Residents Cope with Effects of the Pollution?

Table 13 below indicates the residents' perception to cope with the effect of the pollution. The result showed that 72.95% of the total respondents strongly agree to live in the area with the effects of pollution. However, very few respondents (3.56%) strongly agree to migrate to another area, while 69.03% of the respondents strongly agree to complain to health authorities and lastly, 53.01% of the respondents strongly agree the factory to utilize more efficient and updated technology to enable safely dispose of the waste they produce. As it can be observed from the analysis below majority (72.95%) of the respondents would prefer to live with it due to various reasons. It might likely be due to economic reasons and psychological attachment to their area.

Table 13: How residents cope with the effect of the pollution?

Residents' perception to cope with the effect of the pollution	Response option						
	Strongly Agree		Not Decided		Strongly Disagree		Total
	Freq.	%	Freq.	%	Freq	%	
Live with it	267	72.95	34	9.29	65	17.76	366
Migrate to new area	13	3.56	99	27.04	254	69.40	366
Complain to health authority	249	68.0	16	4.37	101	27.6	366

		3				0	
Utilized latest production technology	194	53.01	0	0	172	46.99	366

Source: Field Survey, 2015

4.10. Efforts of the Factory in Mitigating the Effects of Pollution

According to the result from the table 14 below, it is clear that majority of the respondents put the blame not doing much to address the problem. Similarly, Responses from the interviewed household heads that nothing done to compensate them for the problem.

Table 14: Efforts in mitigating the impacts of pollution

Statement	Response Options						Total
	Agree		Disagree		I don't know		
	Frequency	%	Frequency	%	Frequency	%	
Efforts in mitigating the impacts of pollution	89	24.31	264	72.13	13	3.56	366

Source: Field Survey, 2015

4.11. Suggestions of Respondents on How to Improve Community Development Effort

Table 15 revealed that the majority of the respondents (78.96%) were strongly agreed with the factory should be adopted strict environmental standard and environmental regulations plan to prevent and control the impacts associated with cement production. However, 71.86% of the respondents were strongly against the factory being relocated.

Table 15: Suggestions of respondents on how to improve community development effort

Suggestions of respondents on how to improve community development effort	Response option						
	Strongly Agree		Not Decided		Strongly Disagree		Total
	Freq.	%	Freq.	%	Freq	%	
Relocate the factory	77	21.04	26	7.10	263	71.86	366
The factory shall be compelled to increase compensation	146	39.62	98	26.78	123	33.60	366
Adopt strict environmental standard and regulations	289	78.96	19	5.19	58	15.85	366

Source: Field Survey, 2015

This may not be unconnected with the economic benefits the cement factory is providing them. There was evidence that some members of the community are participating in cement business. According to the results from the interviewed of residents showed that the provision of these opportunities for commercial activities would lead to a better life.

4.12. Efforts of the Factory to the Surrounding Community

According to the data indicated in Table 16 below, 28.97% of the respondents acknowledged that there has been assisting the local community by providing healthcare facilities and creation of employment opportunities. However, 64.75% of the respondents thought their investments were not commensurate with the profits they were making. This sometimes strained the relations between the factory and community members as local people expected more investment done by the company in their community. Therefore, the cement factory better to focus on creating awareness on development of the local community and promoting the efforts of the cement factory on controlling the problems to make good relationship with the community and the factory must publicise its efforts for them to be appreciated by the local community.

Table 16: Efforts of the factory to the surrounding community

No	Efforts to the surrounding community	Response options						
		Agree		Not sure		Disagree		Row Total
		Freq.	%	Freq.	%	Freq	%	
1	Socio-economic benefits to surrounding community	106	28.97	23	6.28	237	64.75	366
2	The efforts to improve health and sanitation	76	20.77	27	7.38	263	71.85	366
3	Provision of medical facilities	89	24.32	5	1.37	272	74.31	366
4	Creation of employment	65	17.76	0	0	301	82.24	366

Source: Field survey, 2015

Based on the details obtained from the labor force survey conducted in 2011 revealed that the permanently employed only few of the local population. The majority were engaged on work that requires little skills. This corresponds with Samuel (2009) findings that most jobs generated by the manufacturing companies were for skilled persons. This left menial and disagreeable jobs to unqualified people. They noted that people from the nearby city occupied most semi-skilled and unskilled jobs. Lack of employment creation for locals contradicts with Urban Development Program (2011) contention that employment must favor to the local population instead of importing labor.

5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1. Summary

Cement industry is among the sectors, which are given priority in the industrial development strategy in Ethiopia. Similarly, Dire Dawa well set up geologically for cement production has large limestone reserves. Furthermore, in terms of production Dire Dawa City is the historical centre of the Ethiopian cement factory. However, the socio-economic and environmental challenges from the established cement factory as well as the quarry from where the raw material mined are high, particularly on the urban community residents who live and work in congested compounds around the factory site. In this study, survey of urban households on the impacts of cement factory and the residents' perception towards the effects of the factory was conducted. For this study, 366 sample urban households selected using a probability systematic random sampling technique. In order to make reasonable comparison, the key informants were selected purposely based on their accessibility, rich in possessing the information required and small in number. Both the primary and secondary data were used as source of data. Questionnaires, interviews, and focus group discussions were used as method of data collection instruments for this study. The data were processed and presented using graphs, figures, tables, percentages, and descriptive statistics using the Statistical Package for Social Sciences (SPSS) for Windows 19.0.

Through the data analyses and discussions, the investigator came up with the following major findings.

- Majority of the respondent identified that the impact of dust deposition on the ground and human population followed by the possibility of creation of breeding grounds due to stagnant water that causes malaria, the wastewater discharged as well as the high noise levels as the major problems in the study area. Furthermore, some of the respondents, which accounts for 78.7% and 75.7% identified that road traffic accidents due to increased truck/vehicle movement and lubricating oil, grease, diesel and gas leakages are the serious problems to the residents in the study area respectively.

- Majority of the respondents perceived the environmental impacts is the major problem in the study. This is due to the fact that majority of the respondents (70.21%) lived within

2km from the cement factory site. This means they are under the influence of pollution resulting from the operation of the factory in their location.

- Additionally, the presence of stagnant water at the study area implies that the human population of the community is directly susceptible and vulnerable to water borne diseases. Although, it has been reasonably argued that malaria major water borne diseases thrives unimpeded at the locations with similar deteriorating physical and environmental conditions. Already, a significant proportion of the sampled population (85.5%) and the Health Office records reveal increasing cases of malaria within the study area.

- It is also found that provision of socio-economic benefits to the surrounding community were not commensurate with the profits they were making. Majority of the respondents mentioned that there were no substantial development was being spearheaded by the company to surrounding households. Although most of the households were not impressed by efforts of the company, poor co-ordination and selective implementation of its initiatives undermined equitable development in the area.

5.2. Conclusions

Based on the findings of the study, the following conclusions are drawn.

From the study, it is concluded that though there have been efforts on the part of the factory to reduce their impacts, more still needs to be done especially in the area of environmental monitoring. The need for authorities to provide the community with less irritating means of protecting themselves from dust inhaling is very important. The siting of cement factory should be strictly controlled such that the menace of noise, vibrations, dust, and heavy vehicles movement will be brought under control and far from cities. Aside from that, the excavated area should be properly filled to prevent the contamination of groundwater. Besides these, growth in the vegetation cover around cement factory can be noticeably influential to absorb and stop dispersing of pollutants via such projects like afforestation programme that involve planting of varieties of

trees that have ornamental values, can hold the soil structure well and could cover the exposed land well.

Most people mentioned the possibility of creation of breeding grounds for disease due to stagnant water. Therefore, Monitor and control of mosquito breeding sites, Inspect for the presence of disease and strengthening of local health facilities through public enlightenment and direct contribution in terms of provision of infrastructures, drugs, and public health programmes to protect against malaria etc.

There is a general need for regular workplace inspections and health surveillance programs in the factories to monitor activities and to identify people and workers with respiratory health problems as early as possible and implement effective administrative control of the work environment. Another important impact of the activity is leakage. Such measures as checking the oil seals regularly and monitored periodically and following a well-guided disposal programme for such oil would have prevented such impacts within and outside the factory.

Since there is safety, problems from the increasing number of big trucks. Road signs should be placed at appropriate locations to alert motorist along the highway especially around the factory site. Speed limits should be enforced for all vehicles and trucks moving into and out of the factory in order to minimize injury from traffic crashes, Put warning signs (written in English and local languages) at strategic sites.

5.3. Recommendations

The following recommendations were suggested based on the study result.

- The study recommends that the factory must adopt effective environmental management tools and adoption of improved and cleaner production technologies to reduce dust emissions to enhance wholesome benefits accrued by the local people. This significantly improves the environment and human health for the surrounding households. Increase

employment opportunities for local people, Furthermore, in order to achieve and promote profitable growth, the factory strives to create highly competitive workforce in manufacturing of cement products. The factory should be trained the employers in various fields of technology to meet professional requirement of the factory and capable of handling every activity in the field.

- The company must also make their local investments commensurate to their profits if they want to change the perceptions of some community members. The local people must as well effectively implement projects initiated by the company to ultimately enhance development. Create mechanisms to facilitate the active involvement and participation of all concerned, particularly communities and people at the local level in decision-making on land use and management. The environmental conditions require the attention and willed intervention of the government, with the Local Government Administration. By now, Government policies and regulations are placing increasing restrictions on industrial emissions, operating practices, health, and safety of the local people. This will influence the cement industry to follow the spirit of the law.

- Moreover, the government, factory, and the community should be encouraged to be partners in progress. They can jointly involve in monitoring environmental resources depletion, especially the compliance level of the factory to minimum standards for sustainable and pollution free society.

5.4. Research Implications

This study suggests the following implication for further research:

- Since this investigation involved a survey instrument consisting of Questionnaire, Interview and Focus group discussion, further investigation would be good if conducted using direct observation and analyses of satellite images by applying appropriate modeling and software techniques to determine each individual household's perceptions and

differences. it is hoped to be a valuable source of information that maybe considered by all concerned organizations which claim to have an interest in making cement factory more productive and to create a clean and healthy urban environment. In addition, it may also help for future researchers as source of data for those who want to conduct an in depth study on similar issues.

5.5. Policy Implications

Based on the findings, the following possible policy implications are made:

The growth of cement producing factories in Ethiopia plays an important role and has significant contribution to economic growth. However, the cement-manufacturing sector to some extent is least industrialized in terms of technology status, labor skills, and export capabilities. To overcome these problems, the appropriate combinations use of skilled manpower, modern and suitable technological level and investment on both public infrastructures and manufacturing activities have to be made. These are done through direct support industries by the government in terms of finance and professions, upgrading personal and institutional capacities of the factory. Specifically, review and develop policies to support the best possible use of resources.

It is extremely important due attention for the cement producing factories have to give pre-employment technical skill training and job training on workplaces using actual work machines and equipment to enhance relevant skills in the field of cement processing technology in improving volume and quality of products.

Moreover, there is the need for the government to intensity effort in the implementation of Environmental impact assessment of cement industries now and in the future considering the nature of its impact on all aspects of human life. Aside from that, the Health Office and the Environmental Protection Authority has to make efforts to achieve a meaningful level of community participation in its endeavors to create a clean and healthy urban environment. In spite of all that has been stated above, cement manufacturing projects should be executed in accordance

with the available polices and legal framework. In addition, the technology proposed for the production of cement should be the best available globally and environmental friendly.

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7. APPENDICES

Appendix-A

Dear Respondents,

The main purpose of this questionnaire is to gather relevant information on the social, economic and environmental impacts on Sabiyan urban community residents who live and work in congested compounds around the factory site**.** Thus, respondents by understanding the importance of this study work, I kindly request you to fill this questionnaire honestly with out any hesitation. For all your cooperation, I thank you in advance.

Part 1: Background information of the respondents

Please give the required information in the appropriate space.

1.1. Address of the household head/respondent City _____ Kebele _____

1.2. Sex Male Female

1.3. Age of household head_____

1.4. Educational background of the household head

Non-formal education Primary education Secondary education Tertiary education

1.5. Occupational status of respondents. Putt an (x) mark inside the appropriate box

Manual Laborers Traders Wage Earners Craft Workers

Part 2: Read and putting an (x) mark inside the appropriate box that indicates your opinion.

2.1. Identify the likely impacts of mining and cement production at your surrounding

Impacts associated with the activities of mining and cement production	Response options		
	Strongly Agree	Not sure	Strongly Disagree
Removal of vegetation cover due to limestone mining			
High noise levels during blasting and production operation			
Impacts associated with waste water and liquid effluents			
Impacts associated with lubricating oil, grease leakages			
Social tension due to increased population			
Impacts associated with increased water born diseases			
Impact of dust deposition on the ground and human			
Increased road traffic accidents due to truck movement			

2.2. According to your Perception which sources of pollution is a serious problem to the surrounding community in your area? Putt an (x) mark inside the appropriate box.

Soil contamination Air pollution

Noise Pollution Water pollution

2.3. How much do you estimate the average distance from your home to the factory?

Less than 1 Kilometer 2-3 Kilometers

1-2 Kilometers Above 3 Kilometers

2.4. What are the major social problems that you confront while living around the factory operation? Have you experienced any social problems?

2.5. Do you believe that factory shows efforts in mitigating the impacts of pollution in the area?

Strongly Agree Strongly Disagree Not Decided

2.6. How do you cope with effects of the pollution? Putt an (x) mark inside the appropriate box

Strongly Agree Not Decided Strongly Disagree

Live with it

Migrate to new area

Complain to health authority

Utilized latest production technology

2.7. Suggest how to improve community development effort and the impacts. Put an (x) mark inside the appropriate box.

	Strongly Disagree	Not Agree	Decided	Strongly Agree
Relocate the factory				
The factory shall be compelled to increase compensation				
Adopt strict environmental standards and regulation				

2.8. What are the efforts of the factory to the surrounding community?

2.9. Did you receive any form of assistance when you were lived in this area? Explain any form of assistance

_____

_____

2.10. How do you evaluate the efforts in mitigating the effects of pollution in the area?

_____

Appendix-B

Questions for interview to key informants

Date of interview: Day _____ Month _____ Year _____

Interviewed by: _____

1. What are the impacts of the factory on the urban community residents?

_____

_____

2. According to your perception, can you mention some of the causes for the diseases and accidents in the surrounding community related to operations and how they were assisting the local people to have healthy lives?

_____

_____

3. What do you think is the primary factor behind the choice of location for a cement factory and mining sites?

   Proximity to end user markets and advantages in labor market conditions ☐
   The availability of raw materials in convenient deposits ☐
   Government policy concerning investment incentives to cement producers ☐
   Huge demand for cement and expansion of infrastructure development ☐
   Accessibility to transportation and transport cost ☐
   Quality of infrastructure and production cost ☐
   Greater prospects for profit and tax incentives ☐
   Please, briefly describe if there are any other factors, which are negatively affecting local community in the study area._____

4. What are the major social problems that community confront while living around the factory operation and mining? Can you mention some of the social problems associated with the operation and mining in the residents' area?

   _____

   _____

5. How do you evaluate the waste disposal service in the area, in comparison to the existence of factory and limestone quarry in your area?
   More clean Less clean No difference

6. If your answer for question number 5 is 'less clean', why do you think?
   Because the residents of the area do not manage their wastes properly
   Because the area receives lower (limited) waste disposal service
   Because there is no follow-up by the responsible bodies to practice the rules and regulations of waste management in the area
   Because their inability to safely dispose of the waste they produce

Because their limited awareness of the potentially harmful effects of their activities

If any other, please describe? _____

_____

7. To what extent is the role of local government in the decision making processes to resolve urban environmental problems?

   Very high ☐ High ☐ Moderate ☐ Low ☐ Very low ☐

   If very low, explain the reasons_____

8. Do you believe that the factory shows efforts in mitigating the effects of pollution?

   Agree Disagree I don't know

9. What needs to be done the management of the factory especially in the area of environmental monitoring to reduce their impacts?

   _____

Thank You for your cooperation

Appendix-C

Group discussion topics for (representatives of urban community, workers, head of local elders, Kebele, Urban Environmental Protection, , the medical staff, and the heads of households)

1. What are the perceptions of the residents' of urban community towards the existence of cement factory around the study area?
2. What are the impacts of the cement factory on the urban community residents of Sabiyan in Dire Dawa?

3. What factors determined the location of cement factory and mining sites in sabiyan area of Dire Dawa?
4. According to your Perception which sources of pollution is a serious problem to the surrounding community associated with the activities of factory operation and mining in your area?
5. What are the major social problems that you confront while living around the operation and mining? Can you mention some of the problems in the residents' area?
6. How do you evaluate the efforts of the factory in mitigating the effects of pollution in the area?
7. Who do you think is mainly (believe) responsible for monitoring the environmental, social and economic impacts of the company to the surrounding community?
8. Suggest how to improve community development effort and reduce the impacts of the factory?
9. What are the benefits and problems being presented by the company?
10. What are the efforts underway to build its corporate image?

Thank You!