32nd Annual Research Bulletin

Theme III Energy, Engineering and Information Technology

Theme IV Human and Social Development

Theme VI Basic Science Research

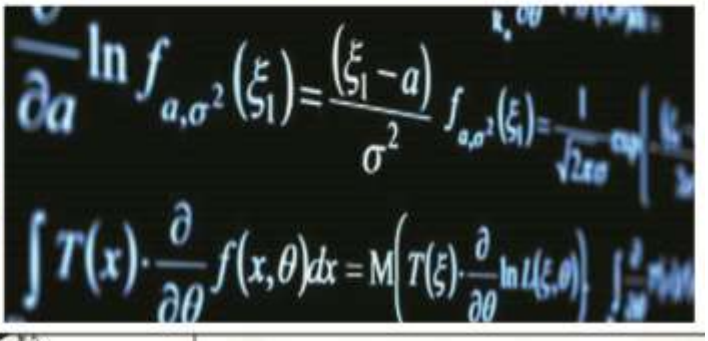

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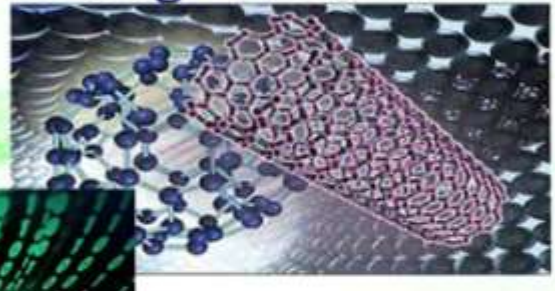
Table of Contents

Theme III

32nd Annual Research Bulletin

Energy, Engineering, and Information Technologies



Theme 3

1. Biogas Production System Design and Bottling in CNG Cylinder and its Feasibility

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Abstract: This study was conducted on designing biogas production system and bottling it in CNG cylinders and its feasibility by crosschecking field survey and data analysis. The field survey data supported the opinion about the importance of constructing biogas plant for Haramaya University where the 8000kg biomass was gathered from ten thousand students' night soil and four hundred cattle's. The study indicated that at optimum condition, 529 m^3/day volume of biogas was obtained from 8,000kg of biomass. The 529m3 volume of biogas produced per day could substitute 19,837.5kWh of electricity. Compressing biogas reduced storage requirements, concentrated energy content and increased pressure to the level needed to overcome resistance to gas flow. As the result of installing compressor for this system, 529m3 of biogas volume was stored in 68m3 of pressure vessel, and the pressure increased to 1600kpa from 110.64kpa. In this study, it was possible to see that the biogas system design for the campus was financially as well as economically feasible as the net present value was positive and benefited cost ratio was greater than one.

1. Introduction

Problem of growing energy consumption and diminishing supplies of fossil fuels has led researchers to find alternative renewable energy sources; and consequently, the development of new technological processes of energy production. One of the renewable energy resources is the biogas produced from green energy crops and organic waste matters.

Conversion technologies for the production of energy from biomass can be classified as biological or thermal (Claasen *et al.*, 1999). The choice between the technologies depends strongly on the material properties together with the social and economic situation. Anaerobic digestion is one of the biological technologies to produce renewable and clean energy (i.e. biogas) from biomass. Besides, it conserves the fertilizer value presented originally in the waste (Van Velsen and Letting, 1980).

The production of biogas from the bio-methanation process depends strongly on temperature. Anaerobic digestion can be achieved under psychrophilic (<25°C), mesophilic (25-45°C) or thermophilic (>45°C) conditions. Digestion under the thermophilic condition has many advantages such as higher metabolic rates and effective destruction of pathogens and weed seeds (Van Lier, 1995).

Biogas is a mixture of gases produced during anaerobic decomposition of organic materials. The main gaseous by product is methane (CH_4), with relatively less carbondioxide (CO_2), ammonia (NH_3), hydrogen sulphide (H_2S), nitrogen and water vapor. The composition of the gases depends on the chemical composition of the substrates (Bates, 2007).

Biogas is about 20 percent lighter than air and has an ignition temperature in the range of 650 to 750°C. It is an odorless and colorless gas that burns with clear blue flame similar to that of LPG gas (Sathianathan, 1975). Its calorific value is 20 MJ/m^3 and burns with 60 percent efficiency in a conventional biogas stove (FAO/CMS, 1996). Designing a biogas system requires the services of a project designer experienced with these systems.

All components of a biogas system must be gas tight. Gas leaks are dangerous because certain mixtures of methane gas and air are explosive. Therefore, the design, construction, and operation of these systems should be undertaken only by experienced or carefully trained personnel. The success of biogas plants at an area depends on: availability of organic materials, cost of constructing, found energy sources and its costs, experience, knowledge, ambient climate conditions, especially temperature, and acceptability for people constructing these plants.

2. Methodology

2.1. General Procedure

For Designing biogas plant and analyzing of its feasibility, data collected from different sectors. The procedure of the study was generally divided in to three phase. These phases were:

Desk study: This was the beginning phase that data and information were gathered from literatures. Hereby were questionnaires prepared for primary data collection

Field study: Investigation and primary data collected.

Data Analysis and Interpretation: Once the field and desk activities completed, all the data collected from the field and secondary sources were crosschecked, verified, analyzed and interpreted using appropriate theory.

2.2. Biogas Production System Design

Basic data and assumptions (Figs. 1 and 2):

Minimum number of students in Haramaya University, main campus =10,000

Average number of cattle in Haramaya University, main campus = 400

Discharge per day of human excrete was assumed to be 0.4kg for assurance of available resource. Therefore:

Total discharge for night soil =10,000 * 0.4kg/day = 4000kg/day

Total discharge for cow manure = 10 * 400 = 4000kg/day

Soil temperature assumed to be 35^0C since Ethiopia is found in tropical zone.

The amount of biogas generated each day G[m^3 gas/d], is calculated on the basis of the specific gas yield Gy of the substrate and the daily substrate input Sd. The calculation was performed based on (GTZ, 1989):

The volatile solids content VS: G = VS × Gy (solids)

The weight of the moist mass: G = kg biomass × Gy (moist mass)

Standard gas-yield values per livestock unit LSU: G = number of LSU × Gy (species)

Where G is daily biogas generated and Gy is specific biogas yield.

Table 1. Dry matter value of fresh discharge and water to be added to make favorable condition *(*At Information, website*)*.

Kinds	Body weight (kg)	Discharge per day (kg)	DM (% by wt.)	Water to be added 8%	%ODM
Human	50	0.5	20	0.75	15
Cow	200	10	16	10	13
Chicken	1.5	0.1	20	0.15	16
Pig	50	5	20	7.5	14

Table 2. Potential of biogas yield of different substrate (Source: At Information, Website).

Livestock categories	Biogas yield m^3/kg substrate	Biogas production rate m^3/kg DM	Biogas yield m^3/ capital
Cow	0.025-0.034	0.2-0.25	0.36
Pig	0.034-0.058	0.25-0.3	0.18-0.25
Poultry	0.065-0.116	0.3-0.35	0.0076-0.0112
Human	0.07	0.38	0.028

Daily biogas generated from human excrete:

$$G = \frac{304 + 280 + 280}{3} = 288 m^3$$

Daily biogas generated from cattle manure:

$$G = \frac{218 + 264 + 264}{3} = 249 m^3$$

Therefore the total daily biogas yield, G =280+249 = 529m^3

2.3. Estimating the size of biogas plant

The digester volume (V_d), is determined on the basis of the chosen retention time (RT) and daily substrate input quantity (Sd) (Figs. 1 and 2).

Dry matter of fresh discharge $Vd = Sd * RT$ of night soil = 4000kg/day*20% = 800kg/day
For 8% concentration of ODM (to make favorable condition).

$$\text{Totalweight} = \frac{800*100}{8} = 10{,}000^{kg}\!/_{day}$$

Water to be added to make the discharge 8% concentration of ODM = 6000kg/day = 6000L/day water should be added. Assuming the density of slurry is half of water, then the volume of the daily charge of the night soil was:

$$V_s = \frac{m_s}{\rho_s} = \frac{10{,}000}{500} = 20\,m^3$$

For cow dung the ratio of water is 1:1. Therefore 4000l/day of water is added. As the result the volume of daily substrate input, V_s= 8m^3 and totally Vs = 28m^3.
Hence, volume of digester:

$$V_d = Sd * RT = 28*80 = 2{,}240 m^3$$

Sizing the gasholder: if compressor installed for plant 529m^3 reduces the volume since biogas is stored in pressure vessel, out of digester. As the result the volume of digester becomes 1,711m^3.
Pressure Developed in the Digester: The pressure of a gas mixture is equal to the sum of the pressure of each gas would exert if it existed alone at the mixture temperature & volume. Dalton's law

$$p_m = \sum_{i}^{k} p_i (T_m, V_m)$$

The partial pressure of a gas is the pressure exerted by a particular component of a mixture of gases. It is given by (W.Z. Black & J.G. Hartley,1985).

$$p_i V_i = n_i RT$$

Where, P_i = pressure developed by each gas in a mixture, V_i = volume of particular component of gas, T = temperature of a mixture in Kelvin, R = ideal gas constant and n = number of moles of component. Based on the maximum volume of biogas produced per a day it is possible to find the maximum gas pressure developed in the digester dome. 5029m^3 of biogas can be produced per a day. Based on their composition, it is possible to find particular volume & molar number of gas. Therefore total pressured developed in gasholder:

$$p_{total} = p_{CH_4} + p_{CO_2} + p_{CO} + p_{NH_3} + p_{H_2S} + p_{H_2O}$$

Equivalence of biogas demand
1kg of Fire Wood $\cong$ 0.2m^{3}biogas, 1kg of Charcoal $\cong$ 0.5m^3 biogas and 0.6liter of kerosene $\cong$ 1m^3 biogas (GTZ, 1989).

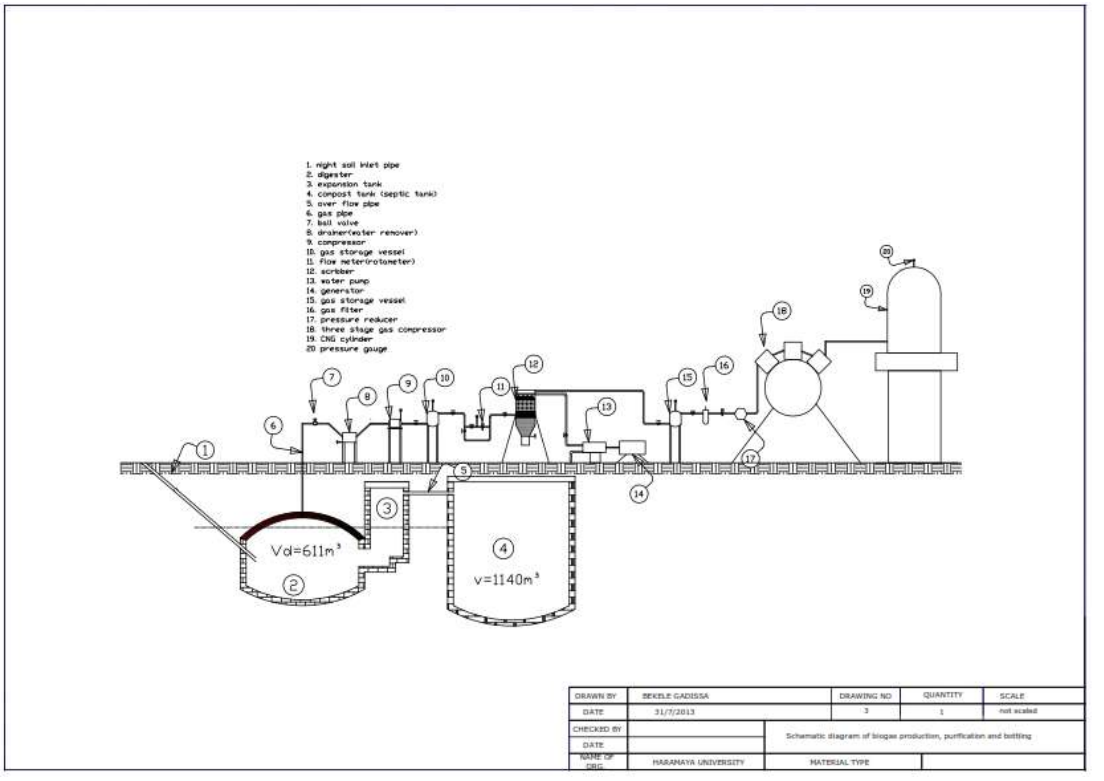

Figure 1. Assembly Drawing of Biogas Plant

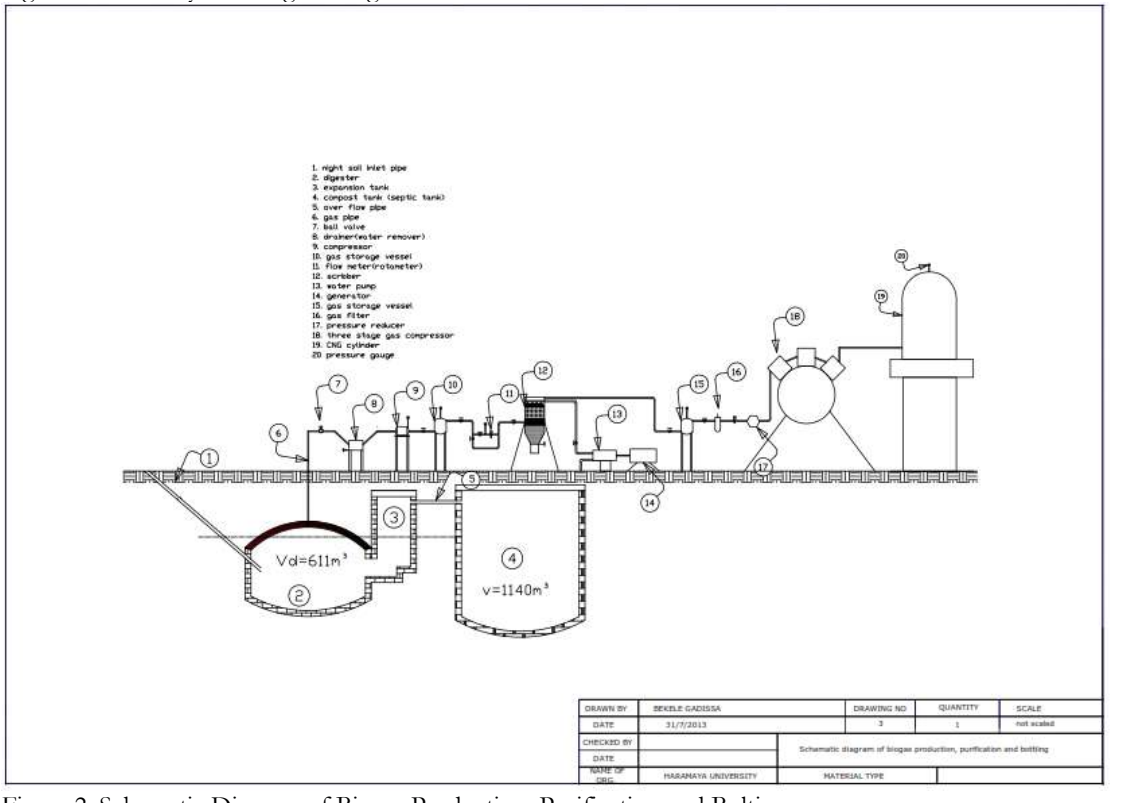

Figure 2. Schematic Diagram of Biogas Production ,Purification and Bolting

2.4. Biogas Compression and Bottling

Compressing biogas reduces storage requirements, concentrates energy content, and increases pressure to the level needed to overcome resistance to gas flow. The energy densities are much higher for biogas that has the H_2S, CO_2 and water vapor removed (100% methane). For adiabatic compression, with no heat transfer across the system boundary (Q = 0), the thermodynamic relation is given by (W. Z. Black & J. G. Hartley, 1995):

$$P_1 V_1^{\gamma} = P_2 V_2^{\gamma}$$

Where γ = adiabatic ratio, c_p / c_v = 1.3 for biogas, V_1= initial volume of biogas that the plant produce per day, P_2 = the compressed raw biogas pressure (16bar) the selected ability of compressor and V_2 = volume of pressure vessel.

Financial and Economic Analysis of Biogas Plant

Any decision for or against the installation and operation of a biogas plant depends on various technical criteria as well as on a number of economic and utility factors. There are many ways to approach economic analysis, depending on the point of view from which plant is considered. The simplest approach is look at the cash flow position of the organization or households.

3. Result and Discussion

The achievements of the study were summarized and tabulated in Table 3. The size of biogas plant depends on the quantity, quality and kind of available biomass and on the digesting temperature. while the size of the digester, i.e. the digester volume (V_d), is determined on the basis of the chosen retention time (RT) and the daily substrate input quantity (S_d). There are many factors affecting the digestion process inside the digester and the quantity of produced biogas. The most important ones are microbes balance, temperature, substrate type, stirring, total solids or moisture, carbon/nitrogen ratio (C/N), time remaining of organics inside the digester, acidity (pH), and the presence of activators or inhibitors. Any drastic change in these factors can adversely affect the biogas production. So these parameters should be adjusted within the desirable range to operate the biogas plant efficiently.

Table 3.Biogas plant components and its size.

Biogas Production system Design	
Basic parameters and operational criteria	Calculated value
Volume of substrate input per day	28m^3
Hydraulic Retention time (HRT)	80 days
Expected biogas production per day	529m^3
Inlet pipe diameter	150 mm
Position of inlet pipe	387mm
Volume of effective digester	2240^3
Volume of effective expansion chamber	529m^3
Volume of compost tank	2240m^3
Diameter of digester	1400mm
Rise of top dome(h_1)	D/5 = 2800mm
Rise of bottom dome (h_2)	D/8 = 1750mm
Volume of gas collecting chamber	529m^3
Pressure developed in digester	110.64kpa
Earth pressure and hydraulic forces on a wall	101.5kpa tensile & 102.57kpa compression

Sometimes the production pressure of biogas source does not match the pressure requirements of the gas appliance. Therefore, to ensure steady supply to utilization equipment, the raw biogas may be compressed and stored in a pressure vessel. Biogas production estimation can be calculated according to several different methods, since available basic data are usually very imprecise so that a higher degree of sizing certainity can be achieved by comparing and averaging the results. Some of the benefits of biogas plants are not limited to the users. If a large number of biogas plants are

installed in a community, the non-users will also be benefited because of its use in avoidance of environmental pollution.

Table 4.Summary of Financial Analysis of a biogas plant.

Financial Analysis of biogas plant	
Parameters	Calculated and Assumed value
Project life	20 years
Interest rate	12% (bank rate for lone (NBE,2003/4)
Initial cost	1,125,650 ETB
Benefit cost ratio	1.17
Net present value	198,654 ETB
Simple payback period	6.34 years

ETB = Ethiopian Birr.

4. Conclusion

The study was conducted on biogas system design and its feasibility. In this study, it was observed that the proper working of biogas digester can be achieved if the operating and process parameters are kept at optimum condition for the designed 2240m^3biogas digester. It is necessary to feed with 28m^3/day for 80 days of retention time to avoid pathogenic effect on the environment. At optimum condition, 529 m^3/day of biogas is obtained from the substrate collected from 8000kg of biomass. The 529m^3volume of biogas produced per day can substitute 19,837.5kWh of electricity. Compressing biogas reduces storage requirements, concentrates energy content and increases pressure to the level needed to overcome resistance to gas flow. As the result of installing compressor for this system, 529m^3 of biogas volume is stored in 68m^3 of pressure vessel and the pressure increased to 1600kpa from 110.64kpa to overcome the problem of mismatch of pressure requirements of gas utilization equipment.

In this study, it was possible to see that the biogas system design for the campus is financially as well as economically feasible as the net present value is positive and benefit cost ratio is greater than one. Financial study has shown that net present value of the plant is Birr 198,654 and the simple payback period is 6 years and four months.

5. Recommendation

The following recommendations were made to make the implementation of the project. To be sure about the loading substrate content, the actual flow of substrate should be measured and checked. If the composition of the dry organic matter in the influent is not between 7 to 10 % the following measures have to be taken.

a) Water from shower and bath room should be completely diverted from the drainage of toilet.
b) To increase the biogas production, pretreated kitchen waste should be added to the digester.
c) Night soil and pretreated kitchen waste should be fed with the feed rate 28 m^3/day having 8% total solid organic matter.
d) The necessity of a pump has to be checked.

6. Acknowledgement

I am greatly indebted to Haramaya University for providing the necessary facilities, support, and for funding this research work. I would also like to thank and express my deep regards to the department of mechanical engineering, Haramaya University and to my colleagues for their continuous encouragement.

5. Reference

At Information website: Biogas Digest: - Application and Product Development. Available at website: http:// www.3.gtz .de .com.

Bates, L. 2007.Biogas. Rugby: Practical Action.

Beek, W. J. & Muttzall, K. M. K. 1975. Transport Phenomena. John Wiley, London, UK.

Biogas Works . 2000. A short History of Anaerobic Digestion.

Claasen,P. A. M. ,Lier, J. B. Van, Lopez Contreras, A.m., Niel, E. W. J., Sijtsma, l., Stams, A. J. M., Varies, S. S. de and Weusthusi, R.A. 1999. Utilization of Biomass for the Supply of Energy Carries. *Appl. Microbiol. BioTechnol.*52 : 741 - 755.

FAO/CMS. 1996. A system Approach to Biogas Technology. Biogas Technology: training manual for extension. Available at website:-http://www.fao.org.

GTZ. 1989. Biogas plants in animal husbandry.

NBP. 2008. Biogas for Better Life. Ethiopia, Addis Ababa, Ethiopia Rural Energy Development and Promotion Centre (EREDPC) and SNV/Ethiopia.

Sathianathan, M. A. 1975. Biogas Achievements and Challenges, Association of Voluntary Agencies of Rural Development, New Delhi, India.

Van Velsen, A.F.m. and Letting, G. 1980. Effect of Feed Composition on Digester Performance. In: Stafford, D.A., Wheatley, B.I. and Hughes, D.E.(Eds.), Anaerobic Digestion. Applied Science Publishers Ltd, Landon, UK www.teriin.org/renew/tech/biogas.

Theme IV

32nd Annual Research Bulletin

Human and Social Development

Theme 4

1. The Prevalence and Legal Remedy of Violence against Women in Eastern Part of Ethiopia

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Abstract

In the current legal context of Ethiopia, whether the various legislative reforms and practical measures that have been implemented to reduce and ultimately end violence against women (VAW) have brought out change on the rates of prevalence of different forms of VAW is not adequately assessed. Hence, the main aim of this study was to assess the magnitude, types, and causes of violence against women in Eastern part of Ethiopia in the last 10 years (since the coming in to force of the criminal Code up to now). The data for this study was generated from primary and secondary or official documents. For primary data collection, questionnaire and focus group discussions were conducted with 20 stockholders sampled by the probability proportion to population size sampling technique. To analyze the collected data, both descriptive and inferential statistics were used. Results show that, women and girls in Eastern part of Ethiopia are exposed to different forms of VAW. The absence of law criminalizing rape within wedlock and limited enforcement of law due to institutional weakness and limited cooperation of local community to report and testify against crime of violence are the major challenges to effectively curbing the problem.

1. Introduction

As underlined in the Declaration on the Elimination of Violence Against Women (DEVAW), Violence Against Women (VAW) refers to: "acts of gender based violence that results in, or is likely to result in, physical, sexual or psychological harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life."1 Battering, dowry related violence and marital rape; female genital mutilation, rape, sexual abuse, sexual harassment and intimidation; and trafficking in women and forced prostitution are among the acts that constitute VAW. 2Such acts of VAW are considered 'gender based violence' because the source of vulnerability to such violence is gender.3-the socially constructed roles, behaviors, activities, and attributes that a given society considers appropriate for men and women.4

According to CEDAW (Committee on the Elimination of Discrimination Against Women), VAW includes all acts that prevent women from enjoying their rights and freedom on the basis of equality with men.5The acts are known for the physical, sexual and/or psychological harm it causes against the victim. Hence, VAW is among the main factors that prevent women to fully and actively engage in development activities of their societies, particularly in sub-Saharan Africa countries like Ethiopia.6

Studies show that VAW exists rampantly in various forms in different regions of Ethiopia. For example, a research conducted by Ethiopia Women's Lawyers Association (EWLA, 2008) in 7

1United nations General Assembly, Declaration on the elimination of violence against women, A/RES/48/104,1993,Art.1, available at www.un.org/documents/ga/res/48/a48r104.htm

2 Ibid, Article 2

3 UN Committee on the Elimination of Discrimination Against Women (CEDAW), *CEDAW General Recommendation No. 19: Violence against women* , 1992 , paragraph 6, available at: http://www.bayefsky.com//general/cedaw_genrecom_19.php

4 World health organization, Gender, women and health available at: http://www.who.int/gender/whatisgender/en/

5 UN Committee on the Elimination of Discrimination Against Women (CEDAW), *CEDAW General Recommendation No. 19: Violence against women* „ 1992 , paragraph 1, available at: http://www.bayefsky.com//general/cedaw_genrecom_19.php

6United nations General Assembly, *Declaration on the elimination of violence against women*, 1993,A/RES/48/104,Preamble, available at: http:// www.un.org/documents/ga/res/48/a48r104.htm

regions of Ethiopia indicated that domestic violence against girls and women was common in the country.7 The research further revealed that in many societies of Ethiopia VAW, particularly battery, was viewed as a martial prerogative of the husband. 8 Another research conducted by the World Health Organization (WHO, year?) proved the fact that a majority of girls and women in Ethiopia (50-60%) are victims of one or more forms of DV (domestic violence) once or repeatedly in their life time.9 The 2009 national report of Ethiopia to the United Nations Human Rights Council supported the WHO finding by stating that DV remained among the four most common forms of violence against women and girls in the country.10

As part of its effort to address the complex problems of violence against women and to execute its obligation, among others, under CEDAW and UNHR, the government of the FDRE (Federal Democratic Republic of Ethiopia) designed and implemented legislative, policy, and other measures that are aimed to protect women from violence. In particular, the government has undertaken various legal reforms with the objective to eliminate such violence through legislative measures. The laws that are promulgated by the current government of Ethiopia that either condemn or criminalize VAW include: the 1996 Federal Constitution of Ethiopia and the 2004 Criminal Code of Ethiopia.

Non-governmental organizations (NGOs) have also been engaged, among others, in dialogues and advocacy works in different regions of the country with the objective to mitigate such violence; and thereby protect Ethiopian women and girls from the harmful consequences of such violence.

However, whether the various legislative reforms and practical measures that have been implemented to reduce and ultimately end VAW have brought out change on the rates of prevalence of different forms of VAW is not adequately assessed. There is no comprehensive data on the magnitude and causes of various forms of VAW in different parts of the countries before and after the legislative and other measures taken by the FDRE government and NGOs. The success, strength, and weaknesses of the measures taken to end violence against women are not assessed. Besides, the challenges faced by those engaged in the fight against VAW are not properly identified and addressed. This research was thus initiated to address the existing knowledge gap in eastern Ethiopia with regard to the magnitude, types and causes of VAW, the strength and weakness of the legislative measures taken and the challenges related to law enforcement by the police, prosecutor and judge. More specifically, the research aimed to:

Assess the magnitude, types, and causes of violence against women in Eastern part of Ethiopia in the last 10 years (since the coming in to force of the criminal Code up to now);

Identify the gaps and limitations in the implementation of Ethiopian laws dealing with violence against women; and

Identify the factors that hinder the effectiveness of the legal measures that has been taken by the FDRE government to end violence against women

2. Methodology

2.1. Data Source

The data for this study was generated from primary and secondary sources. Primary data were generated through key informant interview, questionnaire survey, review of legal documents, and focus group discussions. The secondary sources used include books, journal articles, and Justice Bureau reports. More specifically, 5 focus group discussions were conducted in addition to the interviews conducted with 20 stockholders. Two types of questionnaires were developed and filled by 403 girls and women, and 47 men inmates of prison who had been convicted of different forms of gender based violence including rape, battery and trafficking. Relevant documents and data were obtained from justice bureaus, women affairs bureaus, and organizations and associations working on violence against women in the research area.

7Ethiopian women lawyers association, Berchi, Vol. 2007

8 ibid

9 World health organization, *Multi country study on women's health and domestic violence against women*: Ethiopia, available at: http://www.who.int/gender/violence/who_multicountry_study/fact_sheets/Ethiopia2.pdf

10 UN Human Rights Council, *Report of the Working Group on the Universal Periodic Review : Ethiopia*, 7 July 2014, A/HRC/27/14, available at: http://www.refworld.org/docid/53eb26b04.html

2.2. Study Design

The research was conducted in selected cities, woredas and rural kebeles of Eastern and Western Hararghe Zones of Oromiya Regional State, Dire Dawa City Administration, and Harari Regional State; and therefore, it does not cover the whole part of Eastern Ethiopia. The study employed the probability proportion to population size sampling technique while allocating the estimated total sample size to the zones, region and Dire DAWA City Administration.

The first component involved a questionnaire survey with 403 women and girls selected from East (166) and West (137) Hararghe Zones of Oromia Region, Dire Dawa City Administration (41), and Harari Region (59). The second component involved interview with 47 men inmates of prison who were convicted of different forms of violence against women. Whilst 28 of them were serving their criminal sentence in Harari regional state and East Hararghe zone prisons, 19 of them were serving their sentence in West Hararghe prison.

Table 2. The distribution of the sampled inmates by type of violence committed.

Type of violence committed	Harari Regional State and Oromiya East Hararghe zone Prison	Oromiya West Hararghe Zone Prison	Total
Trafficking	4	5	9
Rape	16	7	23
Murder	4	3	7
Battery	4	4	8
Total	28	19	47

Then the study employed purposive sampling techniques to select the relevant offices, and key informants. Based on the review of available documents and prior consultation meetings, the following respondents were included in the key informant sampling.

10 Judges (3 West Hararghe, 3 Eastern Hararghe, 2 Harari regional State, 2 Dire Dawa Administration),

12 public prosecutors (4 Eastern Hararghe, 4 western Hararghe, 2 Harari, and 2 Dire Dawa Administration),

4 women's affairs office bureau heads

3. Results and Discussion

3.1. The Magnitude and Causes of Different forms of Violence Against Women

3.1.1 Early marriage

Early marriage is one of the prevalent forms of violence against women in Eastern Ethiopia. Out of the 320 married women who filled the questionnaire, 50% of them got married before they attain the full age of 18 years. Of these, 50% got married within the age range of 10-15 years. The average age at first marriage is by far lower than the national average.11

To better understand the various aspects of early marriage in eastern Ethiopia, an effort was made to assess the relationship between early marriage and the mode of conclusion of marriage. For this purpose, a comparison was made between the percentage of women who have concluded marriage before the age of 18 traditionally, religiously, and before the officer of civil status. Accordingly, it was found out that 68% of the 320 married women have concluded their marriage traditionally, 26% of them religiously, and 6% of them before the officer of civil status. About 53%of the sampled women who have concluded their marriage traditionally, 28% of the women who have concluded their marriage religiously, 22 % of the women who have concluded their marriage before the officer of civil status concluded their marriage before attaining the full age of 18.

The research also assessed the relationship between the natures of the marriage – love marriage, arranged marriage, and forced marriage- and the chance of concluding early marriage. For this purpose, a comparison is made between the percentage of women who have concluded early marriage in love marriages, in arranged marriages, and in forced marriages. The result shows that

11 Ethiopia National Action Pan, women watch, available at: http://www.un.org/womenwatch/confer/beijing/national/ethiopia.htm

100% of women who have concluded forced marriage, 63% of the women who have concluded arranged marriage, and 31% of the women who have concluded love marriage got married before attaining the full age of 18 years.

The first and the most important cause of early marriage identified in the research is the traditional dancing ceremony of youngsters. Since the ceremony takes place during night time and in the absence of parent, those youngsters of opposite sex who dance together usually fell in love and rush to conclude marriage. Particularly if a girl sleeps with her dance partner, she feels obliged to marry him for religious and cultural reason. The other cause of early marriage in the area is the societies belief about early maturity of girls. According to the society, girls get matured for marriage at the age of 9.

The finding shows that early marriage is prevalent in the research areas where 50% of the married women concluded their marriage before the age of 18. As indicated above, the majority of the married women (68%) concluded their marriage traditionally. The data also shows that the majority of women (53% of them) who concluded marriage traditionally concluded their marriage before the age of 18. Almost 100% of the women who married following abduction and 63% of the women whose husbands are chosen by family conclude their marriage before the age of 18.

3.2. Abduction and Forced Marriage

Abduction of girls and forced marriage are among the VAW practiced in the area. Three (0.9%) of the 320 married women included in the survey concluded their marriage by abduction and 20% of the 392 girls and women surveyed reported that they knew girls who were forced to marry in the last ten years. This figure shows that the magnitude of women abduction in the research area is relatively low. For example, in Amhara regional state of Ethiopia, the magnitude of forced marriage is about 20%.12 Refusal of the victims or their families to accept the culprits offer for marriage is identified as a cause for abduction. In some instances, the families of the victims indirectly participate in the abduction of their daughters. This happens when their daughter refuse to marry the man they have chosen for her.

3.3. Circumcision

314(78%) of the women and girls included in the survey are reportedly circumcised. 225 (57%) of the 394 women have female children and 54 of them (23%) have circumcised children while the daughter/s of 171 (77%) of them are not circumcised. Out of the 171 women who have uncircumcised female children, only 4 (2%) of them have a plan to give their daughter/s for circumcision for cultural or religious reasons. The remaining 167 (98%) of them do not have a plan to give their daughters for circumcision. They decided not to give their daughter for circumcision because they have learned that it is bad (70% of them); because they do not want their daughters to experience what they have experienced (7% of them), or because it is illegal (23% of them).

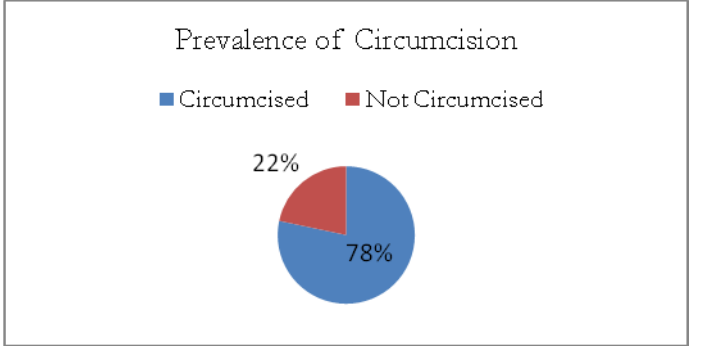

Figure 1.Prevalence of circumcision.

12Agumase Semahegn, Domestic violence and its predictors among married women in reproductive age in Fagitalekoma Woreda, Awi zone, Amhara regional state, North Western Ethiopia, available at:http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3879008/.

The above data show that people's attitude toward Female Genital Circumcision (FGC) is changing. This will remain true particularly if the mothers stick to their plan of not giving their uncircumcised female children for circumcision. For this purpose, the work on FGC should continue.

3.4. Battery

248(64%) of the 387 women and girls saw a woman beaten by a man in the last 10 years. Out of this 131(46%) of them saw a woman beaten by a man three times or more. About 33% (127) of the 387 women and girls reported that they were beaten by a man in the last 10 years. Out of this, 65% of them are beaten by their husbands, 17% of them by their brothers, 6% of them by their fathers, and 2% of them by their boyfriends, 2% by neighbors, and 8% by customers, in-laws, relative, step-fathers and others.

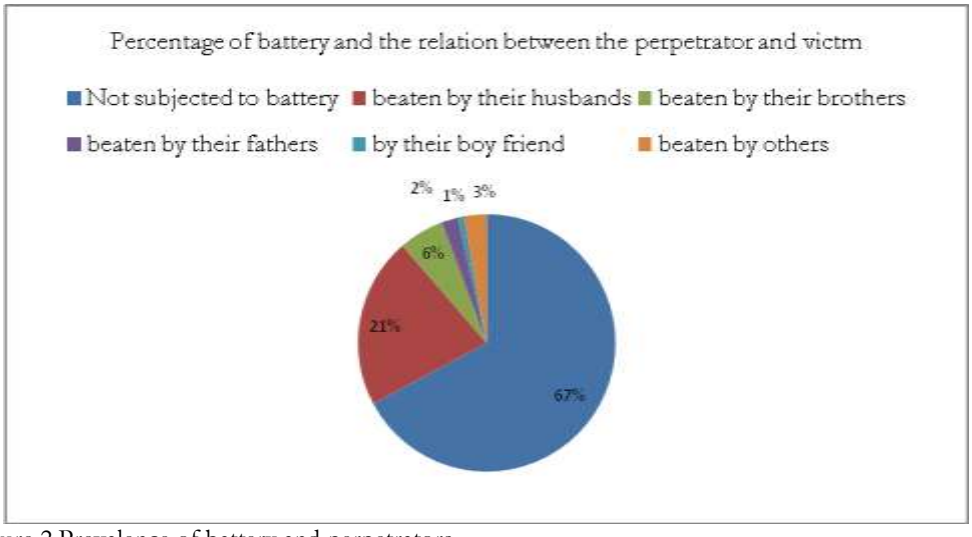

Figure 2.Prevalence of battery and perpetrators.

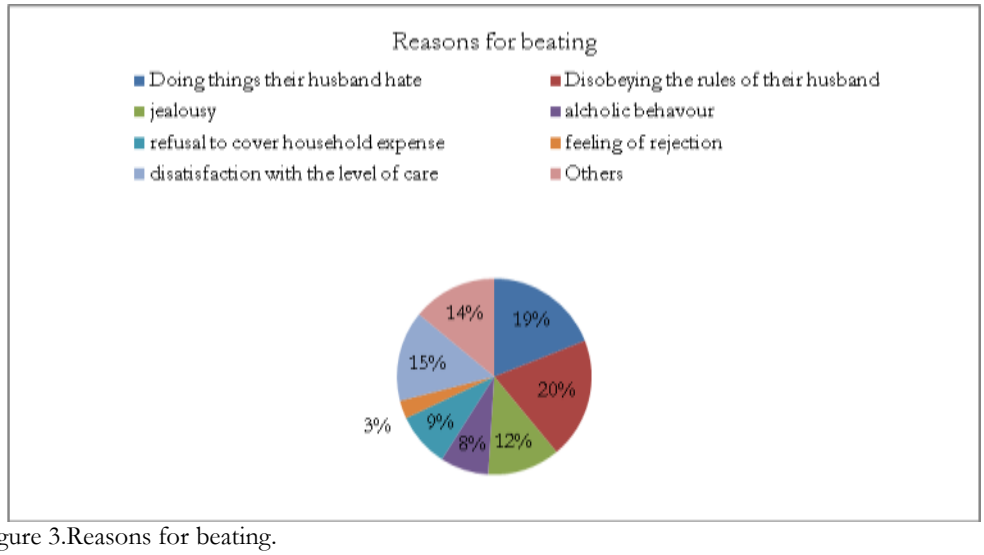

Figure 3.Reasons for beating.

The reason for beating include: doing things their husbands hate (19%), disobeying the rules of their husband (20%), jealousy (12%), alcoholic behavior of husbands(8%), refusal to cover household expense by husbands (9%), dissatisfaction with the level of care husbands get from their wives, and feeling of rejection by husbands (3%). About 14% of them mentioned different reasons

including: refusal to accept offer for sex, refusal to accept marriage offer, refusal to do hard work, land dispute, addiction to chat, and taking birth control
In the research areas, the four main instances husbands beat their wives are:
when wives refuse to have sex with their husbands;
When wives disobey the instructions of their husbands;
When wives insult their husband; and
When husbands feel jealous.

3.5. Injury

126(49%) of the 252 women and girls reported that they knew women who were seriously injured by their husbands, child, brother, and a man living with the victim in irregular union. 115 (91%) of the 126 girls and women were injured by their own husbands while 13 of them were injured by their brothers. Jealousy is the reason mostly given by the offenders, followed by failure of wives to obey their husbands' instruction, followed by alcoholic behavior of the offender, refusal to contribute for household expenses.

3.6. Insult

116 (44%) of the 380 girls and women were insulted by a man in the past 10 years. 40% of them were insulted by their husband, 18% by strangers, 13% by their brothers, 13% by neighbors, 3% by in-laws, and 15% by others.
The four main instances husbands insult their wives in the research areas are:
When wives disobey the instruction of their husbands;
When wives insult their husbands;
When wives refuse to have sex with their husband; and
When husband feel jealous.

3.7. Rape, Homicide, and Trafficking

18 (5%) of the 393 girls and women are victim of rape; and 47(12%) of them have a family member who are victim of rape.
56 (18%) of 317 women and girls know a man who killed his wife, mother, and sister. The reason for killing include: jealousy (29%), dispute over land (25%), disagreement (13%), dispute over property (7%), alcohol (2%), dispute over money (5%), the deceased (the mother of the offender) insulted his wife(2%), dissatisfaction with the decision of a court that decided in favor of the deceased (2%), and for reason not remembered.
104 (27%) of the 384 women and girls have female family member who went to foreign countries in last 10 years. 89 (76%) of them went there legally while 15(14%) of them went illegally. Most of the women and girls went to Arab countries. 95% of them went to foreign countries hoping to find highly paid job and the remaining 5% went there hoping to find rich husbands.

3.8. Deprivation of Liberty and Destruction of Property

275 (81%) of 339 girls and women responded saying that it is important for them to secure the permission of their husbands if they want to visit their families and friends. Women who visited their friends or families may be beaten, insulted, or ignored by their husbands.
47(12%) of the 379 women and girls indicated the destruction of personal property by a man in the last 10 years. The reason given by the destroyer of the property include: request of money by the victim for household expense, illegal claim on the destroyed property, jealous, and the victims' refusal to marry the man chosen by the destroyer of the property.

3.9. Justice Bureaus Reports

According to East Hararghe Zone Justice Bureau, the number of different forms of violence against women committed in the zone fluctuates from one year to another. For example, in 2000 while crimes such as abduction and female genital cutting declined, crimes such as battery, economic violence and rape increased. In 2001,abduction and FGC increased, while battery, economic violence and rape declined. In 2002,all forms of violence against women mentioned above declined. In 2003, all forms of violence against women increased. In 2004, all forms of violence except

economic violence decreased. Since the researcher was able to get only 3 months report of 2005, this wasn't compared with the other years.

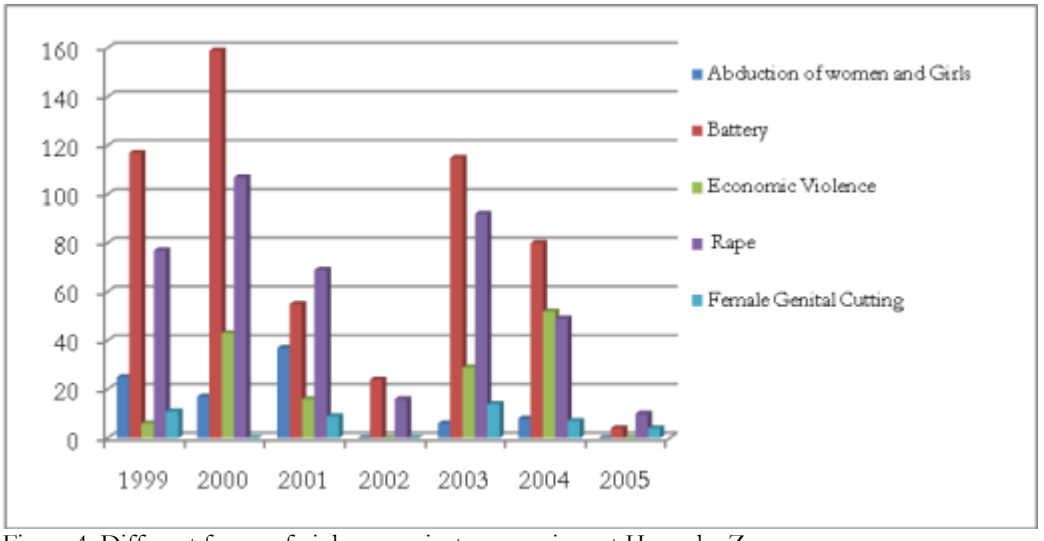

Figure 4. Different forms of violence against women in east Hararghe Zone
Source: East Hararghe Zone Justice Bureau

Based on the west Hararghe zone Justice Bureau report, in the year 2000 the number of economic violence and rape in the zone shows small decline compared to the number in the year 1999. However, the number of Abduction and battery in the same year increased compared to the number in 1999. In 2001, the number of abduction and battery in the zone decline while the number of economic violence, rape, and Female Genital Cutting increased compared to the previous report year. In 2002, the number of battery and FGC increased significantly while economic violence and rape decline compared to the number in the previous year. The number of abduction in 2002 remained the same with the number in previous report year. In 2003, all forms of violence included in the report except abduction showed decline. Again in 2004, all forms of violence against women included in the report continued to decline. The number of battery, rape and FGC committed in 3 months of 2005 is greater than the number of such violence committed in 12 months of 2004.

The reports of the two zonal justice bureaus show that the number of reported acts of violence against women varies from one year to another. The number of some of the acts reported to the office decrease from one year to another while the number of the rest of the reported acts increase. The reports show neither a continuous decline nor a continuous increment of a specific act of reported VAW.

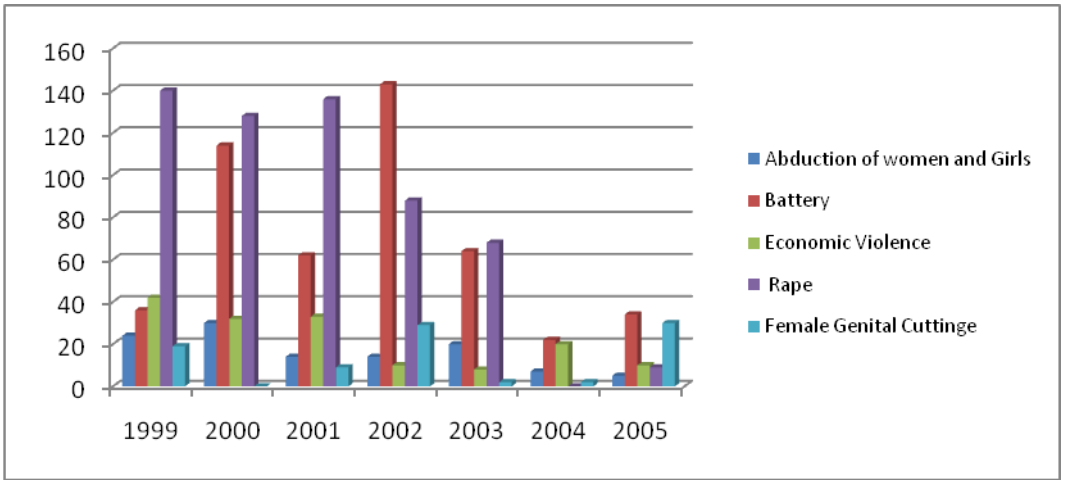

Figure 5. Different forms of violence against women in east Hararghe Zone
Source: West Hararghe Zone Justice Bureau

3.10. Problems in the Implementation of Laws in relation to VAW

3.10.1. Failure to bring the commission of acts of VAW to the attention of the concerned government organ

The fact that lots of crimes that are committed do not come to the attention of police and other concerned organs is the first problem identified. This is attributable, among others, to the societies' culture of solving conflicts through elders, and societies' high value to religious and or customary leaders, victims' fear of the consequence of bringing the crime committed to the attention of police.

The following responses of victims of different crime show how and why victims of VAW try to get remedy.
Response of 311 women to the question: if your husband beats you, what would be your reaction?
153(49%) of them responded saying I would tell elders to advise him so that he stops his violent act.
102 (33%) of them responded saying I would report it to police
26(8%) of them responded saying I would cry and do nothing
46(15%) of them responded saying first I would tell elders to advise him not to do it again. If he fails to listen to their advice I would report to the police
8 (3%) of them said I would take care of it myself
7(2%) of them said I would go to my family
1 (%) of them said I would leave him.

Response of 18 women survivors of rape to the question: what did you do to a man who raped you?
6 (33%) of them responded saying: I reported to police;
6 (33%) of them said: I did nothing because I have got married to him following the incident; and
6(33%) of them said: I did nothing and I kept it secret.

Response of 79 women who have family members or close relatives raped in the past 10 years to the question: what happened to the man who raped your relative or family member?
47(59%) of them responded saying: the culprit was brought before justice;
32(41%) of them responded saying nothing happened to the culprit. This is because:
The culprit married the survivor (15 (46%)) of them);
The victim's family forgiven the culprit because he paid them some money as compensation;
The perpetrator was the victim's father so nobody wants to bring him before justice;
The perpetrator threatened the victim and her family; the perpetrator disappeared; and
The victim was a prostitute so people, even police officials, consider it acceptable

Response of 70 women who are forced to leave their marital home in the last 10 years to the question: what measure have you taken to get your share from your marital property?
14 (20%) of them said I did nothing because my husband threatened me. He told me that he would kill me if I ask for anything.
4(6%)of them said I told elder to help me and they helped me to get my share;
38(54%)of them said I have brought the case before the court and the case is pending;
1(1%) of them brought their case before court and succeeded to get their share from marital property because the court decided in their behalf;
5(7%) of them said I brought the case before elders and the case is pending
2(3%) of them said I brought the case before the court of law, but the court decided against me
6(9%) of them failed to answer the question.

3.11. Delay in Reporting and Witness

The other problem is the fact that Women victims do not report their case to the concerned organs immediately after the commission of the crime. This affects evidence especially in case of rape. In many cases survivors of rape report their case to police days after the commission of the crime. Society's outlook on such victims is one of the reasons that prevent women from reporting their case to the police in shortest time possible.13Witnesses' lack of cooperation to testify is also one of the problems identified. In some cases the suspect gives money to the witnesses so that they would not testify against him. In some other cases, families of the suspect threaten witnesses so that they would not testify. There are many witnesses who deny their presence at scene of the crime during the time of the commission of the crime.

There are victims of rape who do not go to hospital for lack of money. Lack of money is one of the reasons for the delay of victims of rape to go to hospital. It may take them days to get money to cover the cost of medical examination and transportation fee. Shortage of expert witnesses especially in case of rape is the other problem.14In many rape cases, expert witness or evidence given by doctors are helpless as witnesses are not really experts in the area. This is because in most cases the doctors that examine rape survivors are gynecologist.

In the case of early marriage, women who are forced to marry at their early age do not want their marriage to end once it is concluded. For this reason, they and their family work to get evidence that shows that the woman was of legally accepted age by the time she concluded marriage. For example, when the victims are sent to hospital for their exact age confirmation, they beg the doctors to increase their age estimation. The parents of the victims also stand before the court of law claiming that their child was of age by the time she concluded marriage. Sometimes the judges accept such claim out of sympathy. Similarly, when parents plan to give their daughter for circumcision, the family will take their daughter to another place, force her to go through circumcision, and bring her back.

3.12. Low Enforcement

There is a gap in police forces awareness regarding how to treat victims of VAW. The understanding level of police forces and public prosecutors still not at the level wanted. As police forces and public prosecutors are part and parcel of the society, work is needed to change their outlook on VAW. The same is true for workers in women affairs offices and judges. Therefore, work is needed in such area to improve the awareness of the police forces.

Lack of competent police officials who provide the evidence they have collected in an organized way is the other problem.15Further, negligence of judges to create conducive environment to survivors of VAW, particularly to survivors of rape is identified as a problem. Some of the questions that courts raise make victims uncomfortable.16 Courts ask for the detail explanation of how the rape happened. These kinds of questions make victims un-comfortable.17 This is especially serious

13Interview with the head of West Hararghe zone women, children and youngsters affairs' bureau, 2013
14 Focus group discussions in West Hararghe and East Hararghe Zones public prosecutors
15 Interviews with east and west Hararghe zone justice bureau public prosecutors working on crimes against women and children issues
16 Interview with eastern Hararghe zone justice bureau public prosecutors working on crimes against women and children
17ibid

when the victims are children. Therefore, the big concern is on how judges handle (treat) victims of rape.

Shortage of human power and budget, low capacity of the police forces with regard to use of investigation techniques, and absences of child friendly bench among other things are also identified as constraints in the fight of violence against women.

The trainings that have been given by different government offices in relation to violence against women are not as such successful in terms of changing the societies' attitude towards VAW.18This is particularly because most of the trainings are not designed in a way that it helps the society to change its attitude.19 Those who give trainings do not have the necessary data that shows the area that needs focus.20 As a result of this, the trainings they deliver are not that effective. In most cases trainings are not well organized, mostly they are organized emotionally following the news of the commission of acts of VAW somewhere. They are not also continuous.21

Moreover, prevention work in relation to VAW is very weak. The police forces as well as public prosecutors focus on bringing suspects before court after crimes are committed. However, the focus they give for preventive work is minimal.

Finally, the absence of law that criminalizes marital rape (rape of woman by her own husband) is identified as the only legal gap. According to the judges and public prosecutors, the new criminal law addresses all forms of violence against women except marital rape, and the law has no gap or limitations.

4. Conclusion

Women and girls in Eastern part of Ethiopia are exposed to different forms of Violence against Women(VAW): early marriage and abduction to some extent; circumcision, battery, rape, homicide, insult, and trafficking; and restriction of liberty and destruction of personal property by male counterpart. The absence of law criminalizing rape within wedlock and limited enforcement of law due to institutional weakness and limited cooperation of local community to report and testify against crime of violence against women are constraints and challenges to effectively curb the problem in the research area.

5. Recommendation

Awareness creation and continuous discussion, training and education for the community in collaboration with community elders and religious leaders are important to bring about behavioral change in fighting the crime of VAW.

Among the things discouraging the victims of VAW, rape in particular, to bring their cases to police and the court of law is the improper treatment of police officers, public prosecutors and judges. Therefore, police officers, public prosecutors and judges should be given training on how to handle and treat such victims properly.

It is very important that police and justice offices give proper attention to crime prevention works rather than solely focusing on bringing suspects of VAW before the court of law after the commission of the crime..

Lack of money to cover transportation and medical examination fee is one of the major reasons that prevent victims of rape to immediately report to the appropriate bodies. Therefore, the government should either subsidies or provides the services free of any payment for those who cannot afford to pay the standard fee. In addition, the government should give due attention to training medical professionals specialized in examining such victims.

The criminal code of Ethiopia has given recognition to almost all types of VAW. However, marital rape is not recognized as a punishable act under this code. Therefore, the code should be amended to include such act.

18ibid
19ibid
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21ibid

6. References

Agumassie, S., Tefera, B. and Misra, A. 2013. Domestic violence and its predictors among married women in reproductive age in Fagitalekoma Woreda, Awi zone, Amhara regional state, North Western

Ethiopia, Reproductive Health. 2013. 10:63 Ethiopian Women Lawyers Association. 2007. Domestic violence against girls and women, *Berchi*, Vo.l, 2007.

United Nations. 2008. Ethiopian national action plan, Women Watch available at: http://www.un.org/womenwatch/

United Nations Committee on the elimination of discrimination against women. 2007. Available at: http://www.bayefsky.com//general/cedaw_genrecom_19.php.

United Nations General Assembly. 1993. Declaration on violence against women A/RES/48/104, 85th plenary meeting 20 December 1993, available at www.un.org/documents/ga/res/48/a48r104.htm.

United Nations Human Rights Council. 2014. Report of the Working Group on the Universal Periodic Review : Ethiopia, 7 July 2014, A/HRC/27/14, available at: http://www.refworld.org/docid/53eb26b04.html.

World Health Organization. 2005. Gender, women and health, available at: http://www.who.int/gender/violence/who_multicountry_study/fact_sheets/Ethiopia2.pdf

2. Towards a More Sustainable Cement Production: Environmental Challenges and Regulation of Ethiopian Cement Industry

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Abstract

With the expansion of cement investment in Ethiopia, questions about its sustainability including social benefit, environmental concerns and labor protection increased. Complaints are heard from experts and local communities. Nevertheless, neither the federal Environmental Protection Authority nor regional environmental agencies have conducted significant level of assessment or monitoring and evaluation on the industries' environmental performance. Thus, this study intended to investigate into the environmental challenges that Ethiopian cement production sector abounds. Data were collected from purposively selected cement factories, namely two companies from Dire Dawa, one from Tigray and Amhara each, and three from Oromia. Factory workers and managers from the federal and regional government institutions, experts, community leaders, and local residents were involved in series of interviews besides filling out questionnaire. 55 key informant interviews were conducted, 10 observation checklists were filled and 262 questionnaires were administered where 77 of them were female respondents. The collected data were analyzed qualitatively and quantitatively. The findings showed that environmental and social conditions are at the lowest stage giving the way for companies to build their profit margin at the cost of social and environmental elements.

1. Background

1.1. Context of the Study

Ethiopia is attracting investments in recent times in both the agricultural, service delivery and industrial sectors. Such investment, however, is a mixed blessing. While the investments add economic capitalization on the market, they tend to ignore social and environmental issues and disrupt the basis for sustainable development. Many scholars argue that the resource-dependent development path that developing countries are following would result in environmental depletion.22 In that sense the current pattern of growth witnessed in the last decade is neither inclusive nor sustainable.23The problems range from flawed public policies that support powerful elites at the expense of poor landholders and laborers to lack of political will and lack of institutional infrastructure to enforce laws and basic rights. Subsequently, attention is given only to exploitation of the finite yet abandoned resources without considering nature's regenerative capacity and indigenous communities whose livelihood is dependent on it. Ultimately, this ends up with leaving the poor and the helpless workers vulnerable to the hands of industrial tyranny, and economic and physical displacement. At current, among the adverse consequences of this in Ethiopia are the booming of floriculture sector in the productive and most favorable lands,24 expansion of mechanized farms in the vast majority of community grazing and sometimes protected forest lands,25 unregulated industrial waste dumping into water bodies including lakes,26 and competition

22Id.

23 United Nations Conference on Trade and Development (UNCTAD), Economic Development in Africa: Report 2012 Structural Transformation and Sustainable Development in Africa, UN, NY and Geneve, 2012.

24Mulugeta Getu (2009) Ethiopian Floriculture and its impact on the Environment: Regulation, Supervision and Compliance, 3(2) Mizan Law Rev.

25 Darryl Vhugen (2012) Large scale commercial investments in land: Seeking to secure land tenure and improve livelihoods, Haramaya Law Review, Vol.1(1), p.12-16; Sefanit Mekonnen (2012) Rights of citizens and Foreign Investors to Agricultural land under the land policy and Laws of Ethiopia, Haramaya Law Review, Vol.1(1), p. 41

26Malefia Tadele (2009), Environmental impacts of floriculture industry on Lake ziway with particular reference to water quality,A Thesis Report Submitted to Addis Ababa University School of Graduate Studies as a Partial Fulfillment of MSc. Degree in Environmental Science, Addis Ababa University (2009), available atetd.aau.edu.et/dspace/bitstream/123456789/; Behailu Berehanu, (2007) IMPACT OF INDUSTRIES AND URBANIZATION ON WATER RESOURCE IN MOJO

with local community over the use of community resources. Hence, this 'grow-now-clean-up-later' approach coupled with the increased consumption, greater exploitation of natural resources and energy use associated with the growth process are in the long run likely to jeopardize the sustainability of the growth process itself.

A prototypical example of the entire complex situation discussed above is the cement production industry. Cement and concrete products comprise the largest share of construction materials worldwide due to their abundance, durability, and relatively low price. Demand for these products has grown in parallel with world population and development. Global demand is predicted to rise by 7% in 2011 following on from previous year's 9% rise. Ethiopia's cement consumption growth is roughly estimated to be four times the growth of global cement consumption.27 It is also predicted that the demand will continue to rise by 20-25% during the Growth and Transformation Plan (GTP) period (2010/11 – 20114/15).28With the support of government policies and development strategies, cement factories are expanding to meet the growing demands of large-scale public sector infrastructure projects (roads, hydroelectric dams, public housing projects etc.) and private sector construction. Cement production as well is one of the prioritized sectors in the recently crafted five year Growth and Transformation Plan.

As a result, currently, in addition to massive expansion program by state owned cement factories, the sector attracted many local and foreign investors to Ethiopia. At the beginning of the GTP period-i.e. 2010/1-- a total of 11 cement factories were operationalized and around 25 more are at different stages of construction phase. Construction of cement factories will have much social and economic benefit to the country: they provide cement for use within the country to support infrastructure development and the national building program; reduce the need for imported cement and improve Ethiopia's financial standing; create local jobs and expand local infrastructure; stimulate transfer of knowledge to local workers, and raise revenue. However, with the expansion of cement investment in Ethiopia, questions about its sustainability including social benefit, environmental concerns and labor protection increased. Complaints are heard from experts and local communities. Adverse environmental impact, corporate irresponsibility, gaps in the law and policy and institutional framework to address the problem, are among the major complaints. However, little has been done to contain the environmental impacts. Apparently, neither the federal Environmental Protection Authority nor regional environmental agencies have conducted significant level of assessment or monitoring and evaluation on the industries' environmental performance.

1.2. Purpose and Methods

This study intends to fill some of the aforesaid information gaps by investigating into the environmental challenges that Ethiopian cement production sector abounds. The study addressed social, environmental and labor issues of the sector. This paper presents the findings. Firstly, abrief description of the materials and methods is presented. Then, findings on the social impacts of the cement production are presented. Next, the marketing aspect of the product, problems associated with land taking and compensation and social costs of the industry are addressed. The fourth section presented the thorough analyses of the environmental aspect of the production, labor situation and industrial safety before the final section that analyses the monitoring and evaluation issues. Finally, concluding remarks and recommendations are given.

1.3. Materials and methods

This study adopted both qualitative and quantitative research approaches in order to address the different research themes and triangulate evidences that emerged from the data analysis. Data were collected from purposively selected cement factories, namely two companies from Dire Dawa, one from Tigray and Amhara each, and three from Oromia. Factory workers and managers, from the federal and regional government institutions, experts, community leaders, and local residents were

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RIVER CATCHMENT , A thesis submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment for the degree of Master of Science in Hydrogeology, *Addis Ababa University.*

27John Sutton and Nebil Kellow (2010) AN ENTERPRISE MAP OF ETHIOPIA, International Growth Centre, London Publishing Partnership, UK, p. 134.

28 Ministry of Trade and Industry (2010/11),Industry Sector Five Year Strategic Plan (2010/11-2014/15), Draft Document in Amharic, at 35.

selected as respondents. Three phases of data collection were launched with parallel and continues data analysis process. Interviews with key informants, questionnaire, FGDs and field observations were employed to extract data. National laws and policy documents were also collected.

Key informant interview was conducted with factory owners or managers, licensing and monitoring government agencies, local government offices and environmental experts. Majority of the data was collected through questionnaire distributed to the local residents and employees. FGDs were conducted with environmental agencies and local residents. Semi-structured checklists for field observation was prepared ahead of time to note visible environmental impacts as a result of the production, observe mitigation mechanisms and observe the overall environmental performance of the industry. During data reduction process, some of the wrongly filled questionnaires were discarded. As indicated in the table below (See Table 1 and Table 2), a total of 55 key informant interviews were conducted, 10 observation checklists were filled and 262 questionnaires were administered where 77 of them were female respondents.

The collected data were analyzed qualitatively and quantitatively. The data gathered through questionnaires was processed through computer program of SPSS (Version 20), whereas the qualitative data were analyzed through discourse analysis or 'descriptive/interpretative' procedure.29Further triangulation and integration of findings was also conducted.

Table 1. Number of Key-Informant Interviews Conducted and Checklists.

Institution/positions	No
Managers	14
Zone/wereda/kebele admin	20
Federal/regional officials	17
Experts	4
Field observation checklist	10
Total	65

Source: Own survey (2013).

Table 2. Number of questionnaires collected from workers and local residents.

Factories	Workers		Local residents	
	Male	Female	Male	Female
Dejen	19	1	54	22
Mugher	5	1	15	7
Midroc	9	1	18	4
Huang Shan	8	5	14	1
Pioneer	7	5	1	5
Messebo	3	0	26	19
National	5	1	1	5
Total	56	14	129	63
Grand Total	70		192	

Source: Own survey (2013).

2. Socio Economic Impacts

The main environmental challenges of cement companies in Ethiopia are similar to the hurdles cement companies face worldwide. These challenges stem mainly from the intensive extraction of raw materials, significant energy consumption, ambient emissions, and solid wastes associated with clinker production. The collected data pertaining to this theme is presented in four categories: socio economic benefit or impact of the production (section three) appears first followed by environmental concerns (section four), labor and safety situations (section five), and monitoring and evaluation by both factories and agencies (section six).

29 See generally, Ian Dey (2005), Qualitative Data Analysis: A user-friendly guide for social Scientists, Routledge Publisher, London and NY.

2.1. Production

At the end of 2011/12 (2004 EC), 17 cement factories are operational with the capacity of producing 10.04 Mt of cement per year. Yet the production reached only as far as 3.76 Mt per year30(see table 3 below). The production pattern of cement indicates that cement factories are predominantly raw material oriented (lime stone being the major making around 70% of the cement) and in some circumstances market oriented.31 The abundant lime stone presence and their distribution in the country around Abay gorge, Mugher Valley, Dire Dawa and Mekelle areas have contributed to the current pattern of cement factory location.32 Specially, Dire Dawa, Mugher Valley and Abay gorge areas support the vast majority of current production.

Table 3.Cement factories' location, stage of production, location and job opportunity.

Stage of Production	No	Region									Job opportunity		
		Oromia	Amhara	Tigray	SNNP	DD	AA	Afar	Somali	Multi regional	Permanent	Temporary	Total
Operational	18	10	2	2	1	3	-	-	-	-	3,168	3,202	6,370
Implementation	16	10	1	1	-	2	-	-	-	2	10,686	7,700	18,386
Pre-implementation	44	21	7	1	4	1	6	1	1	3	10,856	11,313	22,169
Total	78	41	10	4	5	6	6	1	1	5	24,710	22,215	46,925

Source: Ethiopian Investment Agency, data base (2013).

Note: some of the factories under implementation and pre-implementation stage might have cancelled their investment. In addition, factories registered for cement might produce intermediate products like clinker or even concrete and bricks only.

Ethiopian government assessed that in 2008/09 (2001 EC) annual cement demand was close to 6-7 million tons (mt) while production was less than a million tone. It was then forced to fill the vacuum through imported cement worth of more than a billion ETB (US$72 million)(See Table 4 below).It further predicted that such demand will increase by 20-25% per annum making the demand to 8.8 and 27 mt in 2009/10 (2002 EC) and 2014/15 (2007 EC) respectively. Yet the ambitious GTP plan anticipates the local production to reach only as far as 13.4 mt per annum in 2014/15 (2007 EC)leaving 13.6 mt of deficits behind. Such annual production will leave the per capita consumption to 153 kgs while if the demand is met through import, the per capita consumption will reach its target, 300 kgs. Though overall demand for cement is increasing owing to massive government construction program - road, housing, irrigation scheme, factory expansion, hydro electric dam and –and private business developments, the per capita consumption (37 kg) still lags far behind the global average (390 kg – 2007-08).33.

30Ministry of Industry (2012) Ethiopian Cement Industry growth profile, Unpublished; and Ministry of Industry (2013) Actual Production of Cement in 2010/11 and 2011/12 in Ethiopia, 2013.

31 Some companies considered market as the determining factor for their current location and Huang Shan (Modjo) and Mugher Cement Addis Ababa plant can be mentioned. In addition, some mention that Messebo partly considered north part of the country and northern neighbors as its possible market destination while establishing the company.

32Ethiopian Investment Agency (2008), Investment Opportunity Profiles for manufacturing of Cement in Ethiopia, April 2008, at 2-4.

33 Global Cement Report (2008), 8th edn. 2008

Table 4. Imported cement and cost in 2011.

Type of cement	Net_Mass (Kg)	CIF Value(ETB)
Cement clinkers	294,559,926.00	497,045,658.06
White Portland cement	54,465,613.27	93,583,359.62
Portland cement (excl. white)	380,043,317.89	574,214,201.45
Aluminous cement	13,822.18	744,788.93
Refractory Cement	1,809,504.23	88,453,457.46
Other hydraulic cement, etc	53,523,230.14	126,789,424.56
Total	784,415,413.71	1,380,830,890.08

Source: Ministry of Trade (2013).

Table 5.Per capita consumption of cement in selected counties.

Country	UAE	Saudi	Spain	China	Libya	Tunisia	Vietnam	Algeria	Turkey	Egypt	Sudan	Kenya	Tanzania
Consumption/kg	5,098	1,625	1,119	1,105	806	700	586	500	480	436	90	84	42

Source: Global Cement Report (2008).

With only one and half years remaining for the GTP target year, all seems impossible as the demand slumps forcing factories to produce below their capacity (some cutting production by half) and government to suspend issuing new license.34The price of a quintal is now down from 500 ETB (around US$26.3), around which it had hovered for the past five years, to 300 ETB (US$15.8), the maximum now. Furthermore, information obtained from Ministry of Trade, factories and other media sources indicated that more than eight cement factories have requested export permit to sale their products abroad.35 It has also been indicated that some have already exported their product to South Sudan and Northern Somali.36 Noting that the price of Ethiopian cement at local market is higher than the rate on international market; export is a less attractive option for Ethiopian cement factories.37

Such recent trends cast doubt on the sustainability of cement production and if it is still a lucrative business in Ethiopia. Further studies are required on why the demand slumps so quickly since 2011 and the prospects of the business in the future. Cement investment requires huge capital and there must be a good reason to invest on it.

2.2. Land Taking and Compensation

Location of cement factories (including the quarry sites) in relation to productive land, public facilities (school, market places, health posts, water bodies etc) and residential places are crucial especially in Ethiopia where the pattern of production and monitoring of the same are loose. In addition, such location should consider future development plans (trends) and land use planning of the locality. Most of the old and some of the newly established factories do not fall under the category of safe location. For instance old National cement (former Dire Dawa cement) and Addis Ababa cement (now amalgamated with Mugher) are in the middle of the city whereas expansion of cities have closed the distance between factories and residences in Dejen and Messebo cement factories. Likewise, Huang Shan is located in the middle of highly valued and productive agricultural and horticulture production cites of Modjo area.

34 Ministry of Industry, interview conducted on February, 2013.

35 Such list includes the giant cement companies of Mugher, Messebo and National and smaller factories of Abyssinia and East Cement factories.

36 Information from Ministry of Trade confirms that Messebo has already exported cement to South Sudan. Yet others claim that the poor infrastructure in South Sudan prevented many including Messebo from exporting more. Ethiopia: Company Looks to Export Cement to South Sudan, Addis Fortune, Addis Ababa,16 September 2012, by Mahlet Mesfin. On another development, NCSC is exporting its product to Somaliland. Ethiopian Cement Finds A Booming Market In Somaliland, Somalilandsun (HARGEISA), Feb 28th, 2014, by Osman A.M. Mugher is also struggling to penetrate in to Kenya, South Sudan and Djibouti markets.

37 For instance, in August 2012 a quintal of cement was sold at 213 ETB (US$ 11.2) in the international market. Inchini Looks to Export Cement to South Sudan, Addis Fortune, By Mahlet Mesfin, September 16, 2012.

Though cement is substantially raw material (lime stone) oriented industry, market and infrastructures proximity have significant impact on its orientation. For instance, Huang Shan cement claimed that its location is determined after considering infrastructure availability and proximity to the main market of Addis Ababa and not the raw material which comes from Hirna (270 kms). Literally the average distance between raw material and factory is much lower than the distance between the factory and nearby urban center (See table 6 below). The other related matter is the type of land given to factories and the mode of accusation. It is hardly possible to find any vacant land in Ethiopia favorable for cement establishment. Except the old factories where finding reliable data about the mode of land accusation is difficult, land is taken from local land holders.

Table 6. Raw material and major urban areas distance from production.

Name	Lime stone	Gypsum	Pumice	Clay	Nearby urban center
Mugher Cement Enterprise	7 Km by truck & 3.8 Km conveyor	12 Km	Adama	3 Km	5 km (RejiMejuda)
Messobo cement Enterprise	1.8Km Conveyor	35Km	78Km	40Km (Iron Ore)	3-9 km (Mekelle)
National Cement S.Co.	1.5 Km	230Km	Metehara	17Km	Inside the city but 6 km the new (Dire Dawa)
DerbaMidroc (Main)	14 Km by truck & 6.4 Km conveyer	14 Km	100 km	500m (Basalt)	7 kms (Derba)
Pioneer	1 km	180 km	55 kms		12 km from DD & in MelkaJebdu
Huang Shan	350 km/Hirna	325 km	47 kms	33 kms (DZ)	5 km (Modjo)
Dejen Cement	10 km				1 km (Dejen)

Source: Ministry of Industry (2012) and Own survey (2013).

The vast majority of lands taken by the companies are arable (92.9%) and only 0.8% of them are believed to be vacant according to the local residents. The remaining is shared between grazing (3.9%) and residential (2.4%) land. The figure was not surprising given that most of the companies are market and resource (quarry sites) oriented, and may not consider prior use of the land in determining its location. Often Ethiopian government claims that most of the lands given to investors in general have no pre-existing users.38 Yet in our case even agriculturally productive lands (case of Modjo and Dejen areas) were given to cement factories.

When it comes to property right claims by citizens, in addition to losing the rights, the procedure through which the right was taken is equally important. If the land is taken within the scheme of expropriation, substantive and procedural requirement should be fulfilled: only for 'public purpose', up on giving prior notice and after paying the property and displacement compensation.39 Otherwise, it should be through lease agreements to be reached between the holder (farmer or government) and investors. Confusing and mixed situations are observed in the current assessment where majority of land taking seems to be through leasing but brokered and imposed by local government agencies. In addition to monetary compensation, substitute land for farming and house

38Lorenzo Cotula *et al* (2009), Land Grab or Development Opportunity? Agricultural Investment And International Land Deals In Africa, at 62. Available at http://www.ifad.org/pub/land/land_grab.pdf.

39 Expropriation of Land Holdings for Public Purposes and Payment of Compensation Proclamation No.455/2005 (hereinafter Proclamation No. 455/2005); and Council of Ministers Regulation No. 135/2007 (hereinafter Regulation No. 135/2007)for the Payment of Compensation for Property Situated on landholding expropriated for public purposes.

construction were provided in some localities.40At times local governments pay the lease money to residents in a form of compensation relinquishing farmers from their land holding permanently. The issue demands further investigation where the effects of leasing the land for 30+ years to a permanent development (like cement factory) and expropriation should be studied. Under the current state ownership of land, even if it were lease, it is unlikely that the land would be returned to residents after such long years and lost its productivity. In addition, residents will have little property interest on the unproductive land and could cheaply be compensated by the state after the termination of the lease.

The lease period and amount of compensation are not uniform across the country. Huang Shan has got 13.2 hectar for 30 years and paid a total of 1.25 million ETB (US$ 65,579) in the form of compensation for farmers.41 Likewise, National cement has got the land for 80 years lease period from Dire Dawa city administration for free but paid 337,850 ETB (US$17,782) compensation for local land right holders.42 Though the amount of money depends on the type and area of land taken, and type of development in the land, it goes to the extent of 150,000 ETB (US$7,894). The assessment reveals that 64% of the residents strongly argue that the money paid and resettlement schemes provided are too little to substitute their lost land or its earnings. The fact that no other rehabilitation schemes were provided for displaced farmers made life difficult. Some claimed that they have used the compensation money only for a year and migrated to urban areas for seeking jobs. Most of the farmers did not complain much about the amount of money paid during the accusation believing that the amount was enough for them. The problem comes some years after they exhaust the money and their livelihood decrease.

When we come to the modality of expropriation, the research reveals that while 50% of the residents feel that the government has engaged in consultation with them about such development program and the land taking, the remaining 47.6% believe that the land taking (lease or expropriation) was imposed by the local government without their will. Usually, such discussions are characterized by suspicions and frustration from the local residents, and promises from government sides. Yet half of them remember that the discussion with the government was good enough. Economic displacement is the most to be unobserved owing to little care and investigation paid to the socio-economic impact of introducing new programs in to the locality.

2.3. Community Benefits

Cement have very low investment attraction capacity and only 11% of the communities believe that investment activities increased in their locality after the establishment of the cement production. The field observation proved that the surrounding lands are not conducive for other investment. In the long run economic importance of the land around the production will decreasing which in turn will affect the per capita income of local residents.

The immediate economic gains are recognized by residents and 71.1% of the respondents argue that in general they have benefited from the investment. Accordingly, 92.4% of the residents believe that job opportunities are created for the local residents though most are middle level expertise (53.2%) and daily laborers (41.9%). Only 3.2% of the respondents believe that high level positions are available for local communities. In addition, almost half of the residents argue that non residents are favored in some of the posts. Yet due to the absence of skilled man power in the localities, it is admirable that middle level experts like technicians, machine operators, drivers etc are recruited from the local community.

Traditional only low pay jobs (packing, loading and security services) are offered to local communities for lack of skills to involve in the major production process. However, providing training for local communities and offering appropriate jobs sustains company's relation with local communities. In this regard, NCSC has employed 70 young technicians from local TVET College, and Derba Midroc recruited and trained 300 10th grade graduates. Most of the employees in NCSC are local communities and have good working motivation. By the very nature of production, cement

40 Farmers around MidrocDerba cement complained that they are required to pay land tax for the plot that has been acquired by the factory. The wereda administration and rural land administration official and failed to solve the problem.

41See EIA Study Report on Cement Manufacturing Product for Huang Shan Cement Plc, February 2011, Addis Ababa Ethiopia by Bloom Consultancy Plc.

42 Environmental Impact Statement for National Cement Share Company (New Cement Plant), Dire Dawa, Decemeber 2008 produced by Fitsum Consultancy Services.

factories open up job opportunities outside of the production line especially petty trade around production, loading associations and transport providers. The field observation revealed that many local residents are the ultimate beneficiaries of such opportunities. However, the number of foreign workers employed and their job description in the cement production line deserves some attention by labor and social affairs bureaus. In some companies it goes to the extent of 20% of the staffs and at least 30 foreigners are working in each of the assessed factory. The number is higher in the foreign owned factories (e.g. Pioneer and Huang Shan) and most of them are Chinese and exceptionally Indian and Pakistani. In some factories jobs that could easily be done by local employees like machine operator, physicians and supervision are offered to foreigners.

MoLSA is responsible for regulating expatriate employment service in Ethiopia with the power to issue permit, renew and cancel the same, and issue directives to regulate the process.43In addition, investment law and MoLSA directive require investors to train Ethiopians and replace the expatriate workforce within short period of time.44The conditions listed under Article 6 of the directive, which set in conditions whereby an employer can hire an expatriate, in some cases not clear and some have shortfalls. Yet none of the existing frameworks list down jobs that are closed to expatriate workforce or the criteria of determining jobs that could be offered to expatriate employees.45Under the previous labor law, employers are allowed to hire expatriates when the required qualification is not available in Ethiopia or when a foreign national is necessary for installation of machinery, supervision of work, or to study a project, or to train workers.46Though such stipulations are intentionally omitted from current legislation, the cumulative reading of all those legislations convey the message that expatriate staffs are required for filling the knowledge and skill gap and are required to train Ethiopians during their employment. Earlier research concludes that the expatriate employment service in Ethiopia lacks policy clarity and implementation shortfalls.47

Infrastructure development by the factories which could be shared by local communities is at its poorest level. Fifty percent of the respondents believe that infrastructures likes schools, medical facilities, road, water supply, electricity lines etc are not facilitated or provided by the factories. Communities generally complained that they are tired of promises made by companies for providing infrastructures for local communities. During the current assessment, we have witnessed that more are planned to be done (including construction of health posts, schools and water points) than currently provided. The already provided facilities and supports are different and include electric line installation (Pioneer), road and bridge construction (Dejen, Pioneer, Mugher, Messebo), water lines (Mugher, Pioneer), school construction and providing logistics (Mugher, Messebo), health facilities (National, Mugher), provide seedlings and land rehabilitation (Mugher and Messebo), provide heavy machines and cements for free or at low price (all factories).48 The overall costs of these supports are immense and could reach millions though far behind the demands of local communities. Companies in general do not have community engagement strategy known to the community on how to identify intervention activity for support. Providing assistance is not the legal duty of factories but could be considered to offset the overall socio-economic and environmental impacts on local communities. Such obligations could be supported by the well known principles of social equity, corporate responsibility, polluter pays' and sustainable development that calls for resource users to share the benefit or make good the damages through different schemes.

In addition, the overall relation between the company and local communities does not look interactive and strong. Among the respondents, 37.7% of them said that they witnessed 'no discussion' with the company while 27.4% of them identify the relation as 'bad'. The situation is

43 Ethiopian Labor Proclamation No 377/1996, Federal Negarit Gazeta, 10th Year No. 12 ADDIS ABABA 26th February 2004, Arts. 170-174.

44 Ministry of Labor and Social Affairs, Directive issued to Determine conditions of issuing work permits to foreign nationals (Amharic), February 2010, Art. 8

45 See generally, Ministry of Labor and Social Affairs, Report on the Study of Expatriate Work Permit Service in Ethiopia, Consulting firms - WAAS International PLC, Techno Pack Business Solutions PLC and Nolot Professionals PLC, February 2012, Addis Ababa, Ethiopia.

46 Ethiopian Labour Proclamation No. 64/1975, Federal Negarit Gazeta,

47 Ministry of Labor and Social Affairs, Report on the Study of Expatriate Work Permit Service in Ethiopia, Consulting firms - WAAS International PLC, Techn Pack Business Solutions PLC and Nolot Professionals PLC, February 2012, Addis Ababa, Ethiopia, at 47.

48See the official website of Messebo cement http://www.messebocement.com/socity.ASPX and Aleka Abrha (Mariam DahanKebele head) interview on January 2013.

worst in Dejen, Messebo and Derba Midroc respectively. Only 23.4% of the respondents identified the relation as good and accompanied with periodic discussion. At times broken relations are manifested in the form of serious dispute calling for elders, court or other government agency to intervene. Perhaps 63.5% of respondents know such dispute occurring while only a quarter of the respondents have not heard of such dispute existing. Over all grievances (dust, working condition, land taking and absence of community benefits) triggered public demonstration against Dejen cement factory which was later mediated by woreda and church officials. Forgotten promises are behind the high expectations and later dissatisfactions experienced in many areas.

Besides, the livelihoods of local communities whose activities were dependent on the land to be used by the quarries and cement plants are vulnerable to changes brought by the plant. It is likely that the localities demography and lifestyle will change with the introduction of technologies and settlement of labor forces around the plants. This may expose local communities to undesired social consequences including lose their social norms, customs and living styles, and expose them to transmittable diseases including HIV/AIDS. The current assessment identifies intrusion of local customs as the prominent impact (12.9%) followed by increase in the rate of crime (5.2%) and loss of biodiversity (4.1%). Likewise, movement of heavy machines and trucks, and increase in traffic resulted in road accidents including death, bodily injury and damage to property. Residents from Dejen, Mugher, Messebo and Midroc areas talk about instances of deaths.

With the increase in noise, traffic on local roads and respiratory and other health problems, there is likely to be an increase is stress related illnesses in the local population. It is understood as well that the traffic generated by the sector will have significant impact on existing volumes of traffic that use the main or local routes. Heavy transportation or trucks and heavy machines are expected to move around the site generating significant amount of noise and pressure on local road facilities. Sound pollution or noise has been mentioned as a significant impact by 63.8% of the local communities. Naturally, the noise and vibration is problematic for the workers close to the machines than the local residences found far from these facilities.

Given all those positive and negative consequences of the industry, majority of residents (86.8%) still appreciate the importance of the industry either for their community or the nation in general. Only 11.5% of them opposed the industries. Yet when asked if their livelihood has improved since then, only 31.8% responded positively.

3. Environmental Concerns in Cement Manufacture

The environmental problems associated with cement production are both local or site-specific (such as dust, ground subsidence, noise, vibrations, chemical contamination, tailings spills, scenic and local ecologic degradation, and health problems among miners) and regional or global scale with varying degree.49Most of the concerns, however, are local and affects the residences and ecosystems around the factory or quarry sites.

3.1. Loss of Habitat and Land Degradation

Cement production requires extraction of mineral and removal of soil in quarry sites and high traffic leading to land degradation and change in local ecosystem and water level.50The main direct ecological impact of cement production will be the loss of vegetation associated with the "clearance" at quarry areas, the cement plant, construction camp sites and road construction. With soil and vegetation removed, the habitat for fauna will also be destroyed along with any fauna that cannot readily move away when site clearance takes place. Vegetation loss at the quarry and cement plant sites cannot be avoided, but successful restoration, improvement and long term management of the surrounding areas for conservation and productive uses will provide significant compensation. In addition, land degradation due to the extraction of large amount of mineral in the quarry site and transportation of the same in to the plant and cement to the market results in degradation of lands. In addition, impacts of the plant and quarries by changes to the landscape and visual impacts will affect the aesthetic values of the localities.

49van Oss, H. G., and A. C. Padovani. 2002. Cement manufacture and the environment, Part 1: Chemistry and technology. Journal of Industrial Ecology 6(1): 89–105, at 92.

50The Cement Sustainability Initiative, 10 Years of Progress Report-Moving on to the Next Decade, World Business Council for Sustainable Development, 2012, at 20.

Land degradations are identified as the low profiled yet destructive phenomenon in most sites like Dejen and Messebo cement quarry sites. Quarry sites, hills and the surroundings are dismantled and deserted. Local residents (73%) witnessed that the companies are doing little to change the situation through plantation, terracing and constructing support structures (e.g. gabion). Efforts, however, are witnesses where companies tried to establish buffer zone (National Cement in Dire Dawa) and support local aforestation programs (Messebo and Mugher).

3.2. Emission

Emissions to the air both in respect to local air emissions and international greenhouse gas emissions are concerns of cement production. This includes impacts on air quality as a result of emissions from the cement production process and dust from the quarry activities and crushing and grinding processes. Large amount of dusts and other gasses escape to the environment including carbon dioxide (CO2), Oxides of Nitrogen (NOx) and Oxides of Sulfur (SOx), Heavy Metal and Dioxin. Globally, the cement industry is the second largest CO2 emitting industry behind power generation. It produces about 5% of global man-made CO2 emissions, of which 50% is from the chemical process, and 40% from burning fuel. Some data show that as much as 1.25 tones of CO2 is produced for every tone of cement. Though efforts are continuing, no company will make carbon-neutral cement any time soon.51Most of these emissions are generated during power combustion or clinker formation.52Because of their respirable nature and because they may contain potentially harmful concentrations of toxic metals and compounds, particulates are of great concern.53 The particulates are also likely to cause visual impact on the nearby environ.

More than the socio-economic impacts of cement production, dust particulates are affecting the day to day activities of the localities. Only 18.3% of the residents, half of them from Derban Midroc and another quarter from Mugher areas, claimed to have not been affected by dusts from the operation. Human health impact of the dust alone account for 17.6% of the impacts identified where 60% of them are registered in Mossebe cement areas. The case of Mossebe is further supported through the FGD and key informant interviews conducted with both local community and the regional environmental office, and field observation conducted by the study team. Though not confirmed through prolonged medical records, human eye, respiratory and skin diseases respectively are the most mentioned health impacts accounting for 88% of the reported health impact. Skin disease has been reported in their livestock as well.

Dust has not been welcomed by environmental agencies and forced the Huang Shan production site to be closed after lots of complaints filed by the nearby farms and workers. Electrostatic precipitators (ESP) were used in most factories including Huang Shan, Pioneer, old Messebo and NCSC plants but due to power fluctuation and operational faults, it could not help much. Large bunds of dusts still skip the facility in all factories that use ESP. Recently constructed plants like the new National Cement and Messebo installed the filter bag which is more efficient and safer than the former. Electrostatic precipitators (EPs) and fabric filters both have their advantages and disadvantages. Both types have a very high dedusting efficiency during normal operation. During special conditions such as high CO2 concentration, kiln start up, kiln shut down or switching from compound operation (raw mill on) to direct operation (raw mill off) the efficiency of EPs can be significantly reduced while the efficiency of fabric filters is not affected.54 Fabric filters therefore have a higher overall efficiency if they are well maintained and filter bags are replaced periodically. A disadvantage of fabric filters is that used filter bags are waste and have to be disposed of according to national regulations.

51In certain applications, lime mortar, reabsorbs the same amount of CO2 as was released in its manufacture, and has a lower energy requirement in production than mainstream cement. Newly developed cement types from Novacem and Eco-cement can absorb carbon dioxide from ambient air during hardening. Use of the Kalina cycle during production can also increase energy efficiency.

52See generally van Oss, H. G., and A. C. Padovani. 2003. Cement manufacture and the environment, Part 2: Chemistry and technology. *Journal of Industrial Ecology* 7(1): 89–105.

53Id, at 96.

54 EIA Study Report on Cement Manufacturing Product for Huang Shan Cement Plc, February 2011, Addis Ababa Ethiopia by Bloom Consultancy Plc.

Table 7. Dust or other gas emission impact on livelihood.

Category of Impacts	Name of the cement company							Total (%)
	Dejen	Mugher	Midroc	Huang Shan	Pioneer	Messebo	National	
Human health	5	3	1	1	1	18	1	16.7
Animal health	0	0	0	0	0	0	0	0
Agri-production	11	2	1	1	5	0	0	11.1
House keeping	3	0	0	0	0	0	0	1.7
Combination	44	6	0	6	0	25	4	47.2
Others	1	3	3	1	1	0	0	5.0
Nothing	6	5	16	5	0	1	0	18.3
Total								100.0

The emission standard enacted in 2008 has set the limit for emissions of cement factories (See table 8 below).55 The standard has an immediate effect for newly established factories but five years grace period was given to factories established before its introduction.56 The grace period that has expired in December 2013 is intended to give them the time to transform their production pattern and technology uses so as to decrease emission. During the grace period, existing factories are obliged to undertake environmental audit, and prepare and implement an environmental management plan. Yet records of emission measured are obtained only from Mugher cement and others have not measured it. Some of the companies even did not know the existence of emission standard for cement production. Environmental agencies have done nothing to change the situation and follow the progresses of technology adoption unless complaints come from community or nearby businesses.

Table 8. Limit Value for Emission to Air by Cement Factories.

Parameter	Limit value
Total particulates	150 mg/Nm3
Sulphur dioxide (as SO2)	1000 mg/Nm3
Nitrous oxide (as NO2)	2000 mg/Nm3

Source: A Directive Issued to Determine Industrial Enterprises Subject to the Industrial Pollution Prevention and Control Regulations, Directive No. 008/ 2008, at 9.

Unregulated dust emission has led to different confrontational reactions both from the public and monitoring government agencies. Dire Dawa administration has conducted an independent assessment on the old national cement factory which is located in the middle of the city due public complaints about its dust emission. Dire Dawa EPA has released its assessment report, based on field visit and questionnaire, on January 2011. The report claims that the local communities have been complaining repeatedly; the factory has increased its dust and gas emission; and the city administration has not done anything other than issuing warning to the factory. It also identifies off-site storage of raw materials, power fluctuation and system (burner) inefficiency as the major causes of the emission. The assessment team has witnessed the emission and noticed properties (bicycle, satellite dish and papaya tree) completely covered with dusts. The report mentions actions to be taken by all stakeholders including the factory, health bureau and EPA. Two years after the report were released, we found the community suffering out of the same impacts. Though there are not any public places like school or market places around, houses and properties are covered with dust ruminants making it unsuitable for living and other investment. The factories wall or low land vegetations are too little to trap the dust. The ESP installed in the plant could not trap all the dusts.
Similarly, Huang Shan cement has not installed dust absorbing technology until the local farmers and horticulture producers successfully lobbied the regional government to order closure of it for months. The EIA of Huang Shan which was conducted after such incidence claims that the kebele

55Ethiopia, A Directive Issued to Determine Industrial Enterprises Subject to the Industrial Pollution Prevention and Control Regulations, Directive No. 008/ 2008,
56Ethiopia, Council Of Ministers Regulations to Provide For The Prevention Of Industrial Pollution, 2008, Article 12.

cabinet and local communities revealed that the emission badly affected croplands of 20-25 households by accumulating on plant body and crop residues which they feed on their livestock.57 The EIA also reveals that absence of storage for raw materials and dust absorbing devices are behind the emissions. The factory latter installed ESP but could not absorb the dust in a required amount. The pressure was mounting on the company as dairy farm and horticulture farms in the vicinity were closed and blasts in the company resulted in casualties. Huang Shan has now stopped production.

Similar stories are heard from Messebo cement areas. The old factory installed ESP but due to power fluctuation and interruption, significant amount of dusts are freely emitted to the environment. Local communities claim that the dust is causing several health problems and mainly asthma and hemorrhoid. At the day of our interview a man in the local community has died out and they blamed the dust that caused asthma for that. Children are the most affected, skins of cattle are fed and scratch. The community claimed that agricultural production has gradually decreased with stunted growth. Some of them are notably where the stunted crops and lands filled with dust particulates are observed during field visits in Mekelle and Modjo areas. In addition, loss of horticulture production and chicken farm has been reported in Modjo areas due to the dust. They also claim that livestock could not feed on their crop residuals and nor can they sale it due to dust accumulation. Similar stories are heard from Dejen and Pioneer cement area. Generally, 73.3% of the interviewed local residents from different factories reported decrease in agricultural productivity around the cement factories.

In addition to the technologies used for trapping emission, other production systems could be used to decrease emission. Eructing high wall around the compound, tree/vegetation coverage, using conveyor than tracks for transporting of raw materials, fleshing water on the road, storing raw materials in a proper storage warehouse than in an open air environment etc are some of the mitigation mechanisms. Yet except the conveyor, most of the mitigation mechanisms are neglected by factories. Plantations and high walls are rarely placed to trap emission though some has identified plantation cites in their land use map.

Experts in the Ministry of Industry claim that previously much attention was given to filling the demand deficit by establishing as much cement factories as possible by ignoring its social and sustainability aspects. Later on due to the pressure from community and businesses around cement factories, some factories (e.g. Jema Cement Plc - Mukaturi, Huang Shan-Modjo and Hua Yu Cement Plc - Adama) were closed and reopened after improving their environmental standard. This show that both factories and the government are considering environmental and sustainability agendas during construction of new plants and in the course of cement production.58 Though discussions are underway between environmental agencies and cement factories on measures to be taken against dust emission, political commitment, economic feasibility of closing production and skilled man power and technology for monitoring are behind the lenient measures of government agencies.

Heavy metals and dioxins are emitted basically from combustion, the natural raw materials and from the use of recycled by-products or alternative fuels (tire or wastes). So far companies are not using alternative fuels (e.g. tire, combustion of waste) as a source of power in large volume and the threat is minimized. Yet before measuring the emission from companies, conduct laboratory taste for samples from water, soil, vegetables and human being, and conduct medical checkups for local communities, the exact impact of emissions other than dust particulates are not easily identified. It is also beyond the scope of this research to analyze such impacts.

3.3. Energy

Cement manufacturing is an energy-intensive process. The kiln process consumes more than 90% of the cement manufacturing energy. The remaining 10% is consumed in almost equal amounts by activities related to fuel and raw materials preparation, grinding of clinker and the blending of materials to prepare the finished cement product. Studies show that the sum of energy inputs in cement industry is about 39% of the annual operating costs of a cement manufacturing facility, making energy the largest cost component. It is important to note that although electricity accounts

57Environmental Impact Assessment Study Report On Cement Manufacturing Project for Huang Shan Cement Plc, Bloom Consultancy Plc, Feb 2011, AA, Ethiopia, at 86.

58 For example, Derba Midroc claims that 1/3rd of its cost of constructing are spent on environmental mitigation.

for only 13% of the energy inputs, it is almost 50% of the energy costs of a typical cement plant. The major electrical energy consumption areas are mill drives, fans and conveying systems.
Globally, the cement industry relies heavily on carbon-intensive fossil fuels. A variety of fuels such as coal, pet coke, gas and oil in addition to unconventional fuels such as used tires, non-incinerating hazardous wastes, agro residues etc are used in the cement plant. Coal (53%) and petroleum coke products (29%) account for more than 82% of energy consumption. Natural gas (used mostly as a start-up fuel), liquid petroleum products and waste oil products contribute 4% of total energy requirements, while tire-derived fuels and other alternative energy sources contribute about 2%. More often, the source of energy determines the kind and amount of emission the factory could potentially release to the environment.

As is true in most cement production, assessed companies use combination of energy sources for their operation. Petcock, heavy furnace oil (HFO), coal and electricity are the major once. Only the latter being a national product, HFO and coal are imported from South Africa and Sudan. Though the transformation is slower, a year ago the government ordered all cement factories to make use of coal than other energy sources including petcock and HFO. In addition, government owned Petroleum Corporation is commissioned to import coal in large quantity.59 Currently, cement companies are forced to import coal to substitute the old energy sources. Attempts to produce coal locally are underway in Chilga, Jimma, Dewelle areas which could increase the supply.60 There are additional initiatives in the energy use, Messebo contracted consultant to prepare Biomass energy in the factory61 and NCSC piloting using waste as energy source.62 However, the challenge remains unsolved particularly old companies that use energy inefficient technologies and production system. More efficient technologies and production patterns are bringing down the energy consumption and the associated emission.

The electricity supply which comes from the national grid system takes almost 10% of the national product. This casts doubt as to the sustainability of the supply given the decline in demand of cement and increase in demand of electricity by other sectors. Besides, the available data could not help to evaluate the overall energy consumption pattern and efficiency of the sector due to poor reporting and classification of the information by factories. This report only highlights the risks of shifting the energy source to carbon-intensive and so called alternatives.

59Melaku, Zegeye and Lilay Mohammed (Ministry of Industry – February 13, 2013). Close to 400,000 tones of coal are imported every year. Ministry of Mines and Energy - Geological Survey of Ethiopia, Investment Opportunities in Coals of Ethiopia, Addis Ababa, 2009.

60Though the country has significant amount of untapped coal reserves (800 million tones), the coal mining sector is underdeveloped. Very recently the Delbi areas (South west Ethiopia – in Jimma zone) attracted attentions and a joint investment by Delbi Coal Mining S.C. (Ethiopian) and May Flower (India) are trying to develop the coal fields. Ministry of Mines and Energy - Geological Survey of Ethiopia, Investment Opportunities in Coals of Ethiopia, Addis Ababa, 2009; See also Ministry of Foreign Affairs online news bulletin at http://www.mfa.gov.et/news/more.php?newsid=2639 accessed on December 2013. Delbi Coal Mining sc (co-owned by EFFORT) is supplying coal from Delbi (Jimma area) to Huang Shan, Abbyssinia and Messebo cement factories. Some say that the coal reserve in Delbi has been reserved for the production of chemical fertilizers. Interview with Ministry of Industry, Feb. 2013.

61 Interview with Factory managers conducted on two occasions August 2012 and February 2013.

62 Interview with Dire Dawa EPA officials conducted on August 2012.

Table 9. Cement Factories Electric Demand and supplied.

Name of the Factory	Location	Electric power Demand (MW)	Electric power supplied (MW)
Mugher cement enterprise	Muhger	15	15
Mugher Cement Expansion project	Mugher and Tatek	12	12
Mossobo cement factory	Mekele	12	12
Messobo Cement Expansion Project	Mekele	12	12
National cement Plc	Dire Dawa	12	12
National cement new project	Dire Dawa	32	1.2
Huanshang cement Plc	Modjo	5	5
Dejen- midroc cement	Dejen	4	3.2
Pioneer cement Plc (clinker)	Dire Dawa (MelkaJebdu)	10	5.4
DerbaMedroc cement (Major)	Derba (factory)	50	50
	Chancho (parking)	2.6	2.6
Total		166.2	130.4

Source: Ministry of Industry, 2005.

3.4. Water Supply and Waste Management System

Water as a scarce yet vital resource continued to get attention in the global sustainability discussion.63 Cement production requires relatively small amount of water for cooling heavy equipment and exhaust gases, in emission control systems such as wet scrubbers, evaporates in the process, and used for consumption in the factory (e.g. sanitation).64 Yet companies should consider their water withdrawal, efficiency and recycling so as to avoid water stress and conflict with local community. Often water sources for cement factories are deep well and do not share community water facilities and surface water bodies. Only Huang Shan was found sharing such public water bodies where it pumped 50 to 100 m3 water from the nearby Modjo River.65

Sustainability of such water well should be considered while accessing the water table. It has been claimed that Messebo cement has dug deep wells (close to 150 meters) leading the community well, which was only 50 meters deep, to abandon/disappear. As a result, the factory is forced to share its water well with the community. Yet overwhelming majority of the interviewed residents (80%) believe that the water quality and quantity remain unchanged while the rest mention change in quantity, test and color.

3.5. Waste Management

Unwanted material or products or escaping products could be considered as wastes. Wastes could be categorized under solid, liquid or hazardous. The later could exist in solid or liquid form but due to its impact on the environment and human health, it deserves special treatment and regulation. Paper bags, lubricants, different containers, waste coal are some of the solid waste generated in cement factories. The liquid wastes are mainly comes from waste water generated in the process. It is unlikely that cement production will generate huge amount wastes. Yet potential release of contaminated effluents into the surface water drainage and handling of solid wastes deserves much attention. Accordingly, the four principles of waste minimization process, otherwise known as the '4Rs', (namely, reduction, reuse, recycling and recovery) shall be adopted as applicable.66Wastes

63The Cement Sustainability Initiative, 10 Years of Progress Report-Moving on to the Next Decade, World Business Council for Sustainable Development, 2012, at 21.

64 Id.

65The water consumption ranges from 109,500-146,000m3/year (300 – 400 m3 a day) in Huang Shan to 120,000 m3 /year in Dejen.

66REDUCE, REUSE, RECYCLE AND RECOVER WASTE: A 4R's Guide - For the First Nations Communities of Quebec and Labrador (2008), First Nations of Quebec and Labrador Sustainable development Institute (FNQLSDI), March 2008.

should be handled safely from its generation to the stage of disposal which includes source identification, waste categorization, segregation, handling/storing and finally disposing it.

The current assessment revealed that most of the cement companies do not have defined system, structure and guidelines for safe waste disposal. They usually put solid wastes in containers and later burn it out. In addition, onsite storage (open space) of raw materials, lime stone, coal and pumice facilitate escaping of the products in to the nearby environment. Coal is stored in an open space in Huang Shan, Pioneer and Messebo. As a result, visible amounts of coal ruminants were found in the agricultural fields and water harvesting ponds of Messebo cement area farmers. Impacts could be immense and visible if there were water bodies around cement factories.

More importantly, escaping liquid wastes are the major concerns of local communities. Messebo cement discharges the waste water freely to the nearby environment and agricultural fields. The local community complained about it and the regional environmental agencies took samples of the waste and sent it to Addis Ababa EPA for laboratory analysis.

Regarding waste disposal, 70% of the respondents claim that they have not been affected by waste associated with the factory. Yet liquid wastes coming from the cooling system, cleaning and other facilities and freely discharged to the nearby environment are mentioned by 21.3% of the respondents. Those colorless liquid wastes are affecting livestock and agricultural production in some visited areas. None negligible amount of solid wastes, especially paper bags and coal residuals are also disposed of to the nearby environ. Waste recycling (water and used or torn out cement bags) and establishing treatment facility within the company have not stepped up into implementation stage beyond planning. In addition, none of the factories have waste treatment facilities in their compound, nor measure discharged wastes. Outrageously, most companies are not aware of the industrial environmental standards issued in 2008 that determined the air and liquid emission limits for factories including cement productions (see Table 10 below).

The recent interest in exporting cement would require our cement factories to modernize their social and waste management systems including monitoring. Equally important is monitoring activities of environmental agencies' that might help company become environment sensitive, and specifically establishes their own waste management system and reporting requirement.

Table 10. Limit Values for Discharge to Water by Cement Factories.

Parameter	Limit Value
PH	6 – 9
BOD5 at 20□ C	25 mg/l
COD	150 mg/l
Total phosphorus (as P)	5 mg/l
Suspended solids	50 mg/l
Mineral oils at the oil trap or interceptor	20 mg/l

Source: A Directive Issued to Determine Industrial Enterprises Subject to the Industrial Pollution Prevention and Control Regulations, Directive No. 008/ 2008, at 9.

4. Labor Conditions and Safety Standards

4.1. Working Conditions

The fringe benefits provided to its workers include transportation, housing, clothes, medical service, food and milk. For instance, National and Mugher cements have residential houses prepared for its workers; Messebo and National cement provide food at a subsidized price in their respective compound.

Salaries in the companies are quite different and some have a moderate payment for experts but generally lower rate for daily laborers and unskilled employees going as low as 300 ETB (US$ 15.8) per month.67 The mean salary in the current assessment was 1,315 ETB (US$ 69) with a standard deviation of 1104.638.The working hours are usually 8 but with some variations as high as 10 per day in Midroc, Huang Shan, Pioneer and Messebo cement factories.

67 In Dejen cement daily laborers are paid only 18 ETB per day (less than 400 ETB or US$21 per month) and those who load cement are paid 0.60 cents per package.

After joining cement factories, 61.8% of the workers felt the improvement in their livelihood but 35.3% claimed that it remained the same. The job opportunities created by cement investment and their impact on families livelihood is tremendous. This is strengthened by the fact that only 4.2% of the workers were employed with better pay before joining their current employer while 50% of workers were unemployed or students. As a result, 60% of the workers responded that their livelihood has improved after the current employment. Among those whose livelihood has not improved, daily laborers account for 38%. Availability of cheap and abundant unskilled labor could be the one to be blamed in addition to the absence of minimum pay standard and enforcement of labor rights in Ethiopia. Pretty sure that unskilled labor can be converted in to skilled and more productive labor force with on-the-job skill training and education improvement if the companies have sound human resource development strategies. Yet only 37.9% of the workers have got the opportunity of attending on-the-job training so far.

Equality among workers is at stake and majority of workers feel discriminated on many occasions. Thus, 56.1% of the workers mostly from Dejen, Huang Shan and Pioneer cement companies claimed that they are not equally treated with their fellow workers. The trend shows that companies owned and managed by Ethiopians provide better treatment than foreign companies. Yet the figure does not show any variation between male and female respondents suggesting that gender is not the major basis of discrimination but nationality. Often foreigners (in this case Chinese) are better treated than Ethiopians on the basis of their nationality, and goes to the extent of denying equal medical attention during occupational accident or illnesses. The assessment has not revealed major sex-based discrimination though some sexual harassments are reported by foreigners in some of the companies.

Innovative actions to motivate workers are done by some like giving annual award for best performing worker in Huang Shan. Availability of water and sanitation services and access to it is comparably better in companies' compounds. Toilets with water flesh, bath room and drinking water are available in good quality and quantity.

4.2. Labor Union and Periodic Consultation

Labor unions work to protect their body of employees, control employment opportunities and negotiate both safe working conditions and reasonable wages for workers. According to reports from Confederation of Ethiopian Trade Union (CETU), establishing labor union, bargaining for labor conditions and enforcing minimum labor conditions including leave and due process is relatively difficult in companies owned by foreigners especially Chinese and Indians.

Labor unions are formed in all except one of the companies investigated (Dejen cement). But only 41% of the workers claimed that they are members to a labor union in their company. However, 19.4% responded that they are not a member to a labor union though it exists in their respective company. Quite often labor unions and its leaders are the victims of sabotage by the company that strategically destabilize the union. Not differently, only 15% of the respondents are positive about labor unions and believe that it is functioning to their expectation. However, 74% of the respondents believe that the labor union is not operational or otherwise biased to the company. Its impact is manifested in the dispute settlement and collective bargaining schemes available in the respective companies where labor unions could play a significant role. Collective bargaining is the process of negotiating with a company in which the labor union and the company alike agree to concessions that will allow both sides to reach the goals they have in mind. Collective bargaining seems ideal given the lower member and relative strength of labor unions. Accordingly, only 12.3% of the workers claimed that collective bargaining through their union is possible.

In the absence of stronger labor union, periodic consultation with company management and owners could have filled the gap, and foster good working environment. Yet 55.4% of the workers have ever experienced any general meeting or discussion with the managers about their working conditions. Only 4.5% of the respondents claimed that they have such consultation with the managers once or twice a year. The sense of belongingness and shared visions are lucking, long lasting industrial peace is far reaching and conflicts when they come are difficult to handle in such non-interactive working environment.

4.3. Risks and Available Benefits – Occupational Safety and Health

The cement industry, which is labor intensive and uses large scale and potentially hazardous manufacturing processes, experiences accident rates that are high compared with some other manufacturing industries. There are a number of hazards inherent to the cement production process including exposure to dust, heat, noise and vibration, physical hazards, radiation and chemical hazards.68Noise impacts of the quarries, particularly the limestone quarry blasting and grinding mills could be intermittently significant and likely to lead to nuisance.69As a result, employees deserve continuous health checkups, safety clothe, musk, glove, head covers, timely treatments when they got ill.

The constitution, labor laws (both civil servant other laws) and the Occupational Safety and Health (OSH) Directive are the relevant legal frameworks regulating the issue. The Constitutions broadly sets the standard by prohibiting forced and compulsory labor and stating that "workers shall have the right to appropriately defined working hours, breaks, leisure, periodic leave with pay, paid public holidays, and a safe and healthy working environment."70The labor proclamation, on its part, inter alia, requires employers "take the necessary measures to safeguard adequately the health and safety of the workers" and workers to obey all OSH rules and instructions and report hazards; held employers liable, irrespective of fault, for employment "injuries" sustained by their workers, which include "employment accidents" and "occupational deceases;" establishes the employer's duty to provide aid and assistance to injured workers; defines benefits during employment injuries; and define roles and responsibilities of labor inspectors.71 Furthermore, the OSH Directive issued by Ministry of Labor and Social Affairs (MOLSA) provide detailed mandatory regulations on safety standards and inspector's roles.72Beside, other sectoral laws like investment, environmental, chemical control, public health and criminal laws have scattered OSH related provisions specific to their sector.73

Previous assessments reveal that the labor inspection process mandated to follow up enforcement of labor laws including OSH issues are surrounded by constraints including capacity (material, technical and staffing), absence of objective planning, management and execution of the same; absence of education and outreach programs for awareness raising; and enforcement of inspectors' recommendations.74

According to a report obtained from Ministry of Labor and Social Affairs (MOLSA), based on data from 66 establishments in the period of 2008/09, a total of 1,968 work accidents occurred of which 9 were fatal.75 The report also identified manufacturing industries (including those associated with mining and quarrying) with the highest percentage (56.05%) of reported work accidents followed by construction (22.25%) and agricultural (20.58%) sectors. In addition, accidents caused by machine alone account for 18.50% of the accidents followed by falling and slippery (16.67%) and hand tools (13.21%). Such trends of causes of reports accidents reveals that the cement industry, even if not well included in MOLSA's report, could be among the risky tasks. Furthermore, in six months time prior to our assessment, fatal accidents have occurred in four of the seven cement factories.

The nature of the activity in cement production has exposed workers to different health risks and has high injury and fatality rates among other industries.76It is partly due to the fact that the

68World Bank Group (2007) Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing, April 30, 2007.

69 Id.

70 Ethiopian Constitution, Proclamation No 1/1995, Federal NegaritGasette, 1st Year No.1, 1995 (Here After FDRE Constitution),Arts. 18(3) & 42(2).

71 See generally, Ethiopian Labor Proclamation 377/2003.

72Jeff Wheeler & Keith Goddard (2013),Assessment of Ethiopia's Labor Inspection System, Bureau of International Labor Affairs, U.S. Department of Labor, March 2013.

73 See generally, DawitSeblework (2006), Occupational Safety and Health: Profile for Ethiopia, ILO and Ministry of Labor and Social Affairs, October 2006.

74 See generally Jeff Wheeler & Keith Goddard (2013),Assessment of Ethiopia's Labor Inspection System, Bureau of International Labor Affairs, U.S. Department of Labor, March 2013.

75Ministry of Labor and Social Affairs (MOLSA), Work Accident, http://www.molsa.gov.et/English/HIR/Pages/WorkAccident.aspx.Accessed on 26-02-14.

76 The Cement Sustainability Initiative (2012), 10 Years of Progress Report-Moving on to the Next Decade, World Business Council for Sustainable Development, 2012 (here after called 'CSI 2012 Progress Report); see also Cement Sustainability Initiative (CSI), Health and safety in the cement industry: Examples of good practice, World Business Council for Sustainable Development, Version 1.0, December 2004, at 17.

implementation of occupational health and safety management systems in cement industry in general is not nearly as advanced as some other heavymanufacturing industries.77In addition, existence of heavy machines, manual nature of some activities, production associated externalities including heat and dust particulates are responsible for many of the accidents and illnesses. Deadly accidents are also evident in cement factories. While most of workers mention illness (30%) and injury (21%), non-negligible percentage of them (7.5%) considerfatality as one of the threats. Further inquiry revealed that machine operators, drivers and system operators are those who responded that they risked their life. A large majority of workers who does not have direct contact with machines and field works like office management, supervisors, guards and other experts (e.g. health workers) workers feel that theyare not exposed to any health risks.

With such high health risks due to the very nature of the job, safety standards and regulations are crucial to mitigate or avoid the occurrence and magnitude of the risk. Protecting the health and safety of its workers must of the priorities of the company for its own sake even if the government regulatory frameworks are not good enough. Best practices show that companies should enact their own occupation health and safety (OHS) management system or policy, identify organization structure for its implementation, design implementation program, set up monitoring and evaluation system, and design learning and improvement scheme.78 Companies can adopt the guidelines to suite their production but at least the following measures should be done: provision of personal protection equipment; set workplace instruction, rules and procedure; emergency plans including first aid and medical facilities; training and communication on safety and operating system; necessary and proportionate medical attention during illness and accidents, and periodic checkups for identified workers; and compensation schemes including full workplace insurance coverage.79
Adopting all the details of those best practices to Ethiopian cement production requires the concerted efforts of regulators and companies. The current assessment reveals, however, that the attention given to occupational health and safety regulation is low and characterized by responding to outbreaks and accidents than designing holistic approach. Companies provide different personal protection equipment including clothes, glove, musk and glass to its staffs. Yet 38.5% of workers including laborers, machine operators and system operators responded that they have not got any of these equipments. The frequency at which those equipments are handed over to workers, at what time and place should they be worn and monitoring of the same, compatibility of the equipment with the temperature at workplace and their quality is seriously criticized by workers and supervisors. Even if the equipment are purchased and handed over to workers, the absence of clear policy, monitoring and adapting to conditions risked its utility. There, however, exists slight variation among companies where National cement is comparably good and the worst situation exists in Dejen where 90% of the workers do not have access to personal safety equipment. In addition, low industrial experience and absence of safety regulations made workers not to use the safety equipment. Some workers are selling those safety equipment and mitigations schemes like helmet, milk, clothe and goggle to other users and show up without them.

Responses to illnesses and accidents are comparable better than the prevention measures devised in most of the companies. First aid is provided in all of the companies and first level medical attention in most of the companies. They have also agreements with other medical facilities including public hospitals for further treatment of its workers. Yet implementation of the scheme is lagging behind as issues of equal medical attention for all workers (based on pay rate/position/nationality), proportionate or adequacy of the treatment and determining the threshold for further treatment are complained of. Likewise, periodic medical checkups are not adopted as a policy in all the companies and a total of 76% of the workers never had checkups. To my surprise, a single worker has ever gone for medical checkup from Dejen and Huang Shan cement factories.

The existence of insurance coverage for occupation health, illness and death related hazards are contestable. While most of the managers claimed to have the policy, they, however, could not produce the evidences. Three forth of the workers, on their part, claimed that their companies do not have insurance schemes or have no information about it. The labor law empowered MOLSA to

77 CSI, 2012 Progress Report, at 9.
78 Cement Sustainability Initiative (CSI) (2004), Health and safety in the cement industry: Examples of good practice, World Business Council for Sustainable Development, Version 1.0, December 2004.
79Id, at 10-16.

issue a directive on undertakings required to have insurance coverage for the payment of employment injury benefit.80However, neither the regulation nor other enforcement mechanisms are in place to require such mandatory workplace insurance coverage.81Such insurance products are available in the market and companies provide Workmen's Compensation and Group Personal Accident Insurance Schemes for various undertakings that have arrangements for such coverage.82 The fact that only less than 105 million ETB (US$ 5.5 million) had been paid for such insurance claims from 2000/01 to 2004/05 reiterate the low level of coverage such scheme had.83

Insurance coverage is only one of the possible schemes and should be coupled with other benefits and compensation schemes including medical leave with pay. Yet out of those who sustained occupational accident or illness, a third of them claimed to have not been compensated at all.

5. Monitoring and Evaluation (M&E)

In the wake of science and technology advancement and better understanding of human environment, improved technologies and systems are proposed to ease such environmental impacts. Technologically, mitigation mechanisms and hi-techs are available with negligible additional investments or cost of production.84 System wise, EIA, environmental management plan (EMP) and environmental auditing (monitoring) are three interrelated environmental tools designed for environmental mitigation.85 Inculcating corporate social responsibility in all production phases is equally important.86 This, however, will not go to the extent of attaining CO2 free cement production, which is not expected anytime soon.87 Yet energy efficient productions (the main source of air pollution), alternative energy sources, dust absorbing technologies (filter bags and electrostatic precipitator), waste recycling facilities (both liquid and solid wastes), safety equipment for workers etc., are available in the market. Institutional transformation and stronger government enforcement capacities are as important as the technologies are.

As is true in Ethiopia, developing countries, however, are considering lenient environmental standards and labor conditions to promote investment and economic growth, allowing businesses to minimize costs by polluting with impunity.88 This gives rise to 'race-to-the-bottom': race that

80Ethiopian Labour Proclamation No.377/2003, Article 170(1)(l).

81 The government, however, introduced the Public (Universal) Health Insurance scheme that may partly cover what the workplace insurance scheme might do. Yet these are two entirely different forms of insurance. Though the beneficiary is still the employee in both case, the scope of coverage and responsibilities of employees and employers are quite different. See generally Ethiopian Social Health Insurance Proclamation No. 690/2010, Federal Negarit Gazeta 16th Year No. 50, Addis Ababa, 19th August, 2010.

82Dawit Seblework (2006), Occupational Safety and Health: Profile for Ethiopia, ILO and Ministry of Labor and Social Affairs, October 2006, at 40.

83Id, at 40-41.

84 William A. Pizer and Raymond Kopp (2003),Calculating the Costs of Environmental Regulation, March 2003, Washington, DC: Resource for the Future Discussion Paper 03–06; Michael Greenstone, John A(2012). List and Chad Syverson - The Effects of Environmental Regulation on the Competitiveness of U.S. Manufacturing, CES Working Paper 11-03, 2012; and Porter, Michael E. (1991) America's Green Strategy, Scientific American, 264(4), at 168. The later argued that more stringent regulations enhance productivity by causing firms to rationalize their operations. Many, however, mention that the cost of environmental regulation is less than 2.6% of the total production cost.

85 Environmental Management Plan (EMP) is a site or project specific plan developed to ensure that appropriate environmental management practices are followed during a project's construction and/or operation, while environmental auditing seeks to monitor implementation of EMP, confirm the operational practices and to highlight any deviation from the accepted norm.

86 David Waldman (2009) Corporate Social Responsibility: What it really is, Why it's so important, and How it should be managed, School of Global Management and Leadership, Arizona State University; COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS: A renewed EU strategy 2011-14 for Corporate Social Responsibility (COM (2011) 681),Brussels, 25.10.2011. European Commission defined corporate social responsibility as "a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis".

87 Very recently, however, group of scientists has developed a method for cement production that releases zero CO2 emissions with an estimated cheaper cost of production than the existing process. Stuart Licht, Hongjun Wu, Chaminda Hettige, Baohui Wang, Joseph Asercion, Jason Lau and Jessica Stuart (2012) STEP cement: Solar Thermal Electrochemical Production of CaO without CO2 emission, Chemical Communications,2012,48, 6019-6021 DOI: 10.1039/C2CC31341C.

88 Wheeler, D. (1999), Racing to the Bottom? Foreign Investment and Air Quality in Developing Countries, World Bank Policy Research Working Paper No. 2524; and Davies, Ronald B., and Krishna Chaitanya Vadlamannati (2013) A Race to the Bottom in Labour Standards? An Empirical Investigation, Journal of Development Economics, forthcoming.

decreases social welfare and environmental situation, and leaves the community to pay social and environmental costs relentlessly born by investment activities.89

Negative overlaps – federal vs regional on one hand and regional vs local agencies are abandoning their responsibilities waiting for others to intervene.

Multiples of reasons could be mentioned for the low level of environmental monitoring and enforcing citizens' development rights around cement areas. Officials from different Dire Dawa offices mention high staff turnovers, absence of experts, environmental laboratories and measuring devices, and lack of proper training for experts and administration personnel as reasons for absence of monitoring.90 They also mentioned generality of the law and absence of detailed guidelines, affordability of mitigation measures, and lack of awareness on environmental standards and companies' responsibilities as additional bottleneck.

Beside lack of political commitment to monitor environmental performances, regional environmental agencies are under staffed and equipped to conduct periodic monitoring. At the same time, wereda (local) agencies feel that they are not mandated or empowered to conduct periodic monitoring and evaluation, understaffed and lacks expertise in the subject. DerbaMidroc is an example to this where the company closed its door for any monitoring and wereda officials responded that they have reported the situation to regional offices. Wereda official claimed that as the Company's head office is in Addis, it is not known whom they should held responsible for many things happening around the factory. Similarly, Dejenwereda officials claimed that the company has no communication or reporting duty to them but only to regional agencies.

EIA –companies established before the enactment of the EIA proclamation are unlikely to have gone through the EIA process. However, most of the newly established companies, including new NCSC, Messebo, Huang Shan and Pioneer, have done the EIA assessment though the recommendation and mitigation measures are not implemented at all. In some instance, factories themselves have lost the copy of the document and in other circumstances EMP has not been included in it. Huang Shan conducted the EIA two years after operation when pressure was mounting from communities and governments due to its environmental impacts. In the absence of government monitoring, experiences show that factories are reluctant to impalement mitigation measures and audit their social and environmental performances.

Officials also recommended the establishment of environmental units in the factories which are under process in Messebo.91 Factories are the first to benefit out of the environmental unit as it provides the company with sustainable way of production, deals with safety standards, design strategies of off-setting environmental impacts, measure emissions to the environment and propose proactive measures of dealing with environmental matters.

6. Conclusion and Recommendations

This study has shown that environmental and social conditions are at the lowest stage giving the way for companies to build their profit margin at the cost of social and environmental elements. Degradation of land, impact on the ecosystem, loss of agricultural productivity, contamination of local water and feed sources are reported associated with unregulated dust and other gas emissions and waste discharge and poor resource management practices. Working conditions also suffer short of standard occupational health and safety standards. It ranges from the absence of clear safety regulation and instruction to failing to provide workers with individual protection utilities, and absence of comparable medical attention and fair compensation schemes.

Both in the welfare and enabling state approaches one thing that cannot be dropped off from government's responsibilities is monitoring and evaluation. As the sector is resource intensive and impacts very sensitive environmental and social elements, it deserves close internal (by the company itself) and external (government and sometimes by independent organs like accreditation agencies) monitoring. None is happening in Ethiopian cement industry. They are left to live by their own often in the presence of sustained complaints by the local public and business. Government came to respond to some of those complaints only after the market demand for the production dropped off.

89 Id.

90Dire Dawa Mayor Office, EPA, Investment and Land Administration offices interview conducted on August 2012.

91 Environmental Protection, Land Administration and Land Use Agency: Tigray (FGD) conducted on February 16. 2013.

Such responses are designed to address public complaints and visible impacts and hence characterized by once-off step, and lacks guiding frameworks and scientific evidences.

Surprisingly, cement productions is wrapped with multiples of problems strong enough to cast doubt on its sustainability. Measures taken by the government like stop issuing investment license or intervening when complaint mounts are only a short-sighted solutions. The industry does not have a standalone guiding framework or policy to bring light on the relative location, technology choice, production process, resource utilization, land protection and site restoration, social responsibility, occupational safety and health, working conditions, emission, waste and sound standards/limits, environmental management, monitoring and evaluation requirements etc. Such guiding principles would pave the way for companies and citizens to delineate their rights and responsibilities, and government to timely respond to complaints.

It is noted, however, that such framework will not guarantee that government will respond to complaints or would discharge its monitoring obligations. Monitoring and evaluation has to do more with political commitment from higher and law enforcement capacities from local institutions which is lacking now. Political commitment that could push back unsustainable production what so ever its estimated short term economic gains are. This involves capacity building in bureaus of environmental and land, trade and investment, labor and social affairs, and industry.

Similarly, companies should establish internal monitoring and regulation desk or department in charge of providing valuable information to company and stakeholders whenever needed. In addition, environmental experts could be involving in the M&E process and in regulating environmental performance of the company. Such includes occupational safety and health guideline, and strict monitoring of its implementation.

7. References

Behailu Berehanu. 2007. Impact of Industries and Urbanization on Water Resource in Mojo River Catchmen T , A thesis submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment for the degree of Master of Science in Hydrogeology, Addis Ababa University.

C.T. Eyong1 & I.I. FOY. 2006.Towards Alternative Strategies for Sustainable Development in Africa, *Int. J. Sus. Dev. Plann.* Vol. 1, No. 2: 133 - 156.

Cement Sustainability Initiative (CSI). 2004. Health and safety in the cement industry: Examples of good practice, World Business Council for Sustainable Development, Version 1.0, December 2004.

Cement Sustainability Initiative. 2012. 10 Years of Progress Report-Moving on to the Next Decade, World Business Council for Sustainable Development.

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A renewed EU strategy 2011-14 for Corporate Social Responsibility (COM (2011) 681),Brussels, 25.10.2011.

Darryl Vhugen. 2012. Large scale commercial investments in land: Seeking to secure land tenure and improve livelihoods, Haramaya Law Review, Vol.1(1).

David Waldman. 2009. Corporate Social Responsibility: What it really is, Why it's so important, and How it should be managed, School of Global Management and Leadership, Arizona State University.

Davies, Ronald B., and Krishna ChaitanyaVadlamannati.2013. A Race to the Bottom in Labour Standards? An Empirical Investigation, Journal of Development Economics, forthcoming.

DawitSeblework.2006. Occupational Safety and Health: Profile for Ethiopia, ILO and Ministry of Labor and Social Affairs, October 2006.

Environmental Impact Assessment Study Report On Cement Manufacturing Project for Huang Shan Cement Plc, Bloom Consultancy Plc, Feb 2011, AA, Ethiopia.

Environmental Impact Statement for National Cement Share Company (New Cement Plant), Dire Dawa, December 2008 produced by Fitsum Consultancy Services.

Ethiopia Council of Ministers Regulation No. 135/2007 (hereinafter Regulation No. 135/2007) for the Payment of Compensation for Property Situated on landholding expropriated for public purposes

Ethiopia, A Directive Issued to Determine Industrial Enterprises Subject to the Industrial Pollution Prevention and Control Regulations, Directive No. 008/ 2008.

Ethiopia, Council Of Ministers Regulations to Provide For The Prevention Of Industrial Pollution, 2008, Article 12.

Ethiopian Constitution, Proclamation No 1/1995, FED. NEGARIT GASETTE, 1st Year No.1, 1995 (here after FDRE Constitution),

Ethiopian Investment Agency .2008. Investment Opportunity Profiles for manufacturing of Cement in Ethiopia, April 2008.

Ethiopian Labor Proclamation No 377/1996, Federal Negarit Gazeta, 10th Year No. 12 ADDIS ABABA 26th February 2004.

Ethiopian Social Health Insurance Proclamation No. 690/2010, Federal Negarit Gazeta16th Year No. 50, Addis Ababa, 19th August, 2010.

Expropriation of Land Holdings for Public Purposes and Payment of Compensation Proclamation No.455/2005 (hereinafter Proclamation No. 455/2005);

Global Cement Report.2008. 8th edn. 2008.

Ian Dey. 2005. Qualitative Data Analysis: A user-friendly guide for social Scientists, *Routledge Publisher*, London and NY.

Jeff Wheeler & Keith Goddard.2013. Assessment of Ethiopia's Labor Inspection System, Bureau of International Labor Affairs, U.S. Department of Labor, March 2013.

John Sutton and NebilKellow.2010. An Enterprise Map Of Ethiopia, International Growth Centre, *London Publishing Partnership,* UK.

Lorenzo Cotula.2s009. Land Grab or Development Opportunity? Agricultural Investment And International Land Deals In Africa, at 62. Available at http://www.ifad.org/pub/land/land_grab.pdf.

Malefia Tadele.2009. Environmental impacts of floriculture industry on Lake ziway with particular reference to water quality,A Thesis Report Submitted to Addis Ababa University School of Graduate Studies as a Partial Fulfillment of MSc. Degree in Environmental Science, Addis Ababa University (2009), available atetd.aau.edu.et/dspace/bitstream/123456789/;

Michael Greenstone, John A. 2012. List and Chad Syverson - The Effects of Environmental Regulation on the Competitiveness of U.S. Manufacturing, (2012) CES Working Paper 11-03.

Ministry of Industry.2012. Ethiopian Cement Industry growth profile, Unpublished; and Ministry of Industry (2013) Actual Production of Cement in 2010/11 and 2011/12 in Ethiopia, 2013.

Ministry of Labor and Social Affairs, Directive issued to Determine conditions of issuing work permits to foreign nationals (Amharic), February 2010.

Ministry of Labor and Social Affairs, Report on the Study of Expatriate Work Permit Service in Ethiopia, Consulting firms - WAAS International PLC, TechnoPack Business Solutions PLC and Nolot Professionals PLC, February 2012, Addis Ababa, Ethiopia.

Ministry of Mines and Energy. 2009. Geological Survey of Ethiopia, Investment Opportunities in Coals of Ethiopia, Addis Ababa, 2009.

Ministry of Trade and Industry.2010/11.Industry Sector Five Year Strategic Plan (2010/11-2014/15), Draft Document in Amharic.

Mulugeta Getu.2009. Ethiopian Floriculture and its impact on the Environment: Regulation, Supervision and Compliance, 3 (2) Mizan Law Rev.

New Partnership for African Development (NEPAD).2001. Sustainable Development and Environmental Awareness.

Porter, Michael E. 1991.America's Green Strategy, Scientific American, 264(4).

Project Antea Environmental Statement: Development of Cement Production Plant and Associated Quarrying Activities, Albania Environmental and Social Impact Assessment (ESIA) - Non-Technical Summary, 2008.

Reduce, Reuse, Recycle And Recover Waste: A 4R's Guide - For the First Nations Communities of Quebec and Labrador. 2008. First Nations of Quebec and Labrador Sustainable development Institute (FNQLSDI), March 2008.

Sefanit Mekonnen. 2012. Rights of citizens and Foreign Investors to Agricultural land under the land policy and Laws of Ethiopia, *Haramaya Law Review*, Vol: 1(1).

Stuart Licht, Hongjun Wu, Chaminda Hettige, Baohui Wang, Joseph Asercion, Jason Lau and Jessica Stuart. 2012. STEP cement: Solar Thermal Electrochemical Production of CaO without CO2 emission, Chemical Communications, 2012,48, 6019-6021 DOI:10.1039/C2CC31341C.

United Nations Conference on Trade and Development (UNCTAD), Economic Development in Africa: Report. 2012. Structural Transformation and Sustainable Development in Africa, UN, NY and Geneve, 2012.

van Oss, H. G., and A. C. Padovani. 2002. Cement manufacture and the environment, Part 1: Chemistry and technology. *Journal of Industrial Ecology* 6 (1): 89 - 105.

Wheeler, D. 1999. Racing to the Bottom? Foreign Investment and Air Quality in Developing Countries, World Bank Policy Research Working Paper No. 2524.

William A. Pizer and Raymond Kopp.2003. Calculating the Costs of Environmental Regulation, March 2003, Washington, DC: Resource for the Future Discussion Paper 03 - 06;

World Bank.2013. Country Profile-Ethiopia Overview of 2013.

World Bank Group. 2007. Environmental, Health, and Safety Guidelines for Cement and Lime Manufacturing, April 30, 2007.

World Commission on Environment and Development.1987. Our Common Future: Report of the World Commission on Environment and Development, U.N. Doc. A/42/427/Annex (Mar. 20, 1987).Online sources

Inchini Looks to Export Cement to South Sudan, Addis Fortune, By Mahlet Mesfin, September 16, 2012.

Ethiopia: Company Looks to Export Cement to South Sudan, Addis Fortune, Addis Ababa,16 September 2012, by Mahlet Mesfin. On another development, NCSC is exporting its product to Somaliland.

Ethiopian Cement Finds A Booming Market In Somaliland, Somalilandsun (HARGEISA), Feb 28th, 2014, by Osman A.M.

Ministry of Labor and Social Affairs (MOLSA), Work Accident, http://www.molsa.gov.et/English/HIR/Pages/WorkAccident.aspx.Accessed on 26-02-14.

Ministry of Foreign Affairs online news bulletin at http://www.mfa.gov.et/news/more.php?newsid=2639 accessed on December 2013.

Official website of Messebo cement http://www.messebocement.com/socity.ASPX and

Annexes

Cement factory profiles

	Cement factory	Location/woreda	Year of estabt. /expansion	Type of cement produced	Quantity of cement produced	Distance from major urban areas	Distance from major quarry site	Previous use of the land	No of employees
1	MESSEBO	Mekelle, Tigray	1999/2010	OPC, PPC, Clinker, PLC, LHH	1,000tpd cement & 5,000tpd clinker	3-9kms, Mekele	2 kms	Resident, agriculture, grazing & mountain	1,732 Ethiopian & 30 foreigners
2	DERBA MIDROC Cement Plc	Derba, North Shoa	2010	PPC, OPC	8,000 quintals	10 kms	21 kms,	Agricultural, grazing	600
3	DEJEN cement			OPC	60,000 tones	1 kms, Dejen	10 kms	Agricultural& residential	400 Ethiopian and 45 foreign
4	NATIONAL CSC	Dire Dawa	1938/2010	OPC, PPC	1,500 tpd cement	Inside the city but 6 km the new, DD	1.5 kms	Agriculture, residence & grazing	470
5	HUANG SHAN Cement Plc.		2009	Clinker & OPC	500tpd clinker & 750 tpd cement	5 kms, Modjo	270, Hirna	Agriculture	285 (15 Chinese& 85 women)
6	PIONEER Cement Manufacturing Plc	Melka, DD	2009	Clinker and PPC	800-900tpd clinker & 800-900tpd cement	12 kms from DD & in MelkaJebdu	2 kms	Resident & agriculture,	300 Ethiopians and 60 foreigners
7	MUGHER	Mugher, West Shoa	1984/2011	Clinker, OPC, PPC, PC & PLC, LHH	2000 tpd cement 5000tpd clinker	5 kms, RejiMejuda	11 kms	Agricultural, grazing and forest	1,577 (245 female)

Cement Data obtained from Ethiopian Investment Agency, March 2013.

No	Date of Permit	Name of Investor	Country of Origin	Phone	Investment Activity	Region of Investment	City/Town of Investment	Investment Status	Perm Employment	Temp Employment
1	17-Jul-93	Mesebo Building Materials Production Share Co.	Ethiopia	513923	Cement Factory	Tigray	Mekele	Operation	402	0
2	15-Mar-04	Mugher Cement Enterprise	Ethiopia	519422	Cement Factory	Oromia	Muger	Implementation	211	0
3	13-Feb-06	DerbaMidroc Cement PLC	Saudi Arabia	011-3711277/ 0115549888	Cement factory	Oromia	Derba	Operation	474	500
4	12-Nov-08	Pioneer Cement Manufacturing PLC	China/Ethiopia	0911-226305/ 0112-756279	Cement Manufacturing	Dire Dawa		Pre-Implementation	350	50
5	18-Jun-08	Hung Shan Cement PLC	China	0913-548394	Cement Manufacturing Plant	Oromia		Implementation	350	
6	10-Nov-08	Nailonal Cement Share copmpany	Ethiopia	118941	Manufacturing of Cement	Dire Dawa		Pre-Implementation	15	10
7	28-Dec-10	National Cement Share Company	Kenya/Ethiopia	123787/ 0915321013	Cement Manufacturing /Expansion/	Dire Dawa		Pre-Implementation	500	1000
8	15-Dec-05	National Cement Share Company	Kenya/Ethiopia	011-3201263	Cement Production	Dire Dawa	Dire Dawa	Pre-Implementation	100	100

3. An Assessment of Factors that Contribute to theHigh Level of Students Attrition amidst Growth and Transformation Plan (GTP)

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Abstract

At current, statistics from Haramaya University shows significant rate of student attrition, though the rate is different among the colleges, and even among the departments. This comes at odd with the Ethiopian Ministry of Education's plan to achieving the high graduation rates for undergraduate program, namely 93 percent, specifically 95 percent for males and 90 percent for the females at the end of the Growth and Transformation Plan(GTP) period (2015).The general objective of the study is(was) to assess contributing factors for students' attrition in Haramaya University and its impact on meeting the GTP goal. Besides the secondary data sources, primary data were collected mainly from Haramaya University, Dire Dawa University and Jigjiga University students who were once dismissed and got the chance to be readmitted. The data were analyzed quantitatively and qualitatively. The results shows, poor placement policy, poor student background, poor assessment methodology, absenteeism from classes, and environmental factors are the main factors for the existing high level of student attrition.

1. Introduction

The main development goal of Ethiopian government is poverty reduction or eradication (GTP, 2011/2011-2014/15). For this reason the country's development policies and strategies are geared towards this prime policy objective. Effective implementation of these policies and strategies in an integrated and comprehensive manner at various levels of government is the key for eradicating poverty and dependency on food aid.

Theorists agree that a country's capacity to generate, accumulate, deploy and utilize knowledge, skills and information is critical to its development. Progress and development increasingly depend upon the training, research, invention, innovation and adaptation of educated minds. Education is the most effective means that any society has to possess for confronting the current and future socio-economic challenges, and indeed to shape our world of tomorrow (ESDP IV, 2010). To get the required manpower at the required level of competence to achieve Ethiopia's knowledge based economic development, the role of higher education is invaluable. Higher education institutions contribute to human resource development in many ways. These produce professional personnel who participate in training producing educators that enhance the training of other professionals, as well as contribute to development, adaptation, and diffusion of innovations in the economy. Thus, such institutions should create new, or continually extend, the boundaries of existing knowledge through research and advanced training, and serve as a conduit for knowledge transfer, adaptation and dissemination. For this reason, it seems, the 'Future Directions of Higher Education in Ethiopia' (Teshome, 2005) identified the major challenges and problems of the higher education sector in Ethiopia as:(a) Lack of clarity in vision and mission, (b) Problems of quality and relevance of programs of studies and research, (c) Lack of clear program and institutional evaluation mechanisms, (d) Financial and resource constraints, (e) Lack of alternative ventures in resource mobilization in addition to the public purse, (f) Inefficiency in resource utilization, and (g) Poor quality and commitment of the leadership of the sector at all levels (Teshome, 2005).

1.1. Statement of the Problem

Student attrition has been the focus of investigation for many years. Some have argued that student completion rates are fundamental measurements of student success. Student attrition is one of the greatest areas of interest in higher education and has been a popular topic for quite some time. Every year, institutions investigate retention through various forms of assessment (Simpson 2004).

MoE when stating about the conditions of high increment in students' enrolment at higher education institutions:

> *Notwithstanding major investments in improving the numbers and the qualifications of teachers and the availability of equipment, student achievement and retention has not sufficiently improved. The gains in access are of little meaning if they are not accompanied by improved student learning and students do not persist in institutions. If students do not acquire significant knowledge and skills up to the end within the time specified, Ethiopia will not be able to compete within a global economy (ESDP, 2010 p. 10).*

Academic institutions should be concerned about the withdrawal of students and would like to reduce the percentage of students who withdraw from their institution (Sabrina, 2004). Without the continued study of attrition, institutions of higher education will lose more and more students. The long-term effects this will have on institutions of higher education will be a direct financial loss, and with the financial condition of every state supported institution; it is clear that this will become a serious matter.

Concerning the focus given to students' attrition, Higher Education Relevance and Quality Agency (HERQA) in Haramaya University Institutional Quality Audit Report Document (Reference: HERQA QARO 2/07, January 2008) reported that *'The University has no well-developed system to collect and analyze data on student attrition.' And so does by this time the department or the registrar not give attention to the case in an organized especially to males, rather continuing with the best runners.*

The data about students admitted to Haramaya University during their first year, second year and graduation after three-year or four-year study times are presented in Table 1. The table shows only the information about students from few programs.Source: Haramaya University Registrar, 2001-2003 E.C. Students' Enrollment Data and Attrition Collected from Data Base.

The data from the Table 1 can witness the significant rate of attrition in Haramaya University though the rate is different among the colleges, and even among the departments. For this matter, the students' enrollment and attrition data collected from the university's registrar office call for a serious attention/intervention.

One can see the seriousness of the problem from the table; the enrolment and attrition data for College of Business and Economics (CBE) show that in Management department only, out of 231students registered in 2001 E.C., only 74 graduated in 2003 E.C. with 157 (68%) attrition rate. Similarly, in Economics at the same college, out of 168 students registered, only 62 graduated with 106 (63%) attrition rate; in accounting, out of 172 students registered, only 68 graduated with 104 (60.5%) attrition rate; in Cooperatives, out of 230 students registered only 119 graduated with 111 (48.3%) attrition rates for the same entry and expected exit years. From the data, it is clear that out of 801 students registered in 2001 E.C. in all the departments under CBE, about 478 (60%) of them could not graduate at the expected year 2003 E.C.

Like the CBE, the CNCS has also a significant difference between students' enrolment and graduation data. For instance, in the department of Sport Sciences from 247 enrolled in 2001E.C. as first year students, 132 graduated with 115 (46.6%) attrition. Similarly, in the chemistry department, 243 were registered and 138 graduated with 105 (43.3%) attrition. From Mathematics, out of 179 registered, 106 graduated with 73 (40.8) attrition. In Physics department, 82 registered 48 graduated with 34 (41.5%) attrition. From Biology department, 251 registered and 181 graduated with 70 (27.8%) attrition rates. From the data of CNCS one can see that out of 1002 students registered in 2001 E.C. in all the departments under the college about 397 (39.6 %) could not graduate at the expected year 2003 E.C.

As to the GTP targets for higher education, among the major expected tasks of higher education, is to decrease attrition rates and maximize graduation rates without compromising the quality of education. In line with this, the Government of Ethiopia, Ministry of Education, has planned to achieve the average graduation rates for undergraduate program will be 93 percent, specifically 95 percent for males and 90 percent for the females at the end of the GTP period. Based on this, the Ministry put greater responsibility on University management and University community in general in contributing to ensuring our development plan.(GTP,2011/2011-2014/15:97).

To address the above problems, the following questions are explored:

1. What is the perception of the University staff towards students' attrition from higher education?
2. Are there attrition differences between sexes, colleges and departments of the Universities?
3. What are the factors contributing to students' attrition in higher education?
4. What are the current attempts being done in reducing students' attrition in these universities to meet Ethiopian Growth and Transformation Plan?
5. Are there any mechanisms through which students' attrition in higher education would be reduced?

1.2. Objectives of the Study

1.2.1. General objectives of the study

The general objective of the study is to assess contributing factors for students' attrition in Haramaya University and its impact on meeting Ethiopia's Growth and Transformation Plan and suggest the possible mechanisms through which students' attrition would be minimized.

1.2.2. Specific objectives of the study

The specific objectives of the study are to:

1. Identify the perception of the University academic staff towards students' attrition in the University.
2. Identify if there is any difference between both sexes and among colleges and departments in attrition in the universities.
3. Find out contributing factors for students' attrition in the Universities.
4. Examine the current attempts being done in reducing students' attrition in the universities to meet Ethiopian Growth and Transformation Plan?
5. Suggest the possible mechanisms through which students' attrition in higher education would be reduced.

2. Materials and Methods

2.1. Research Design

Descriptive survey research is designed to obtain pertinent and precise information concerning the existing status of phenomena and, whenever possible, to draw valid generalizations for the facts discovered without making any interference or control over the situation. Such type of studies is restricted not only to fact finding but may often result in the formulation of important principles of knowledge and solution of significant problems concerning local, state, national and international issues. As attrition is a complex phenomenon and a lot of factors affect it, applying descriptive research design is of paramount importance to collect data from large population. Therefore, the researchers used a descriptive survey method to investigate the factors that contribute to student attrition on a large scale across universities and large group of respondents.

2.2. Source of Data

The primary data were collected from students who were once dismissed and got the chance to be readmitted, female students supported through tutorial by the universities' special project, students' council, instructors teaching in the different sampled colleges and departments, students support services, cost sharing office head, planning and budget office, department heads, deans, academic program development and promotion office and vice president for academic affairs of the universities, MoE, higher education students placement office and state minister for higher education, HERQA, HESC and related and concerned bodies were contacted.

Secondary data for the study was collected by analyzing the students' attrition data from the registrar of all universities. By this, the students' attrition data for each semester were considered. In addition, the data of students registered to a certain program as freshman (first year) and how many graduated at the expected year level were assessed. Strategic Plan of the universities in relation with student retention and GTP and PASDEP documents, ESDP IV focus on higher education and graduates role in creating knowledge based economy and transforming Ethiopia through reduction and /or elimination of poverty were assessed.

2.3. Sample and Sampling Techniques

Simple random sampling (will be used) for teachers and availability sampling was used for students' council, students support services, cost sharing office, planning and budget office, department heads, deans, academic program development and promotion office and vice president for academic affairs, MoE higher education students placement office and state minister for higher education, HERQA, HESC and finally all readmitted students in the year 2001 up to 2003 E.C for a 3 year program and 2000 up to 2003 E.C. for four year program was selected purposively.

2.4. Data Collection Instruments

In order to collect the data the following data collection instruments were employed. Questionnaire was used to collect data from the University students who got the chance to be admitted in the year interval from 1999 E.C. -2004 E.C., instructors and student union representatives. Interview was employed for the top management of the universities. In order to get an in-depth data from the students, instructors, and some middle level managers of the university, focus group discussion (FGD) was employed. To substantiate the data collected from primary sources, documents on students' records, Universities strategic plan concerned with students' attrition and some related documents were analyzed.

2.5. Data Analysis and Interpretation

To analyze the data collected, both descriptive and inferential statistics were used. Descriptive statistics like frequency, percentages, weighted mean and inferential statistics like spearman correlation, T-Test and Regression were used to see the degree of effect of different factors on attrition.

Table1. Sex: Students'.

Sex of Students (For all)		
Sex	Frequency	%
Female	34	24.6
Male	92	66.7
Total	126	91.3
Missing	12	8.7
Total	138	100.0

From the total number of respondents in the three universities, 92(66.7) and 34(24.6) were males and females respectively. 12(8.7) were missing value and a total of 138 candidates were included in the study.

Table 2: Age of Students (For all).

Age of Students (For all)		
Age Category	Frequency	Percent
18-20	16	11.6
21-23	88	63.8
24-26	13	9.4
27 and above	2	1.4
Total	119	86.2
Missing	19	13.8
Total	138	100.0

Majority of the students 88(63.8) who took part in the study were 21-23 years and 16(11.6) were between 18-20 years of age. And there high number 19(13.8) of the respondents were missing.

Table 3. Colleges/institutes to which the questionnaire was distributed

Colleges/Institutes	Dire Dawa		Haramaya		Jigjiga	
College/Institute	Frequency	%	Frequency	%	Frequency	%
Agricultural & Environmental Sciences	1	1.7				
Faculty of Business & Economics	39	65	18	41.9	4	11
IOT	5	8.3	1	2.3		
Law	1	1.7				
Natural Sciences	11	18.3	13	30.2	10	29
Social Sciences & Humanities	3	5	10	23.3	21	60
Missing			1	2.3		
Total	60	100	43	100	35	100

Parents' educational level and their children are directly proportional to their children's education. And it is also believed that families with better higher level education is a model for their daughters and provide parental support. Majority of the respondents at the three institutions 18(30%) don't have any formal education; similarly, about close to 7(11.7%) at an average are primary education completers. Even though completing basic primary education is a base for other upcoming educational levels. And it would be important if the students from the low family support are under conditions of being attrition.

Table 5. Families Financial Support.

	Dire Dawa		Haramaya		Jigjiga	
	Frequency	%	Frequency	%	Frequency	%
Not at all	4	6.7	3	7.0	6	17.1
Very minimal	15	25.0	10	23.3	10	28.6
Average	18	30.0	18	41.9	11	31.4
Adequate	16	26.7	12	27.9	6	17.1
Total	53	88.3			33	94.3
Missing	7	11.7			2	5.7
Total	60	100.0	43	100.0	35	100.0

The financing system of Ethiopian higher education is on cost sharing bases where the beneficiaries share a small amount of the expenses. Regarding this, close to half 27(76) of the respondents responded that the financial support they get from their families' were very less across the three universities. It was only close to 12(27.9) at an average who get an adequate financial support from their families.

Table 6. Families Material and Moral Support.

Families Material and Moral Support						
	DDU		HU		JJGAU	
	Frequency	%	Frequency	%	Frequency	%
Not at all	4	6.7	2	4.7	4	11.4
Very minimal	14	23.3	8	18.6	7	20.0
Average	17	28.3	17	39.5	16	45.7
Adequate	19	31.7	15	34.9	5	14.3
Total	54	90.0	42	97.7	32	91.4
Missing	6	10.0	1	2.3	3	8.6
Total	60	100.0	43	100.0	35	100.0

Family's financial capacity and material support are much related and at the same time, educational level and the support they provide are directly proportional. However, as one can see from the table above, majority of the student respondents 36(60) don't get adequate family support. It is only

19(31.7) of the student respondents which responded they get adequate family support from their families'.

Table 7. Substance Use.

Substance Use						
	Dire Dawa		Haramaya		Jigjiga Un.	
	Frequency	%	Frequency	%	Frequency	%
Not at all	29	48.3	28	65.1	24	68.6
Rare user	8	13.3	4	9.3	2	5.7
Sometimes	5	8.3	7	16.3	3	8.6
Frequent user	6	10.0	1	2.3	2	5.7
Total	48	80.0	40	93.0	31	88.6
Missing	12	20.0	3	7.0	4	11.4
Total	60	100.0	43	100.0	35	100.0

Substance use was very common among many of the university students. However, as to this data, the researcher could not find a reliable data because the respondents were not happy to reflect. As a result the missing value was very high 19(31.7) respondents have not responded in the three sampled universities.

Table 8.School Type

School Type	Dire Dawa		Haramaya		Jigjiga	
	Frequency	%	Frequency	%	Frequency	%
Government school	42	70.0	32	74.4	29	82.9
Religious school	1	1.7	4	9.3	2	5.7
Private school	5	8.3	3	7.0	1	2.9
Total	48	80.0	39	90.7	32	91.4
Missing	12	20.0	4	9.3	3	8.6
Total	60	100.00	43	100.00	35	100.00

Majority of the Student respondents 42(70), 32(74.4) and 29(82.9) of them from the three universities Dire Dawa, Haramaya and Jigjiga respectively came from Government Schools. Whereas 6(8.3) of them came from private schools and almost very less of them came from Religious Schools.

Table 8. Factors Contributing to Students' Attrition

		Descriptive Statistics								
		Dire Dawa			Haramaya			Jigjiga		
Factors to Students attrition	Items	N	Mean	Std. Dev	N	Mean	Std. Dev	N	Mean	Std. Dev.
Study habits	I am comfortable in doing individually than in groups	60	4.07	1.118	41	3.56	1.361	34	3.53	1.285
	I have a plan for study for all the courses I take	58	4.03	1.075	40	3.48	1.261	34	4	1.326
	I always start reading when the exam approaches	56	3.77	1.388	42	3.17	1.464	33	2.94	1.456
	I use different supporting reference materials in addition to handouts	57	3.82	1.104	42	3.12	1.329	34	3.79	1.366
Academic advising	There is structured academic advisory service in my department	59	3.69	1.133	42	3.00	1.431	33	2.85	1.326
	I have got appropriate advice during my first year study to make the right program choice	57	3.53	1.441	41	2.88	1.308	33	2.94	1.321
	I get support from my academic advisor up to my expectation	57	3.4	1.294	42	3.07	1.421	32	2.62	1.338
	My advisor let me know the mechanisms for course transfer and withdrawal	55	2.96	1.515	41	2.68	1.386	30	2.93	1.311
Satisfaction	I am satisfied with the subject matter knowledge and teaching methods many of my instructors.	58	3.93	1.137	42	3.02	1.278	30	3.43	1.524
	I am Interested in the program/field I am studying	55	2.16	1.067	41	2.39	1.8	32	2.65	0.67
	I am satisfied with the support/service my department provides	58	3.76	1.288	43	2.98	1.244	32	3.25	1.27
	I am happy with the Cafeteria, Health, counseling and Library services	58	2.43	1.5	42	2.24	1.303	34	2.65	1.433
Communication	I have good communication with my class mates	59	2.24	0.751	42	2.64	1.265	33	2.12	1.166
	I comfortably share my concerns with my teachers	57	2	0.926	42	1.38	1.209	33	2.58	1.324
	I have good communication with my dorm mates	56	3.27	0.981	42	2.81	1.215	34	2.24	0.91
	I have good communication with librarians	57	3.67	1.244	43	2.91	1.377	34	1.26	1.286
Expectations	I perceived my department as a difficult one before I joined.	58	2.26	0.891	40	2.90	1.482	33	2.51	0.913
	I believed that I can generate a good income after graduation.	57	4.02	1.11	42	3.69	1.490	34	3.85	1.351
	I aspired to obtain my degree before I joined my department.	58	3.79	1.072	42	3.48	1.418	33	4	1.118
	I expected I will achieve maximum.	58	4.33	0.944	43	3.53	1.369	30	3.6	1.276
Motivation	I joined the university to acquire degree and become future scientist.	58	2.23	1.326	41	2.19	1.360	34	2.03	1.467

	I went to university to acquire degree with outstanding grade.	56	3.8	1.257	41	3.27	1.500	33	3.82	1.286
	I came to university to be called a university student.	55	3.16	1.537	40	2.60	1.429	34	2.76	1.653
	I joined university because I had no any other option.	53	2.79	1.549	40	2.30	1.344	33	2.42	1.393
Assessment & grading	My instructors make clear what is expected of the students to achieve a better grade.	55	2.87	1.277	41	3.10	1.300	34	1.53	0.308
	My instructors give me continuous assessment and feedback.	55	3.05	1.145	40	3.15	1.145	33	2.52	1.253
	I am happy with my instructors grading system.	55	2.44	1.424	41	2.73	1.342	34	2.32	1.342
	There are pre-determined criteria for assessing deciding students' performance.	55	2.6	1.486	40	2.75	1.410	34	2.38	1.477

Students study habit was among the major variable which contribute to students retention or attrition. However, as to the data collected from the three universities indicated are some students feel more comfortable when they study individually than in groups. More than (3.77) mean value, SD (1.38) which is above average (2.5). Students prefer/start to study when the exam approaches. The students have to maximize their resource utilization and 3.82 mean value and 1.11 SD value students responded they use different supporting reference materials in addition to handouts. On the contrary also the FGD result with the Academically dismissed female students showed, it is difficult to get appropriate reference material for each courses and utilization problem also from the part of the students. They also responded on the questionnaire that they have a plan for study for all the courses they take, but the FGD result showed the female students who were under attrition case responded they didn't have the plan to study hard.

Academic advising is a very important indicator to quality of education as it is a component of student support services. 3.69 mean value, 1.13 SD. Majority of the students responded they have got appropriate advice during their first year study to make the right program choice and academic advisor-ship but not up to their expectation and they were not made known mechanisms for course transfer and withdrawal.

Students are believed to be as the primary customers of educational institutions. Educational organizations should try to work hard in an effort to satisfy the needs of these primary customers. Regarding this, the students were asked that majority of them with the mean value below average 2. 43 and SD of 0.87 were not satisfied with the subject matter knowledge and teaching methods of their instructors. Similarly, because student's interests were not respected for program choice, majority of the respondents were not satisfied in the program/field they were studying, and the support/service they got from their respective departments and the Cafeteria, Health (Clinic), Counseling and Library.

There should be a two way communication between the teachers, students, classmates and university administration at different levels. And if there is a good communication among the students, teachers and support staff, the students can easily succeed with the academics, social and emotional wellbeing Avery small percentage Mean Value 2.01 and SD of 0.49 the student responded they have good communication with their classmates and don't have a good communication with their doormats and librarians. And we cannot deny that these variables contribute to creation of a health organizational environment. If healthy organizational environment is not created the students achievement shall be affected and attrition would be resulted.

Expectation as to different scholars affects once performance positively or negatively. As to the question posed for the students, majority of the student in the three centers with the mean value of 2.26 and SD of 0.891 could not meet their expectations from different aspects among others, because they perceived that their department as a difficult one. Therefore, they had not aspired very well to obtain degree and had low expectation on their achievement, they didn't believe that they could generate a good income after graduation. Some of them thought that there would be no job.

Motivated and ready student is a productive and/or successful student. With mean value of 2.23 and SD 1.23, majority of the respondents in the three selected universities showed that their motivation was very low. Thus, one has to aspire his/her future, and joined the university to acquire degree and earn just a salary; not more than that or become future scientist or acquire degree with outstanding grade (simply to be called a university student and joined university even because they had no any other option.).

Assessment and grading. The students were not comfortable with the grading of the instructors give during continuous assessment and feedback. And instructors don't make clear what is expected of the students to achieve a better grade; there are pre-determined criteria for assessing deciding students' performance.

2.6. Data Analysis and Interpretation: Qualitative Part

Teachers' Responses to the Open-ended Questions at Haramaya University

Team of researchers at FGD at HU HDP Office with female students under academic warning

2.6.1. Knowledge and thought about students attrition

At the end of each semester, there are a number of students who receive a status of academic dismissal at an alarming rate. Many teachers are always aware of the problem and contemplate as to how to solve such rampant problem. However, some teachers do not know the exact figure of attrition and they feel that attrition rate is decreasing these days than the last four or five years. Some view that the attrition rate is different in different colleges and is ever high in technology and natural science fields.

2.6.2. Best practices by departments/colleges to reduce attrition

There is an attempt to provide academic guidance, support, and tutorial to reduce attrition but most teachers believe that it is not sufficient. Some teachers believe that the efforts that have been made to reduce attrition so far is almost insignificant. The implementation of continuous assessment and the arrangement of remedial actions are considered as a good practice by some teachers.

2.6.3. Who is responsible for students' attrition?

According to the response of teachers, everybody are responsible for this problem including students themselves, teachers, heads of departments, and university management. Some still hold the Ministry of Education more responsible for admitting less prepared students.

The major contributing factors to student attrition

- Lack of proper academic guidance and support in the form of tutorials, advice, and counseling
- Previous academic background in terms of preparedness
- Lack of standardized academic resources
- Lack of culture of cooperation between students and students; students and teachers for experience sharing
- Large class size
- Job insecurity in the future and then lack of motivation
- Forceful Placement to programs
- University environment
- Theoretical dominanceof education than practice
- Inappropriate Assessment methods
- Lack of assertiveness
- Negligence from instructors

- Lack of experience from some teachers in some colleges and poor subject matter and pedagogical knowledge
- Socio-economic background (Poverty)
- Expectation crisis
- Language Barriers
- Lack of sufficient orientation and awareness creation

2.7. Intervention Mechanisms according to Teachers

It is evident from the response of teachers that student attrition can be reduced through giving proper and timely guidance and counseling or special support (tutorial) and academic advisor-ship. In addition, good rapport and interaction between students and teachers contribute a lot to minimizing attrition. Creating awareness at certain interval is also crucial. Reducing class size for effective teaching and assessment is important as well. Applying rigorous admission criteria and using placement examination before the students join the university is also another good mechanism to reduce attrition. There should also be organizations to arrange extra-curricular activities that will help students not to waste their time unnecessarily. Bringing students and teachers face to face to discuss their issues and problems plays great role in addressing the matter at hand. Overall, establishing functional student support system is indispensible in reducing student attrition.

2.8. Students Response Views

The major contributing factors to attrition according to the participant students are the following:

- Relationship between the students and teachers
- Lack of Self-confidence
- Less Attendance
- Placement without interest
- Lack of sufficient information especially during first year
- Addiction of (d/t drugs)alcohol, cigarette, and chat (Substance Abuse)
- Weather condition which is cold
- Living condition on campus
- Lack of proper facilities
- Extreme tension
- Peer pressure
- Inappropriate mode of delivery
- Lack of family support
- Conflict between student and teacher
- Lack of fairness from the teachers for all students
- Language barrier
- Lack of awareness of assessment techniques
- Lack of cooperative learning

Table 9.Students' views about contributing factors to student attrition

No	Factor	Frequency
1.	Environmental problem(weather condition)	9
2.	Shortage of reference material	8
3.	Health problem	6
4.	Shortage of handout	6
5.	Cafeteria related problem	6
6.	Irresponsibility of students for their own learning/carelessness, sleeping much	6
7.	Poor performance of Instructors	5
8.	Poor time management and study habit	5
9.	Disagreement/conflict between students and teachers/students and student	4
10.	Violation of university's rules and regulations/ Disciplinary case	4
11.	Low awareness about the university situation	4
12.	Lack of counseling service	4
13.	Lack of information	4
14.	Low grade	3
15.	Lack of cooperation among students themselves	3
16.	Lack of advising and motivation from instructors	3
17.	Absenteeism/poor class attendance	3
18.	Fear/tension	3
19.	Lack of financial support	3
20.	Inappropriate grading system	3
21.	Water problem	2
22.	Instructors' Late class starting and unable to finish courses on time	2
23.	Students background	2
24.	Cafeteria	1
25.	Low classroom participation	1
26.	Teachers ethnic partiality in grading	1
27.	Drug using/chat, cigarette, alcohol..	1

Generally, the data obtained through Focus Group Discussions (FGD) shows that three major impacts of attrition to individual students are: emotional (low self-esteem, low self-confidence, depression, anxiety, self-blaming), social (labeling, stereotyping, conflict, unemployment), and economic (unemployment, poverty).

The FGD discussants believed that there is attrition rate difference across gender, colleges and departments. According to the discussants, attrition rate is higher for female students than male students. Across schools attrition from high to low rate is school of IOT, Computational Sciences Business Economics, Natural, Social Sciences and Humanities and law respectively. Across departments, attrition is higher in biology, sport sciences, pre engineering, physics, chemistry and mathematics respectively.

Condensed data from all the instruments briefly indicate that the major factors that generate student attrition are:

- Placement policy (70:30)- though 70 percent are assigned in Science and Technology, their performance is not up to the expectation.
- Students' background- Poor conceptual and language skill, poor time management unplanned reading/ study style of students, low readiness, irresponsibility, poor co-operation with friends
- Absenteeism and late coming to classes
- Environmental factors- inability to adapt the hot weather condition (according to students), exposure to different drugs such as chat, alcohol, cigarette, Shisha.

- Lack/shortage of Facilities- cafeteria, dormitory, water, classroom, library, internet, reading materials.
- Instructors- the methodology, the assessment styles, sexual relationship and conflict because of age similarity with students

3. Recommendations

Based on the above findings, the researches recommend the following strategies for reducing the high level of student attrition

- The university ought to provide awareness creation and, life skills training to students time of entrance
- The university ought to improve its facilities especially if guidance and counseling service is provided at the standard level
- The university ought to work to improve the society's perception towards university student
- The university ought to develops instructors' professionally: teaching method, Assessment and advising skills in particular
- The university ought to fulfill the necessary facilities (office, recreation center, internet access) and incentivize instructors
- The government ought to work strongly in primary, secondary and preparatory level to prepare students for higher education

4. References

Abel, Tilahun. 2003. Assessment of Student Attrition at the Faculty of Science, Addis Ababa University, Unpublished MSc Thesis, AAU.

Ashcroft, K. 2005. Higher Education Strategy Center Analysis and Discussion of Curriculum, Resource and Organizational Issues. Addis Ababa, Ethiopia.

Baxter, P. & Jack, S. 2008. The Qualitative Report Volume 13 Number 4 December 2008 544-559 http://www.nova.edu/ssss/QR/QR13-4/baxter.pdf

Enguday, A. 2008.Under Achievement among Female Students in Higher Education in Ethiopian. Perceived Causes, Priorities and Single-sex Teaching. Otto-von Guricke, University of Magdeburg. Shaker, Verlag.

FDRE (MoE). Education Sector Development Program IV (ESDP IV). (2010/2011 - 2014/2015).Program Action Plan. Addis Ababa, Ethiopia.

Garland, M. 1993. Student Perception of the Situational, Institutional, Dispositional, and Epistemological Barriers to Persistence. Distance Education.

HERQA.2008. Haramaya University, Institutional Quality Audit Report: Document Reference, QARO2/07, Addis Ababa, Ethiopia.

MoFED.2010. Growth and Transformation Plan (GTP). Volume I, Main text, Addis Ababa, Ethiopia.

Moore, R., & Miller, I. 1996. How the Use of Multimedia Affects Student Retention Learning. *Journal of College Science Technology.*

Moore, W., & Carpenter, L. 1985.Academically Underprepared Students. San Francisco: Jossey-Bass.

Pascarella, E. T. 1980. Student-Faculty Informal Contact and College Outcomes. Review of Educational Research, 50, 545-594.

Robert, A., Larry E. and Deanna C. 1983.Breaking the Attrition Cycle: The Effects of Supplemental Instruction on Undergraduate Performance and Attrition. *The Journal of Higher Education*, Vol. 54(1).(Jan. - Feb.,), Ohio State University.

Sabrina, D. 2004. A Study of Attrition in Higher Education with Implications for Supportive Services, Thesis submitted to the Marshall University, Graduate College.

Tadesse, Sh. 2009. Understanding Female Students' Academic Performance: An exploration of the Situation in South Nations Nationalities and Peoples Regional State–Ethiopia. International Institute of social studies (ISS).The Hague, the Netherlands.

Teshome Yizengaw. 2005. "Formulas that work: Making Higher education Support More effective,' The Hague, The Netherlands, 23-24, May, 2005; Ministry of Education; Addis Ababa, Ethiopia.

Teshome, Yizengaw. 2005. Policy Development in Higher Education in Ethiopia and The Role of Donors and Development Partners. Nuffic Conference 'A Changing landscape', The Hague, 23-25 May.

Teshome, Yizengaw. 2003. 'Transformations in higher education: experience with reform and expansion in Ethiopian higher education system'. Keynote Paper in Improving Tertiary Education in Sub-Saharan Africa: Things that Work., Ghana, Accra.

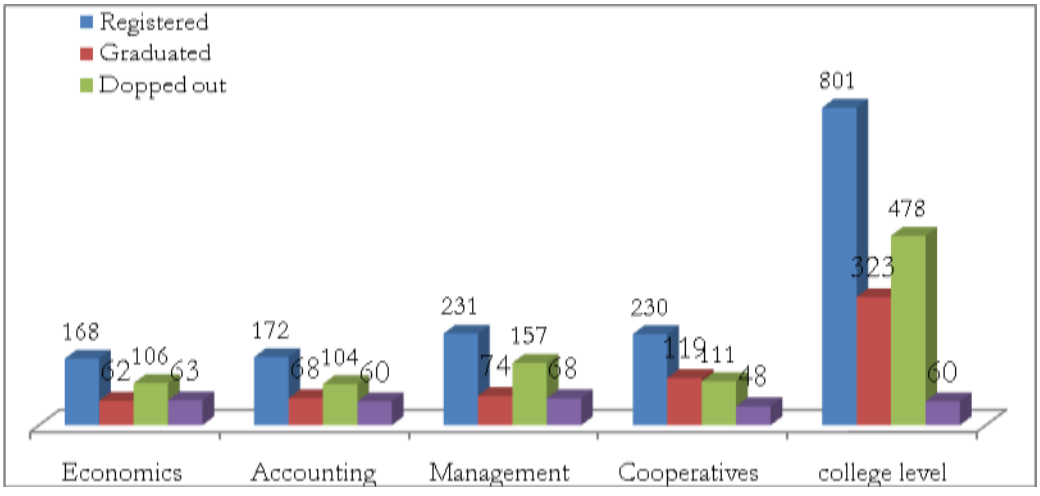
TGE (Transitional Government of Ethiopia).1994. Education and Training Policy. EEP 86, Addis Ababa.

Tinto, V. 2000.Leaving College. Chicago, IL: University of Chicago Press. USA.

Wylie, J. 2004. Non-Traditional Student Attrition in Higher Education: A Theoretical Model of Separation, Disengagement then Dropout. Self-Research Centre, University of Western Sydney, Australia.

Yusuf, O, Lakew, Wolde, T. and Mekonnen, Y. 1989. Students drop-out in Institutions of Higher Learning in Ethiopia: Magnitude, Causes and Cures. The Ethiopian Journal of Education, Vol. X., No.2.

Annex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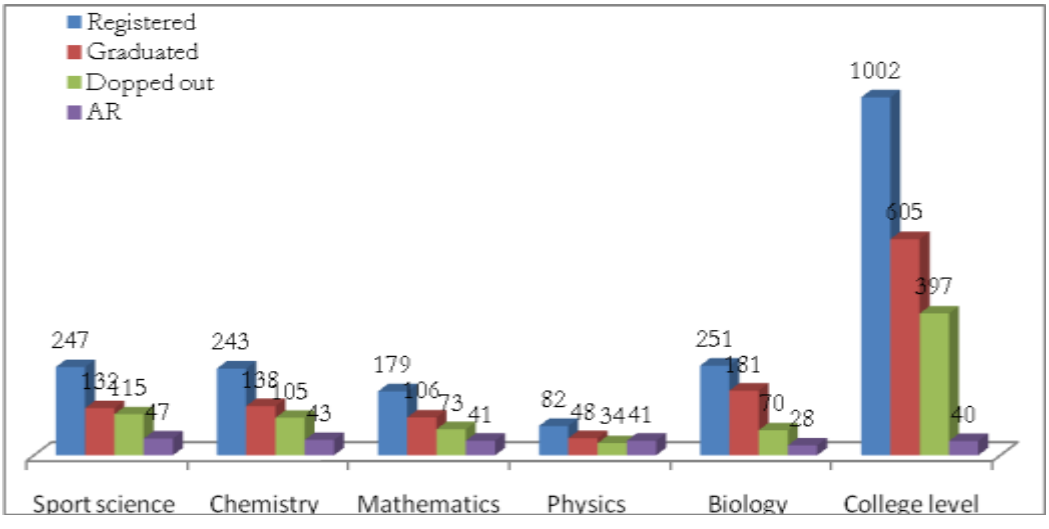
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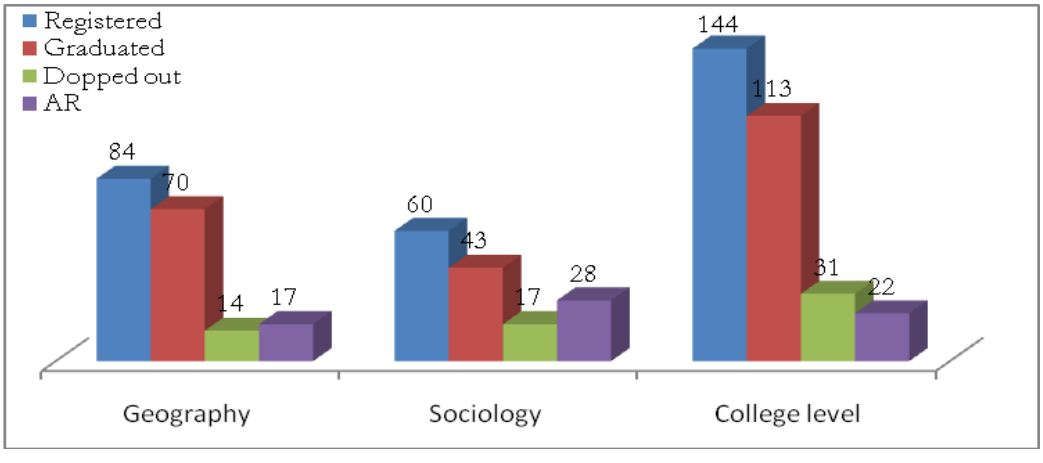
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4. Practice of Teachers Continuous Professional Development Program Implementation: The Case of Dire-Dawa Administration, Harari Region and Haramaya Woreda Town Primary and Secondary Schools

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Abstract

The purpose of this study was to explore the practice of teachers' Continuous Professional Development (CPD) programme in Dire Dawa Town Administration, Harari Region and Haramaya Town of Oromia Region, Ethiopia. The study design was descriptive case study. A total of 43 schools459 teachers were taken as participants of the study using questionnaire. For observation nine schools which are serving as cluster resource centers were used. Regional education Bureau and Woreda Education Office CPD focal persons were used as interviewees. The data were analyzed using descriptive statistics for quantitative data and narration for qualitative ones. The data analysis shows that many efforts have been made by the different stakeholders of teachers' CPD such as Ministry of Education, Regional Education Bureaus, School principals and teachers themselves. On the other hand, the efforts made were not consistent, specific CPD budget was not there. Cluster Resource Centers were not functioning to their level best, CPD practices were limited to primary school teachers but not practiced by secondary school teachers, principals and supervisors. The major challenges identified include resistance to change, low of commitment, non-functioning Cluster Resource Centers, and lack of regular follow up. Eventually, to implement teachers' CPD as per MoE guideline, there should be commitment at the different level of the Education system, the Regional Education Bureaus should organize the Cluster Resource Centers should have regular communication and support for the schools, supervisors and principals shall be models to their teachers in doing their own CPD were recommended.

1. Introduction

Changes in the educational system of a nation and global requirements demand staff development activities. In a major initiative to address problems related to access, equity, and quality of educational provision, the Transitional Government of Ethiopia (TGE) introduced the Education and Training Policy in 1994. The ETP, supported by articles in the Ethiopian constitution, sought to decentralize educational authority to the 11 states and called for new

Paradigms of education based on relevant, active, and student-centered teaching and learning. The ETP established the foundation for all subsequent strategies, guidelines and programs.T he education sector programs were Education Sector Development Programs I, II and III which were developed in 1997, 2002 and 2005 respectively. In line with the goals of creating "trained and skilled human power at all levels who will be driving forces in the promotion of democracy and [economic] development in the country" (MoE, 2005, p. 5), the programs have focused on the expansion of the system, increased access for marginalized children and girls, and reduction of attrition. With rapid quantitative expansion, attention has increasingly been directed toward the issue of quality. Improving curricula, providing textbooks, increasing community participation, and augmenting financing for education are among the strategies pursued to address the perceived decline in the quality of education. Moreover, while all policy documents stress the importance of teachers for promoting learning, the emphasis on improving teacher quality is most prominent in the 2005 Education Sector Development Programme (MoE, 2005).

The Ministry of Education has given priority for continuous professional development CPD believing that it is the right of teachers as well as of a great value for national development (Barrow, *et al.*, 2006). The school staff must have the necessary subject professional support to bring about changes in the classroom. At school level professional development programmes should include

school principals/directors, teachers and technical and administrative personnel. The ETP set standards for teachers and described a new approach to education. The new approach promotes active learning, problem solving, and student-cent red teaching methods. With the expansion of education and large class size teachers still rely on the teacher centered methods with limited opportunities for (CPD). In Ethiopia, CPD focuses on improving the teaching-learning process, with the priorities of introducing active learning, practicing Continuous assessment and managing large classes.

1.1. Statement of the Problem

The aim of Continuous Professional Development is to improve the performance of teachers in the classroom and raise student achievement. It is a career-long process of improving knowledge, skills and attitudes - centered on the local context and, particularly, classroom practice. According to MOE (2009b), all teachers must be actively engaged in: (a) their own learning process, (b) working with their colleagues, (c) identifying their own and (d) the wide range of activities, formal and informal, that will bring about improvement of their own practice and the practice of others.

According to the MoE (2009) National CPD framework, there were six major challenges identified; failure to synchronize the career structure and the CPD values and activities, CPD facilitators' high turnover, time constraints on teachers as well as their school leaders, CPD program's lagging behind its time and the tendency of rushing to cover the course, total absence or inadequacy of the minimum resources required to run CPD, and lack of systematic collaboration and coordination between Education Bureaus, TEIs and NGOs.

Unless the above challenges are solved, the vision to produce professionally well informed and motivated teachers capable of transforming the quality of educational delivery will not be fulfilled. Therefore, the intention of this research is to contribute some strategies to the solution of the above mentioned problems of school CPD program implementation in Dire-Dawa City Administration and Harari Region Primary and Secondary Schools. To this end, the following research questions were proposed.

1. To what extent the schools are implanting CPD according to the national framework?
2. What are the success areas of the schools in implementing the CPD?
3. What are the major gaps of schools in implementing the CPD?
4. What are the major challenges that hinder schools to implement CPD?
5. What should be done to implement CPD effectively?

1.2. Objectives of the Study

1.2.1. General objectives of the study

The general objective of the study is to assess the extent of practical implementation of CPD program in *Dire-Dawa Administration, Harari Region state and Haramaya Woreda TownPrimary and Secondary Schools* and explore challenges faced by schools in implementing the program.

1.2.2. Specific objectives of the study

The specific objectives of the study were to:

- Explore the status of schools' CPD implementation as per the national framework.
- Identify the success areas of the schools in implementing the CPD.
- Identify the gaps of schools in implementing the CPD.
- Explore the challenges the schools face in implementing the CPD.
- To suggest some possible solutions/strategies for the effective implementation of CPD.

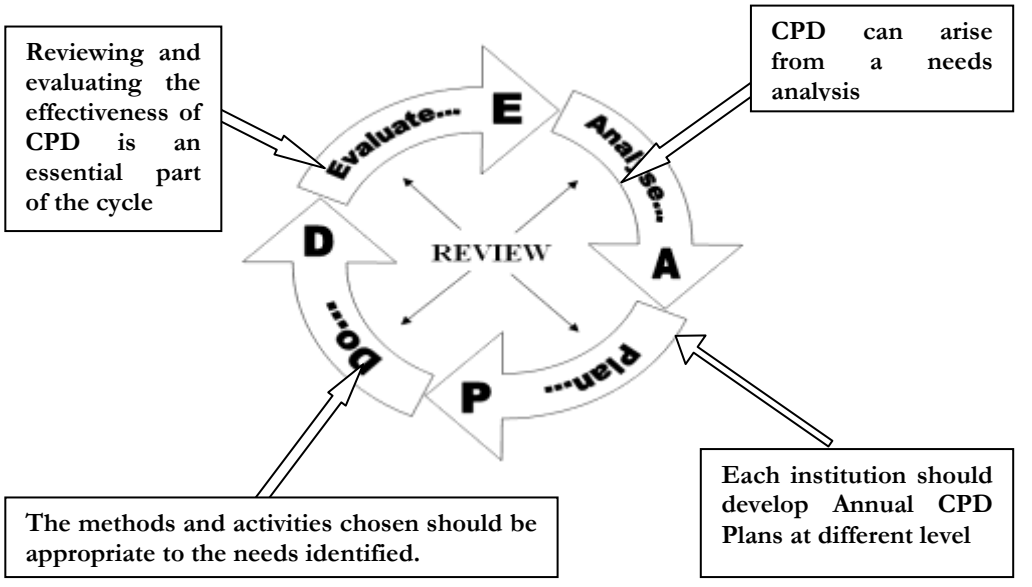
1.3. Delimitation of the Study

The very concern of this study is to assess the status of CPD implementation in the sample primary and secondary schools of DireDawa Administration, Harari Region and Haramaya town of Oromia Region in line with the MoE CPD framework. Therefore, the result of this study will be generalized for the schools in the mentioned localities.

1.4. Limitations of the Study

The major limitations of this study were inability to conduct classroom teaching observation of teachers, lack of attention of some of respondents in filling in the questionnaire and the researchers were forced to void out incomplete ones.

1.5. Conceptual Frame Work of CPD Program



All CPD programmes will have the following similar characteristics.

- **The programme will be carried out in order to address the learning or development need of an individual, groups of individuals or an identified need of an institution.**
- **The need will have been identified by a process of needs analysis or review**

Figure 1. Processes of Teachers' CPD (Source MoE, 2009b).

2. Review of Related Literatures

2.1. Overview of Professional Development

Professional development, in broad sense, refers to the development of person in his or her professional role more specifically,(Teacher development is the professional growth teacher achieves as result of gaining increased experiences and examining his or her teaching systematically Glatthorn,1995),professional includes formal experience(such as attending workshops and professional meetings, mentoring, etc) and informal experiences such as reading professional publication ,watching on television documentaries related to academic discipline etc. (Ganser, 2000).

This conception of professional development is, therefore, broader than career development which is defined as "the growth that occurs as the teacher move through the professional career cycle" (Glatthorn, 1995) and broader than staff development, which is "the provision organized in-service training programs designed to foster the growth of groups of teachers ;it is only one of the systematic interventions that can be used for teacher development "Glatthorn,(1995) when looking at professional development, one must examine the content of experiences, the process by which the professional development will occur, and the context in which it will take place(Ganser,2000; Fielding and schalock,1985).

This perspective is, in a way, new to teaching. For years the only form of professional development available to teachers was 'staff development' or in service training usually consisting of workshops or short term course that would offer teachers new information on particular aspects their work. Only in the past year has the professional development of teachers been considered a long-term process that includes regular opportunities and experiences planned systematically to

promote growth and development in the profession. This shift has been so dramatic that manly have referred to it as a 'new image' of teacher learning a 'new model 'of teacher education, a 'revolution' in education, and even a 'new paradigm 'of professional development (Cochrant-smith and Lytle, 2001; Walling and Lewis, 2000).

There has recently been a significant increase in the level of interest and supports that teachers thought out the world are receiving in their professional development .Evidence of this include the following.

- The extensive literature which is available; including documents, essays and research reports on Models and practices of professional development.
- International and national donor agencies have acknowledged the important of teacher professional development.
- Many national and international organization have supported the implementation of initiatives which aim to improve the professional skills and knowledge of teachers.(Cobb,1999).
- Most educational reforms currently being designed and /or implemented include a component of teacher professional as one of the key elements in the change process.

This new perspectives of professional development have several characteristics:

1. It is based on constructivism rather than on a' transmission-oriented model' .as Consequence, teachers are treated as active learner (McLaughlin and Zarrow, 2001) who are engaged in the concrete tasks of teaching, assessment, observation and reflection.
2. It perceived as a long –term processes as it acknowledge the fact that teachers learn overtime. As resent, a series of related experience allows teachers to relate prior knowledge to a new experience (Dudzinski *etal.* 2000).
3. It perceived as a process that take place within a particular context.The most effective form of professional development is that which is based in schools and is related to daily activities of teachers and learners (Ancess, 2001, Ganser, 2000) schools are transformed into communities of inquiry, professional communities (king and Newmann, 2000).
4. Many identify this process as one that is intimately linked to school reform. As professional development is a process of culture building and not mere skill training (Cochran –smith and Lytle, 2001).
5. A teacher is conceived of reflective practitioner's, someone who enters the profession with a certain knowledge base, and will acquire new experience based on the prior knowledge (Cochran –smith and Lytle, 2001).
6. Professional development is conceived of a collaborative process. Even though there may be some opportunities for isolated work and reflection, most effective professional development occurs when there is meaning full interactions (Clement and vanderberghe,2000) not only among teacher themselves, but also between teachers administrators, parents and other Community members.

2.2. Concept of CPD

CPD is a concept that is not exclusive for education. In all areas of society where professionals are working is CPD apart of the job. CPD is needed in all the professions that acquire well educated workers. Worldwide CPD programs are developed for physiotherapists, technicians, designers, dentists, accountant s etc. So the concept of CPD is related to all professional fields; it is worldwide a regular part of the profession.

ThatiswhythereisaneedtodefinemorepreciselythecontextofCPD.InthisstudythetermCPDis used for the continuous professional development of in-service teachers working in primary or secondary education. In Ethiopian schools CPD is much further narrowed as following the central developed CPD manuals. What does the literature say about the concept of CPD for in service teachers?

The first two letters of the abbreviation are explained by Mintesnot (2008): "Continuous refers to throughout the practioner's working life; professional refers to maintaining the quality and relevance of professional service." Butwhatis meant with development? In the literature there are different aspects mentioned for instance, Glatthorn(1995) cited in Villegas-Reimers (2003) states that "Teacher development is the professional growth a teacher achieves as a result of gaining increased experience and examining his other teaching systematically."

This definition correlates two aspects: experience and systematic reflection. In what way the concrete experience and systematic reflection are related in the learning process is elaborated by Kolb (1976). According to Kolb there are fours tages of experiential learning; Concrete experience (Feeling), Reflective observation (Watching), Abstract conceptualization (thinking) and Active experimentation(Doing) illustrated as follows.

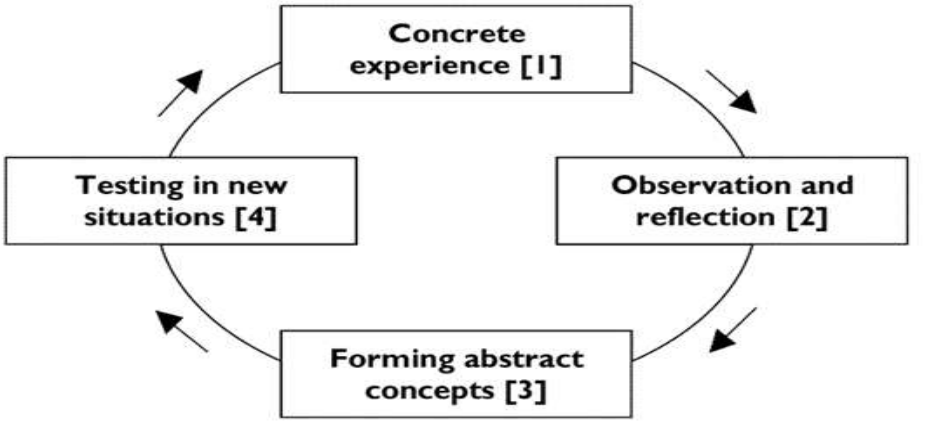


Figure 2. Stages of experiential learning Adapted from; Kolb(1976).

The diagram illustrates how these stages are related in acyclic process. Kolb combines these stages with four different learning styles but there is no need to work that out in this context (although very interesting for trainers.). Kolbs'learning theory is however interesting for a better understanding of teacher's development.

In a recent article Huebner (2009)based on literature research from Rosenholtz, Putnam and Coburn-name stwoma in components in teacher learning: the individual and the interpersonal: In the individual realm, teachers gain knowledge about content and pedagogy. In the interpersonal realm, teachers engage in dialogue and collaboration to further develop and support their own learning.

The CPD Cycle /Process/
The CPD Cycle is a carefully planned response to indentified needs. The CPD cycle is similar at individual, group, Woreda, Zone, Region and National levels (MoE, 2009b).

The stakeholders, the contents of the needs analysis, responsible persons and examples of need analysis for the CPD in Ethiopian context are presented in Table1.

3. Research Methods

The research design used was descriptive case study. According to Baxter and Jack (2008), case study methodology provides tools for researchers to study complex phenomena within their contexts. When the approach is applied correctly, it becomes a valuable method for research to develop theory, evaluate programs, and develop interventions (p. 1). As CPD implementation is somewhat contextual and many factors affect it, applying case study research method is of paramount importance. Therefore, the researchers have decided to use a descriptive case study method to investigate the effectiveness of the CPD implementation, the challenges of CPD implementation in the schools.

3.1. Sample and Sampling Techniques

Simple random sampling technique was used for teachers while, availability and Purposive sampling techniques were used for Woreda and Education Bureau CDP focal Persons respectively. The total population, the sample schools and sampling techniques are presented below.

Table 2. Sample and Sampling Techniques

Data sources	Setting	Region/Woreda						Total sample	Sampling technique
		Harari		Dire-Dawa		Haramaya			
		Total	Sample	Total	Sample	Total	Sample		
Primary Schools	Rural	32	10	40	11	0	0	39	Stratified Random
	Urban	25	6	20	7	10	5		
Secondary Schools	Rural	0	0	1	0	0	0	6	Stratified Random and available
	Urban	5	3	8	2	1	1		
Total								43 (two are both primary and	
Primary Teachers	Rural	200	61	344	99	0	0	372	Simple Random
	Urban	324	70	1331	94	160	48		
Secondary Teachers	Rural	0	0	65	0	0	0	87	Simple Random
	Urban	173	41	455	20	?	26		
Total								459	

Source Dire-Dawa Administration and Harari Region Education Bureaus and Haramaya town Education Office

3.2. Data Collection Instruments

The primary data were collected from teachers, directors, and CPD focal at Regional Education Bureau and Woreda Education Office. Questionnaire was used to collect data from the teachers of the sample schools. Interviews were conducted with Woreda and Education Bureau CPD focal persons and cluster resource center Schools focal persons.

Secondary data for the study were collected by analyzing the reports from schools, teachers' portfolios, schools monitoring and evaluation result, minutes of supervisors and schools on CPD.

3.3. Methods of Data Analysis

Data collected with questionnaires were analyzed both quantitatively and qualitatively whereas data from interview and documents were analyzed qualitatively. To analyze the data collected statistical methods like frequency, percentages, weighted mean were used Moreover, T-Test was used to see whether there is significant difference between the three locations of the study in implementing CPD or not.

4. Analysis and Presentation of Data

This chapter focuses on the presentation and analysis of the data collected on the background of respondents, the perception of teachers towards the relevance of CPD, the process of CPD needs

analysis of schools and how much the different stakeholders are playing their roles in the implementation of Teachers Continuous Professional Development, the major hindering factors of CPD implementation and the perception of stakeholders about the effectiveness of CPD implementation in their schools..

4.1. Background of Respondents

Table 3. Number of sample schools.

Region/ Woreda	Number of sample schools	School Setting			Number of sample teachers		
		Rural	Urban	Total	Male	Female	Total
Dire Dawa	18	99	114	213	106	107	213
Harari	19	61	111	172	89	83	172
Haramaya	6		74	74	40	34	74
Total	43	160	299	459	235	224	459

As can be seen from the above table, a total of 459 teachers from 43 schools were taken as respondents of the research through questionnaire. Of them, 213 (M=106, F=107) were from Dire Dawa Administrative Region, 172 (M=89, F=83) from Harari Region and 74 (M=40, F=34) were from Haramaya Woreda town of Oromia Region. From the total respondents, 160 were from rural schools and the rest 299 were from schools in urban settings.

Table 4. School/grade level across research locations.

School/Grade Level	Region/Woreda			Total	
	Dire Dawa	Harari	Haramaya	No.	%
1-4	97	35	12	144	31.4
5-8	96	96	36	228	49.7
9-10	20	28	19	67	14.6
11-12	0	13	7	20	4.36
Total	213	172	74	459	100

As can be seen in the above table, respondent teachers were taken from both primary and secondary schools. From the total of 459 teachers 87 (18.9%) were secondary school teachers and the rest 372 (81.1%) primary school teachers. Sample respondent teachers were taken from different grade levels. As can be seen in Table 4, majority (49.7%) were teaching in grades 5-8, 31.4% were in grades 1-4, 14.6% were in grades 9-10 and the rest were teaching in grades 11 and 12.

Table 5.Educational qualification of teachers across grade levels in which they teach

Grade level They teach	Educational qualification									
	Certificate		Diploma		BA/BSc		MA/MSc		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
1-4	53	36.8	90	62.5	1	0.7	0	0	144	100
5-8	8	3.5	189	83	31	14	0	0	228	100
9-10	0	0	5	7	60	90	2	3	67	100
11-12	0	0	0	0	17	85	3	15	20	100
Total	61	100	284	100	109	100	5	100	459	100

The above table illustrates that from teachers who are teaching in the first cycle primary schools, 62.5 % were Diploma graduates,36.8 % were Certificate and the rest 0.7% were First Degree graduates. From grade second cycle primary teachers,83% were Diploma graduates, 14% First Degree graduates and the rest 3.5% of them were Certificate level graduates. From general secondary school (grade 9-10), 90% were BA/BSc Degree holders, 7% Diploma and 3% Master's

Degree holders. From Preparatory school (grade 11-12), 85% were First Degree holders and the rest 15% were Master's Degree holders.

From these data, we can infer that the teachers assigned to each grade levels are up to the appropriate level except the preparatory grade levels which are expected to have Master's Degree holder teachers.

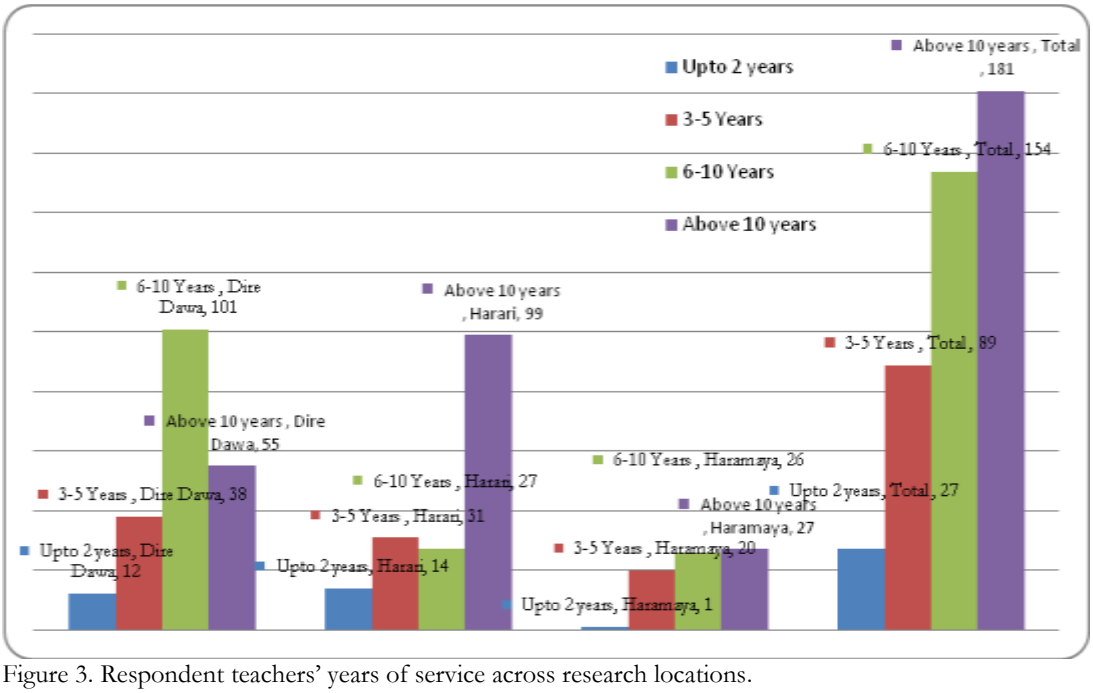


Figure 3. Respondent teachers' years of service across research locations.

Figure 3 above, indicates that majority 181 (40%) of the teachers are senior teachers with experience of above ten years, 154 (34%) were with 6 to 10 years work experience, 89(20%) of them have 3 to 5 years work experience and the rest 27 (6%) of them are beginner teacher with below 2 years teaching experience. When we compare the three locations the result is the same for Harari region and Haramaya Woreda whereas in Dire Dawa the majority of the teachers have six to ten years work experience.

This may tell us that most of the teachers are engaged in CPD and there will be teachers who are eligible to be mentors of the programme.

Table 6.Teaching load of teachers per week.

Minimum	Maximum	Mean	Std. Deviation
3	35	18.11	5.496

As can be seen from the table above, the maximum teaching load of teachers is 35 periods per week, the minimum load is 3 and the average load is about 18 periods per week. Regarding the load of teachers there is significant difference between Dire Dawa and Harari Regions but there is no significant difference between Dire Dawa Region and Haramaya town as well as Harari Region and Haramaya town (as can be seen in Table 7 below).

Table 7. Comparison of weekly teaching load across research locations.

No.						95% Confidence Interval of the Difference	
	Region	N	Mean	Std. D	t-value	df	Lower	Upper
	Dire Dawa	211	19.24	5.782	5.143**	381	1.680	3.759
	Harari	172	16.52	4.241				
	Dire Dawa	211	19.24	5.782	.784	283	-.950	2.208
	Haramaya	74	18.61	6.365				
	Harari	172	16.52	4.241	-3.024	244	-3.452	-.729
	Oromia	74	18.61	6.365				

*** There is significant difference*

Table 8 .Frequency of teachers engaged in additional responsibility beyond teaching.

	Responsibility				Total	
	No		Yes			
Region	No.	%	No.	%	No.	%
Dire Dawa	141	66.2	72	33.8	213	100
Harari	126	73.3	46	26.7	172	100
Oromia	63	85.1	11	14.9	74	100
Total	330	71.9	129	28.1	459	100

Table8 shows that majority (71.9%) of the teachers do not have additional responsibility beyond teaching. The rest 28.1% of the teachers are working as department heads, unit leaders, homeroom teachers and club or committee heads. This may tell us that teachers will have time for their CPD.

4.2. Perception of Respondents towards Importance of CPD

Teachers were requested give their perceptions towards the importance of CPD to the different areas of their teaching learning activities. Accordingly, their responses are summarized as follows.

Table 9. Teachers' response towards the importance of CPD.

Item	Responses						Mean
	1	2	3	4	5	Total	
The contribution of CPD in improving my classroom management is	10	25	120	180	124	459	3.83
The contribution of CPD in improving my skill of lesson preparation and delivery	10	29	87	182	151	459	3.95
The contribution of CPD in understanding the new Education and Training Policy is	14	32	113	187	113	459	3.77
The contribution of CPD in applying different Active Learning Methods ALM in my teaching is	8	24	85	192	150	459	3.98
The contribution of CPD in cooperating with colleagues is	7	31	110	163	148	459	3.90
The contribution of CPD in forming partnerships with students' parents is	18	55	132	172	82	459	3.53
The contribution of CPD in improving my skill of record and report of students' results is	11	31	90	186	141	459	3.90
The contribution of CPD in reflecting on own practice is	10	34	110	165	140	459	3.85
The contribution of CPD in using continuous assessment is	8	30	86	175	160	459	3.98
The contribution of CPD in improving my skill of curriculum and other program development is	17	36	124	156	126	459	3.74
							3.84

1= poor, 2= to some extent 3= Moderate, 4= High and 5=Very High

Moreover, in open ended items, teachers were requested the specific professional advantages they get from their CPD works, accordingly they responded as follows:

a. It enables me develop effective methods of teaching and use of various active learning methods,
b. It builds and advances my previous understanding and skills,
c. It helped me create good communication among the school and good attitudes towards processes of learning and teaching in the schools.
d. It enables me how to prepare lesson plan and handle students' results obtained through continuous assessment,
e. It enables me to build my teaching skills and develop my communication skills with others,
f. It enables me to discuss about the problems prevalent in the schools with the colleagues and solve them cooperatively
g. It enables me to identify my weaknesses and
h. It enables me to learn and share new information and good experiences from others (colleagues).

Table10. T-test value of importance of CPD across research locations.

Region/Woreda	N	Mean	Std. Deviation	Std. Error Mean	T	df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
								Lower	Upper
Dire Dawa	213	3.9836	.75139	.05148	5.206**	383	.000	.25209	.55807
Harari	172	3.5785	.76842	.05859					
Dire Dawa	213	3.9836	.75139	.05148	-.744**	285	.457	-.28156	12707
Haramaya	74	4.0608	.81892	.09520					
Harari	172	3.5785	.76842	.05859	-4.426**	244	.000	-.69698	-.26767
Haramaya	74	4.0608	.81892	.09520					

*** There is significant difference.*

But the calculated t-value in table above indicates that there is significant difference between the three locations of the study Dire Dawa and Harari Regions and Haramaya town teachers' perception towards the importance of CPD in contributing to their teaching practices.

4.3. Implementation of CPD

4.3.1. The practice of school needs analysis priorities identification

The following are the summaries of the information about the way the CPD needs of the school analysis is done, the CPD planning process of school and individual teachers are done and the attempts of awareness creation trainings and the resources allocated for CPD process.

Teachers were requested whether their schools conducted CPD Needs analysis or not. The sources of data for school CPD needs analysis were teachers, supervisors, department heads, students and students' parents. The major tools of data gathering used in school CPD needs analysis were Focus Group Discussion, Questionnaire and Interview. About the effectiveness of the needs analysis processes in participating stakeholders, 51.9% of the teachers responded as yes. When we see the teachers' response from the three localities, 63.4% teachers of Dire Dawa, 39% of Harari teachers and 48.6% of Haramaya Woreda teachers believe that the needs analysis processes was effective in participating stakeholders.

Moreover, majority (88.5%) of them affirmed that CPD needs analyses were done before planning. Besides, their responsibilities as individual teachers were meeting with mentor and supervisors, they made self-reflection in their classroom and they were preparing for new responsibility.

Beyond the needs analysis, majority (86%) of teachers confirmed that their schools identify the priorities of the year. Moreover, the majority (95%) of the teachers responded that they have agreed on their school priorities of the year.

Most (83.9%) of the respondents affirmed that they had have meetings, reviewing of previous and introduction of new initiatives of CPD at their school level. Of these 83.9% of respondents,

49.9% of them had more than three times, 13% three times,21.3% only two times and the rest 16.1% of them had only one meeting.

Majority (51.6%) of the teachers replied that they have got the CPD materials (national, regional or school based) in time but Most (62.3%) of the respondents responded that they have not enough resources that can serve them as a bench mark/ best practices for your CPD from your school, CPD cluster centre or REB. Moreover, the result of the interviews held with REB CPD focal persons and Woreda TDP team affirmed this fact. The explained that they provided teachers with the necessary guidelines but there are no sample best practices displayed for teachers.

Majority of teacher respondents (67.3%) replied that, the clusters centre coordinators/supervisors or Regional Education Bureau (REB) experts are not supporting them in working on their CPD. The researchers' actual observation of CRCs and some schools as well as interview with REB CPD focal persons and Woreda TDP team witness that the support from REBs is relatively good but the CRCs are not well organized, do not have any plan and they do not perform their roles in all the three locations especially in 2012/13 and 2013/2014 academic years.

Though the majority (71%) of the respondents replied that there is no reduction of load teachers because of their CPD work, most (54.7%) of them believe they have enough time to work on their CPD besides their regular teaching task. As can be seen in table 6 and 7, the average number of teaching loads per week was 18 (Dire Dawa=19.24, Harari=16.52 and Haramaya= 18.61).

Majority (48.4%) of the respondent teachers replied that their school principal/s identify and empower the expert teacher (mentors), 20.3% responded as most of the time, 19% as never and the rest 12.4% replied as always.

Most (74.9%) of teachers responded that there are senior teachers in their schools who can play coaching/mentoring role. But 53.4% of them believe that the mentors' support their mentees sometimes, 23.5% replied as most of the time, 11.5 % replied as always and the rest 11.5% as never. Moreover the result of the interview conducted with the REB CPD focal persons and Woreda TDP team; there are teachers who can serve as mentors except in some rural schools. But their willingness to be mentors and commitment to support teachers is very limited. This might be because of no reduction of teaching load, no incentive mechanisms (packages).

Majority (72.5%) of the respondent teachers replied that they have taken trainings on the what, why and how of CPD program. Majority (54.7) of them confirmed that the trainings were given by schools, some (19.5) by REBs, 9.01% by CRCs, 3.6% by MoE and the rest by all of the mentioned stakeholders. (Appendix B).

From the above date we can infer that the REBs and schools provided trainings on CPD, distributed the necessary national and local documents but still REBs and CRCs and principals are not supporting teachers by providing sample works that can serve as bench marks, principals are not empowering and identifying potential mentors and the mentors are not committed enough to support their mentees. These gaps may affect the effective implementation of the CPD programme.

4.4. The Practice of Stakeholders on Teachers CPD

This section presents the practice of different stakeholders in the implementation of teachers' continuous professional development. The major stakeholders considered in this research were teachers themselves, school principals, Cluster Resource Centres and Regional Education Bureaus. Thus, in the following table the response of teachers on their practice, their principals', Cluster Resource Centers and Regional education Bureau contribution on Teachers' CPD is summarized (Refer to appendix C).

Teachers were asked to rate how much the different stakeholders were practicing their roles as per the Framework of Ministry of Education. Accordingly, as can be seen in table above, the average value of teachers' response about their own practices the school principals' practices were almost "Agree" (mean=3.9 and 3.7) respectively whereas teachers' response about the Cluster Resource Centers' practice was almost "Disagree" (mean=2.4) and about the Regional Education Bureaus it was undecided (mean 3.3). This indicates that, the teachers and principals are trying to play their roles but the contribution of the REB is not as expected and the CRCs are not playing their roles. Though the teachers and principals are better in contributing for teachers' CPD, the principals are not able to do their own CPD beyond facilitating and supplying resources to teachers. The secondary schools practice is very limited almost not practiced. In all the three locations CPD is being implemented by the primary school teachers.

In addition, the personal observation of the researchers' on CRCs, the result of interviews held with REB, CPD focal persons and Woreda TDP team indicates that the practice of CPD is more of owned by the teachers with supervision of principals and follow up of REBs(with report). The REBs allocated the basic guidelines and organize trainings for both teachers and mentors. They believed that these activities were strong in the previous three years (2010-12). In all the three locations the contribution of CRCs is almost none and they are available only nominally.

Moreover, with the exception of Dire Dawa, the REBs and Woreda Education Office do not have as such strong follow up and encouragement particular to CPD activities. But Dire Dawa REB used to have organizing annual conferences and certification of teachers for completing their 60 hours' work.

As indicated in table, t-value was calculated for the three localities about the practice of the different stakeholders on teachers' CPD. Significant difference was observed between all the three localities across the different stakeholders. Regardless of the differences, the contribution of REB and CRCs were very much limited all the three locations.

Table 11. T-value of Practice of stakeholders across research locations.

I. Practice of teachers									
No.	Region/Woreda	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
								Lower	Lower
	Dire Dawa	213	4.0466	.71062	3.887**	383	.000	.13967	.42555
	Harari	172	3.7640	.70735					
	Dire Dawa	213	4.0466	.71062	.710**	285	.478	-.12866	.27396
	Haramaya	74	3.9739	.88107					
	Harari	172	3.7640	.70735	-1.978**	244	.049	-.41903	-.00089
	Haramaya	74	3.9739	.88107					
II. Practice of principals									
	Dire Dawa	213	3.8428	.82258	2.362**	383	.019	.03245	.35499
	Harari	172	3.6491	.77138					
	Dire Dawa	213	3.8428	.82258	2.680**	285	.008	.08204	.53607
	Haramaya	74	3.5338	.94185					
	Harari	172	3.6491	.77138	1.004**	244	.316	-.11088	.34154
	Haramaya	74	3.5338	.94185					
III. Practice Cluster Resource Centers									
	Dire Dawa	213	2.6701	.98007	6.728**	383	.000	.37417	.68313
	Harari	172	2.1415	.35343					
	Dire Dawa	213	2.6701	.98007	4.813**	285	.000	.32687	.77914
	Haramaya	74	2.1171	.20138					
	Harari	172	2.1415	.35343	.555**	244	.579	-.06210	.11081
	Haramaya	74	2.1171	.20138					
IV. Practice Regional Education Bureaus									
	Dire Dawa	213	3.3769	1.02909	1.498**	383	.135	-.04760	.35185
	Harari	172	3.2248	.94141					
	Dire Dawa	213	3.3769	1.02909	.338**	285	.736	-.22572	.31934
	Haramaya	74	3.3301	1.01730					
	Harari	172	3.2248	.94141	-.785**	244	.433	-.36949	.15887
	Haramaya	74	3.3301	1.01730					

** *There is significant difference.*

4.5. Major Challenges of Effective Implementation of CPD

Teachers, school CPD focal persons and REB, CPD focal persons and Woreda Education Office TDP team were asked about the major challenges that hinder the effective implementation of CPD package. Accordingly, teacher respondents listed the following; Education Bureau did not give consistent training to the group, Lack of taking adequate training, Lack of adequate time, Stakeholders' lack of confidence in the program, Lack of educational materials and their absence of distributions on time, Lack of budget that enables the trainees/teachers to take adequate training for a long time, Lack of adequate experience, lack of giving adequate training to the school, absence of specific budget for CPD and absence of incentive package.

In addition, the researchers' personal observation of sample CRC schools and discussion with focal teachers witness that there is limited support and follow up from REB, the trainings given are not consistent and need based, the CRCs are with no resources to support other schools and even the CRC are with no function except their names.

Moreover, the Dire Dawa REB, TDP expert stated that the major challenges are lack of commitment of mentors to support teachers because of no reduction of loads, poor organization and limited support of the CRC in primary schools and resistant from secondary schools. Harari Educational Regional Bureau CPD focal person stated that the following are the major challenges: absence of ownership of the programme at the different levels (MoE, REBs, and WEOs), lack of consistent support from REBs, absence of linkage between CPD practice and teachers' career structure, lack of any incentive mechanism, lack of commitment of principals and supervisors to do their own CPD, unwillingness of some of the school principals to allocate budget for training resulted from their school grant,

Haramaya Woreda Education Office TDP team members emphasized on the following as major challenges of CPD implementation; resource limitation specific to CPD activities, lack of consistent training of teachers and mentors, absence of ownership of CPD at all levels, lack of incentive mechanism and absence of linkage between CPD and teachers' career structure, turnover of CRC facilitators, lack of trained personnel in CPD at the CRC level and absence of monitoring and evaluation of the status of CPD.

From the above discussions, we can understand that there are challenges that affect the implementation of CPD at all levels.The challenges identified by this study are more or less similar with those of MoE(2009b), Amhara Regional State Education Bureau (2009) and Yewoinhareg (2013).

4.6. Perception of Stakeholders about the Status of CPD Implementation

Respondents were asked whether they personally believe that CPD is being implemented as planned in their schools or not. Consequently 409(53.8%) of them responded as yes. When we compare the result across the three localities, about 75% of Dire Dawa Administration Region teachers believe that CPD is being implemented as planned in their schools but majority of teachers in Harari region (57%) and Haramaya town (67.6%) believe that CPD is not being implemented as planned in their schools. (Refer to table 10).

On the other hand, Dire Dawa Regional Education Bureau CPD focal person responded that regardless of some gaps like, lack of commitment of mentors, resistance from secondary schools and failure of CRCs, it is being implemented effectively as planned whereas, Harari REB CPD focal person responded that it is still difficult to say it is effective or not without formal research but he believed that there are many gaps and the effort of stakeholders' is getting weaker when compared to the previous years.

The team of Haramaya Woreda Education Office TDP believed that the primary school teachers are trying their best but when we see the support from REB, ZED, WEO and CRCs very limited and the follow up is through written report only. Thus, it is difficult to say it is being effectively implemented.

he result of this study is somewhat similar with MoE(2009b) and Amhara Regional State Education Bureau in (2009) and Yewoinhareg (2013) except the findings of this study indicated that the major gaps are on the practical aspects of CPD.

Finally, respondents of the questionnaire and interviewees from CRCs, REBs and WEO were asked what is expected of the different stakeholders to implement CPD effectively. For effective implementation of teachers' CPD; teachers are expected of own their CPD, consistently implement their activities as per their plans, be committed to complete their portfolio honestly, principals

should be models for their teachers in performing their own CPD, allocate budget to give updating trainings for teachers. Moreover, the teachers responded that the REBs show allow adequate budget for CPD, adopt good experiences from schools that have good teaching experiences and sharing to other schools, Consistent awareness training should be given to all teachers, supply CPD materials to the school timely, organize and give training to the cluster groups from time to time to-up-date their skills and awareness, monitoring and follow up of the program, create teachers' motivation package and organize collaborative work between schools.

Moreover, Dire Dawa REB, CPD focal person suggested that, teachers should not be reluctant on their CPD since it is for them, the school principals should follow up teachers practice and work their own so that they will be trusted, the REBs should organize CRCs and make them functional, and establish system that let schools share best practices and work together.

Harari Regional Education Bureau CPD focal person suggested the following; MoE should consider CPD as an independent unit so that it will have owners at all levels, provision of consistent training, follow up of teachers especially at the secondary school level, principals and supervisors should be committed to do their own CPD and then monitor their teachers, assigning CPD professionals at CRC level.

In addition Haramaya Woreda Education Office TDP team members emphasized the following; MoE should organize at least annual discussion forums to see the status of CPD implementation and let different regions share their best experiences, there should be consistent training for teachers and mentors to improve their attitude and skills, CPD should have independent structure at all levels, the CRCs should be organized and a trained professional should be assigned.

5. Summary of Major Findings

In the sample schools of three locations studied in this research, the following findings stood out.

- CPD priorities tended to be linked more too national initiatives and the School Development Plan than to individual personal professional development needs.
- The CPD needs analysis of the schools was performed using the information from different stakeholders.
- Most teachers have got trainings on the what, why and how of their CPD by the REBs and their schools though it lacks consistency.
- CPD documents were prepared in the local language and distributed to schools though some teachers complain that they were nit supplied timely.
- Most of the teachers perceive the importance of their CPD positively
- The practice of teachers and principals in the implementation of CPD was relatively good whereas the CRCs and REBs practice were not up to the expected level. The CRCs are almost non functional.
- Most teachers in Dire Dawa believed that CPD in their schools is being implemented as planned but in Harari Region and Haramaya Woreda majority of the teachers believed it is not being implemented as planned.
- The obstacles that hinder the implementation of CPD programs stated include; absence of ownership at the different levels, absence of specific budget, lack of consistent training and follow up from WEOs and REBs, lack of commitment of mentors to support teachers because of no reduction of loads and poor organization and limited support of the CRC in primary schools, resistant from secondary schools, absence of linkage between CPD work and teachers' career structure, absence of incentive package, Lack of adequate time, stakeholders' lack of confidence in the program, and the like, lack of and turnover of CRC facilitators and the like.

6. Recommendations

Based on the findings, the researchers made the following recommendations:

1.To implement teachers' CPD as per MoE guideline, there should be ownership at the different level of the Education system (MoE, REB, ZED and WEOs) so that it will have its own plan, budget and monitoring and evaluation systems. Thus MoE should reconsider the structural issue of CPD.

2. The REBs and the Woreda Education Offices should organize and furnish the CRCs so that they will serve as really as resource centers for the schools. If the CRCs are organized very well, they will

provide professional and material supports for the other schools, they will serve as center for sharing good practices and promote the teachers community of practices.
3. The REBs and the Woreda Education Offices should have regular communication and support for the CRCs and schools. So that, challenges will be resolved immediately, the status of the practice will be identified and innovative ways of doing will be selected and practiced.
4. Supervisors and principals shall be models to their teachers so that it will be easy for them to monitor their teachers. Otherwise, teachers may assume that CPD is a burden lied on them rather than a professional improvement opportunity.
5. Teachers' particularly secondary school teachers should be loyal to their professions and be models in solving their classroom and other ins**tructional problems through action researches.**

7. References

Amhara Regional Education Bureau. 2009. Evaluation of CPD Implementation in Amhara Region. Bahir Dar. Unpublished.

Barrow, K. 2006. Professional Development and Teachers' Conceptions of Educational Quality. Cross-National Synthesis on Education Quality Report No. 2: American Institute for Research.

Baxter, P. & Jack, S. 2008. The Qualitative Report Volume 13 Number 4 December 2008 544-559 http://www.nova.edu/ssss/QR/QR13-4/baxter.pdf.

Bransford, J. D. 1999.HowPeopleLearn:Brain,Mind,Experience,andSchool, Washington D.C Development, Program Planning and Policy Analysis Department.

Clement, M. j .Vandenberghe, R. 2000. "How schools Leaders can promote teachers professional development: an account from the field ", *In: school Leadership and management,* 21(1): 43-57.

Cochrane-smith, M.; Lytle, S. L.2001. "Beyond certainty: taking inquiry stance on practice ".In: Lieberman, A., Millar, L. (Eds), Teachers caught in action: professional development that matters .New York; Teachers College press.

Dud Zinski, M, j Rosmann-Millican, M.; k. 2000 "continuing professional development for special educators: reforms and implication for university programs". *Teacher Education and special Education* 23(1): 109-124.

Federal Democratic Republic Government of Ethiopia.1994. Education and Training Policy, Addis Ababa.

Fielding, G. D. and Schalock, H. D. 1985. Promoting the professional development of teachers and administrations. Eugene, Oregon: ERIC Cleaning hose on Educational Management.

Galtthorn, A. 1995."Teacher development". In: Anderson, L. (Ed). International encyclopedia of teaching and Teacher education (Second edition). London. Pergamon press.

Ganser,T. 2000. "An ambitions vision of professional development for teachers". In: NASSP Bulletin, 84 (618): 6-12.

Huebner,T.2009. TheContinuumofTeacherLearning.HowteacherslearnVol.66,no.5.

King.M.B.; Newmann; F.M.2000." Will teacher learning advance school goals? In: phi Delta Kappan.pp.576-580.

Kolb, D. A. 1976. The Learning Style Inventory: Technical Manual, Boston.

McLaughlin, M, W.; Zarrow, J. 2001."Teacher engaged in evidence-based reform: trajectories of teachers' inquiry, analysis and action". In: Lieberman, A., Millar, L. (Eds), Teachers caught in action: professional development that matters .New York; Teachers College press.

MoE. 2009b. Continuous Professional Development for Primary and Secondary School Teachers, Leaders and Supervisors in Ethiopia: The Framework. Ministry of Education.

___ . 2005. .Education Sector Development Programme III(ESDP-III):Program Action Plan.

__ . 2002. Education Sector Development Programme II (ESDP-II): Program Action Plan. Addis Ababa: Ministry of Education, Education Management Information Systems (EMIS) Department.

___ . 1997. Education Sector Development Programme I (ESDP-I) Program Action Plan. Addis Ababa: Ministry of Education, Education Management Information Systems (EMIS) Department.

Villegas-Reimers, E. 2003.Teacherprofessionaldevelopment:aninternationalreviewofliterature.

Yewoinhareg D. 2013.Practices of teachers' continuous professional development: The case of secondary school in North Shoa Zone of Oromia National Regional State. *Prime Journal of Social Science*. V2(12): pp. 531-545.

APPENDIX

S. No.	Item	Response	Region							
			Dire Dawa		Harari		Haramaya		Total	
			No.	%	No.	%	No.	%	No.	%
	Have your school conducted needs analysis and review of the CPD?	Yes	202	94.8	143	83.1	61	82.4	406	88.5
		No	11	5.16	29	16.9	13	17.6	53	11.5
		Total	213	100	172	100	74	100	459	100
.	If your answer for item number 1 is yes, what were your responsibilities as an individual teacher?	I met with mentor	59	29.2	30	21	19	31.1	108	26.6
		I made self reflection	28	13.9	27	18.9	9	14.8	64	15.8
		I was preparing for new responsibility	21	10.4	17	11.9	5	8.2	43	10.6
		I engaged in all of the above	82	40.6	68	47.6	28	45.9	178	43.8
		I engaged in none of the above	12	5.94	1	0.7	0	0	13	3.2
		Total	202	100	143	100	61	100	406	100
	Did your school identify the priorities of the year?	Yes	185	86.9	143	83.1	68	91.9	396	86.3
		No	28	13.1	29	16.9	6	8.11	63	13.7
		Total	213	100	172	100	74	100	459	100
	If you answer for item 3 is yes, have you agreed on your school priorities of the year?	Yes	173	93	138	97.2	67	98.5	378	95.5
		No	13	7	4	2.82	1	1.47	18	4.55
		Total	186	100	142	100	68	100	396	100
	At school level, did you have meetings, reviewing of previous and introduction of new initiatives of CPD?	Yes	187	87.8	139	81	59	79.7	385	83.9
		No	26	12.2	33	19	15	20.3	74	16.1
		Total	213	100	172	100	74	100	459	100
	If your answer for item number 5 is yes, how many times?	Once only	32	17.1	16	12	14	23.7	62	16.1
		Only two	33	17.6	33	24	16	27.1	82	21.3
		Three	17	9.09	23	17	9	15.3	49	12.7
		More than three	105	56.1	67	48	20	33.9	192	49.9
		Total	187	100	139	100	59	100	385	100
	Do you believe that CPD needs analysis procedure was appropriate and effective in participating all	Yes	135	63.4	67	39	36	48.6	238	51.9
		No	77	36.2	68	39.5	26	35.1	171	37.3
		Missed	1	0.47	37	21.5	12	16.2	50	10.9

stakeholders?	Total	213	100	172	100	74	100	459	100
Is there a reduction of load for you because of CPD works?	Yes	64	30	54	31.4	15	20.3	133	29
	No	149	70	118	68.6	59	79.7	326	71
	Total	213	100	172	100	74	100	459	100
How frequently does your school principal/s identify and empower the expert teacher (mentors)?	Always	26	12.2	20	11.6	11	14.9	57	12.4
	Most of the time	55	25.8	28	16.3	10	13.5	93	20.3
	Sometimes	92	43.2	96	55.8	34	45.9	222	48.4
	Never	40	18.8	28	16.3	19	25.7	87	19
	Total	213	100	172	100	74	100	459	100
Do you think you have enough time to work on your CPD besides your regular teaching task?	Yes	127	59.6	79	45.9	45	60.8	251	54.7
	No	86	40.4	93	54.1	29	39.2	208	45.3
	Total	213	100	172	100	74	100	459	100
Are there senior teachers in your school who can play coaching/mentoring role?	Yes	162	76.1	127	73.8	55	74.3	344	74.9
	No	51	23.9	45	26.2	19	25.7	115	25.1
	Total	213	100	172	100	74	100	459	100
How frequently do teachers assigned as mentors support their mentees?	Always	28	13.1	18	10.5	7	9.5	53	11.5
	most of the time	57	26.8	30	17.4	21	28	108	23.5
	Sometimes	107	50.2	105	61	33	45	245	53.4
	Never	21	9.86	19	11	13	18	53	11.5
	Total	213	100	172	100	74	100	459	100
Have you taken trainings on the what, why and how of CPD program?	Yes	147	69	128	74.4	58	78.4	333	72.5
	No	66	31	44	25.6	16	21.6	126	27.5
	Total	213	100	172	100	74	100	459	100
If your answer for item 13 is yes, who gave you the training/s? (you can choose more than one)	MoE	2	1.4	6	4.7	4	6.9	12	3.6
	REB	20	14	39	30	6	10.3	65	19.5
	CRC	7	4.8	14	11	9	15.5	30	9.01

	School	100	68	51	40	31	53.4	182	54.7
	All	13	8.8	14	11	8	13.8	35	10.5
	REB and CRC	1	0.7	0	0	0	0	1	0.3
	MoE and School	0	0	2	1.6	0	0	2	0.6
	CRC and School	3	2	2	1.6	0	0	5	1.5
	REB,CRC and School	1	0.7	0	0	0	0	1	0.3
	Total	147	100	128	100	58	100	333	100
Do the clusters centre coordinators/supervisors or Regional Education Bureau (REB) experts are supporting you in	Yes	51	23.9	71	41.3	28	37.8	150	32.7
	No	162	76.1	101	58.7	46	62.2	309	67.3
	Total	213	100	172	100	74	100	459	100
Have you got the CPD materials (national, regional or school based) in time?	Yes	99	46.5	97	56.4	41	55.4	237	51.6
	No	114	53.5	75	43.6	33	44.6	222	48.4
	Total	213	100	172	100	74	100	459	100
Have you got any resources that can serve you as a bench mark/ best practices for your CPD from your school, CPD cluster centre or REB?	Yes	91	42.7	57	33.1	25	33.8	173	37.7
	No	122	57.3	115	66.9	49	66.2	286	62.3
	Total	213	100	172	100	74	100	459	100
Do you personally believe that CPD is being implemented as planned in	Yes	160	75.1	74	43	24	32.4	409	53.8

Response of teachers on CPD implementation

		No	**53**	**24.9**	**98**	**57**	**50**	**67.6**	**350**	**46.2**
		Total	**213**	**100**	**172**	**100**	**74**	**100**	**759**	**100**

Appendix C

Stakeholders practice on teachers' CPD

No.	Statement on teachers' practice	Responses					
		1	2	3	4	5	Mean
1	I'm convinced and engaged in my CPD throughout my career.	13	22	87	208	128	3.9
2	I have identified my personal CPD needs in line with my school's annual CPD plan.	12	24	83	194	146	4
3	I have identified my personal CPD needs in collaboration with mentors/supervisors/senior colleagues.	12	43	91	200	112	3.8
4	I usually work collaboratively with my colleagues to improve learning and teaching.	8	26	64	171	188	4.1
5	I am putting CPD into practice in the classroom.	13	22	75	198	150	4
6	I am committed in supporting the CPD needs of my school.	9	24	79	176	171	4
7	I am maintaining a professional portfolio and recording all my CPD activities.	15	21	151	152	115	3.7
Teacher's Grand mean							**3.9**

No.	Statement about principals' practice	Responses					
		1	2	3	4	5	Mean
	My principal created a CPD management strategy within the school.	20	30	110	178	119	3.8
	My principal is ensuring effective CPD needs analysis process every year.	15	35	116	170	12	3.8

						3	
	My principal together with colleagues identified issues for consideration as CPD priorities.	17	34	109	189	110	3.7
	My principal is ensuring that each department produces an annual CPD plan and manages the budget.	26	50	133	159	91	3.5
	My principal is monitoring the effectiveness of the changes to teaching and learning.	14	31	99	174	137	3.9
	My principal is monitoring and assessing the content of individual professional portfolios and giving constructive feedback.	11	37	125	178	106	3.7
	My principal is collaborating with REB professionals to ensure that the national CPD priorities are addressed in school CPD plan	17	40	139	170	92	3.6
8	My principal is participating in regional and national CPD activities which ensure that their knowledge and experiences are up-to- date.	19	47	149	141	100	3.6
Principals' Grand Mean							3.7

No.	Statement about Cluster Resource Centers' practice	Responses					Mean
		1	2	3	4	5	
	Our cluster centre established and supports the cluster committee.	27	250	91	54	37	2.6
	Our cluster manages and coordinates CPD activities in the cluster centre effectively.	25	269	89	47	29	2.5
	Our cluster collects and shares individual school CPD plans regularly.	20	351	46	23	19	2.3
	Our cluster supports teachers' professional portfolio development.	15	349	47	29	19	2.3
	Our cluster provides opportunities for collaboration and sharing of good practices within the cluster.	14	352	47	22	23	2.3
	Our cluster makes available resources for cluster schools to use in classrooms.	19	351	53	28	8	2.2
	Our cluster provides trainings for teachers as appropriate.	19	341	48	32	19	2.3
	Our cluster support s the delivery of the induction program for newly deployed teachers.	17	348	47	26	20	2.3
	Our cluster supports inclusive education.	19	330	53	37	18	2.4
Cluster Resource Centers' Grand mean							2.4

No.	Statement about the practice of REB	Responses					
		1	2	3	4	5	Mean
	The REB analysed and identified regional priorities, produced materials and delivered training to implement them.	49	57	135	146	71	3.3
	The REB shares information with all stakeholders.	39	61	160	142	57	3.3
	The REB annually produces and circulates regional CPD plans.	34	62	151	124	87	3.4
	The REB allocates resources needed to implement the regional CPD programme.	49	61	145	134	68	3.2
	The REB ensures that CPD materials are written in the language that teachers will understand best.	37	62	143	127	89	3.4
	The REB monitors and evaluates the CPD programme regionally and produces annual report.	54	50	149	136	70	3.3
	The REB is raising awareness of and promoting inclusive education throughout the region through CPD.	44	63	149	140	63	3.3
REB Grand mean							3.3

1=strongly Disagree, 2= Disagree, 3= Undecided, 4=Agree and 5=Strongly Agree.

5. Human Resource Development, Climate and Employee Engagement: A Study of Some Public Universities in Ethiopia

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Abstract: The overall development of a society is largely determined by the quality of its education, especially of the higher education. A well-educated, well-trained population could propel a nation towards rapid economic growth. The aim of education is to create well-trained, competent and progressive individuals who can perform all kinds of tasks and take on a lot of responsibilities. Higher education is the stage of education that takes place at the postsecondary level, and is provided mostly and most meaningfully by universities. The objective of a university is not only to create and disseminate knowledge but also to develop human resources that will accelerate the socio-economic development of the nation. This is possible only when the employees working in these universities are motivated and empowered. Employees are a critical component to every organization, and their engagement serves as a barometer of organizational health. In response to the dire need for organizations to increase engagement levels of employees, the importance of the human resource development (HRD) climate cannot be overlooked. The purpose of this study is to explore the impact of HRD Climate on employee engagement in select public universities in Ethiopia. The research approach and methodology adopted to carry out this study includes collection of primary and secondary data. Primary data were collected through a well-structured and well-designed questionnaire on HRD climate developed by XLRI Jamshedpur (India) and Employee engagement (EE) developed by Schaufeli *et al. (2002)*. The questionnaire had been administered to 576 respondents selected from the five leading universities of Ethiopia. The findings revealed that the extent of HRD climate and HRD climate elements are all below average (Mean=2.677(41.925%) implying existence of poor HRD climate in the selected public universities in Ethiopia. On the other hand, the employee engagement result shows above average (Mean=4.44) regardless of the prevailing poor HRD climate in the universities. The study also showed that a significant and positive correlation exists between these two variables ($r=.418$, $p<.01$).Besides, HRD climate influences the Employee engagement. Based on the findings, the guidelines, recommendations and policy implications were made for the improvement of HRD Climate in the universities thereby enhancing Employee engagement. Thus, by studying HRD Climate and employee engagement together, this paper makes a significant contribution to the existing dearth of academic literature on employee engagement and HRD Climate in an Ethiopian context.

1. Introduction

The rise or fall of the organization depends upon its people. Irrespective of the size and type of the organization whether it is an educational institution, a retailing store, a government institution, a hotel, a manufacturing unit or a bank always looks for good, competent and self-motivated work force. It is strongly believed that people constitute the vital source of the competitive advantage for the present organizations. In the context of the challenges faced by the organizations in the dynamic competitive environment, organizations are trying to attract best talent, develop and retain them. In accordance with the dynamic environment, the competencies required from the employees are also changing. Updating the capabilities and learning new skills is the need of the hour for the existing workforce. Every individual employee is required to acquire and update his/ her skills, knowledge and capabilities from time to time in the organization for the effective performance of their job tasks.

The human resource is the most significant and the only active factor of the production. All over the factors like capital, materials, buildings, plant & machine etc. remain inactive unless there are competent people to utilize them for producing goods & services desired by the society. The goal of achieving, greater quality and higher productivity depend on the skill of the people. Developing human resource, upgrading their skills and extending their knowledge and competencies

would lead to organizational development. Therefore, human resource development is the key to entangling the effecting utilization of intellectual, technological and entrepreneurial skills of human resource.

HRD is the process of increasing the knowledge, the skills, and the capacities of all the people in a society. In economic terms, it could be described as the accumulation of human capital and its effective investment in the development of an economy. In political terms, human resource development prepares people for adult participation in political processes, particularly as citizens in a democracy. From the social and cultural points of view, the development of human resources helps people to lead fuller and richer lives, less bound by tradition. In short, the processes of human resource development unlock the door to modernization (Harbison and Myers, 1964). HRD is a series of organized activities conducted within a specific time and designed to produce behavioural change (Nadler, 1970).

Human Resource Development (HRD) is a process by which the employees of an organization acquire and develop their capabilities and inner-potentials to perform various functions or duties assigned to them by the organization. It ensures development of their 'self' and the 'organization' and helps in developing an organization culture to achieve the pre-determined objectives. To facilitate HRD an optimal level of 'Developmental Climate' is necessary. HRD Climate is an integral part of Organizational climate. It can be defined as the employee's perceptions about the working environment of their organization. HRD Climate contributes to the organizations overall health and self-renewing capabilities which, in turn, increase the enabling capabilities of individuals, team and the entire. The primary goal of HRD is to maximize the efficiency of the existing workforce for increasing their overall performance that can lead to the improvement of the entire organization's performance.

The success of HRD in any organization depends, to a large extent, on the existence of a favorable HRD Climate.HRD is more personnel-oriented than technology-oriented and believes that participation and communication would bring about greater commitment, efficiency, and growth of individuals.

1.1. Conceptual Framework

1.1.1. HRD climate

The term climate is used to designate the quality of the internal environment which affects, the quality of cooperation, the development of the individual, the extent of member's dedication or commitment to organizational purpose, and the efficiency with which that purpose becomes translated into results. It influences morale and the attitudes of the individual toward his work and his environment. Webster's dictionary (1992) defines climate as: (1) the prevailing or average weather conditions of a place, as determined by the temperature and meteorological changes over a period of years; (2) any prevailing conditions affecting life, activity, etc.; and (3) a region considered with reference to the kind of weather prevailing there. In Organization context, climate consists of the prevailing conditions within the organization that affect the life of employees and the activities within the organization (Smith, 1988).

The HRD climate can be characterized by tendencies such as treating employees as the most important resources, perceiving that developing employees is the job of every manager, believing in the capability of employees, communicating openly, encouraging risk taking and experimentation, making efforts to help employees recognize their strengths and weaknesses, creating a general climate of trust, collaboration and autonomy, supportive personnel policies, and supportive HRD practices (Rao and Abraham, 1986). According to Mishra *et al.* (1999), a healthy HRD climate certainly bolsters the overall internal environment of the organization and fosters employee commitment, involvement and satisfaction with the job. Saxena and Tiwari (2009) contend that HRD climate plays a very important role in the success of any organization because directly or indirectly it affects the performance of the employees. If the HRD climate is good then the employees will contribute their maximum for the achievement of the organizational objectives. The management can improve the HRD climate by introducing the changes in HR policies and practices.

1.1.2. Employee engagement

One of the most glaring issues concerning the concept of employee engagement is that there is no clear definition. Numerous definitions of engagement can be derived from the practice- and

research driven literatures. Common to these definitions is the notion that employee engagement is a desirable condition, has an organizational purpose, and connotes involvement, commitment, passion, enthusiasm, focused effort, and energy, so it has both attitudinal and behavioural components. Whilst there is no one clear definition of employee engagement, what most agree on is that engaged employees are committed to making the organization a success, are enthusiastic and satisfied with their job, want to stay with the organization, are willing to talk positively about the company and are willing to go the 'extra mile'. In short, engagement can be thought of as the degree of employee organization alignment. Organizations must work to engage the employee and the employee has a choice about the level of engagement to offer the employer.

A careful consideration of a cross section of employee engagement definitions from practitioners, corporations, and academic researchers will provide a clear picture of extensive variations. Johnson and Johnson company defines employee engagement as 'the degree to which employees are satisfied with their jobs, feel valued, and experience collaboration and trust. Engaged employees will stay with the company longer and continually find smarter, more effective ways to add value to the organization. The end result is a high performing company where people are flourishing and productivity is increased and sustained'. Hewitt Associates research and consultancy firm observe that, engagement is the state of emotional and intellectual commitment to an organization or group producing behaviour that will help fulfill an organization's promises to customers - and, in so doing, improve business results. According to Robert J Vance (2006) engaged employees:

Stay - They have an intense desire to be a part of the organization and they stay with that organization;
Say - They advocate for the organization by referring potential employees and customers, are positive with co-workers and are constructive in their criticism;
Strive - They exert extra effort and engage in behaviours that contribute to business success.
Finally, Schaufeli *et al.* (2002) defined worker/employee engagement as contrasting concept to burnout; they define work engagement "as a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption". Hence, this definition is adopted by the researchers of this study to measure employee engagement in the selected universities.

1.2. Review of Earlier Studies

A multitude of researches have been conducted to examine on the extent of HRD Climate in both public and private sector organizations. The result has shown that HRD Climate affects the performance of the employees. Among the researches, a study carried out by Rao and Abraham (1986) recognized the importance of HRD climate and hence laid a foundation in developing a 38-item HRD Climate questionnaire to survey the extent to which a development climate exists in organizations. The study was based in 41 organizations in India and found that the HRD Climate is appeared to be at an average level.

Benjamin (2012) examined the relationships among human resource development climate (HRDC), organizational Citizenship behaviour (OCB) and voluntary turnover intentions (VTI) in Nigerian banks. He found Nigerian banks 'management can reduce turnover and foster citizenship behaviour by ensuring that a favourable developmental climate exists within their organizations. Furthermore, Richa Chaudhary, *et al.,* (2012*)* carried out study on the middle and senior level business executives from select business organizations in India and examined the impact of HRD Climate and its various dimensions on engagement level of employees. The researchers found that both HRD Climate and employee engagement in the organizations under study were at a moderate level. The correlation analysis of the study variables revealed that HRD Climate and all its dimensions were positively and significantly correlated with employee engagement. Nawab Ali Khan and Sheema Tarab (2012) carried out *a Case Study* of HRD Climate and Employee Development in Telecommunication Industry *on Indian Private Sector.* The study reveals that there exists a positive relationship between the climate of the organization and the development of employees.

Benjamin (2012) conducted a study to measure employees' perception of their affective, normative and continuance commitment in relation to the prevailing developmental climate within the Nigerian banking sector in the context of reforms and change. The study indicated the existence of positive relationship between HRD climate and Organizational Commitment. .Birajitmohanty, *et al.,* (2012*)* carried out study on HRD climate and its impact on Job performance in private insurance companies in Odisha and concluded that HRD Climate has a positive influence on job

performance of the employees. Solkhe and Chaudhary (2010) examined the Impact of HRD Climate over Job satisfaction in the selected public sector enterprise in India. Measures to improve the Organizational Performance have been studied and findings indicated that HRD Climate has a definite impact on Job Satisfaction which in turn leads to the increased organizational performance. Gupta and Malhotra (2012) carried out HRD climate survey in 13selected different information technology organizations and found most of the employees are highly satisfied with the prevailing human resource development practices, policies and climate in the different organizations. Subramaniand Jan (2011) discussed the importance of the efficiency of human resource in the success of any organization in their published research paper. The authors emphasized their work over the study of organizational climate in IT industries of Chennai, and suggested to improve the organizational climatic conditions to match the requirements of the organizational development.

A comparative study conducted by Saraswathi (2010) presented a better understanding of the HRD climate prevailing in software and Manufacturing organizations. The general climate, HRD Mechanisms and OCTAPAC culture were found to be better in software organizations compared to manufacturing organization. Riyaz, R. (2002) carried out a study in commercial banks for analyzing the HRD Climate and found that there was a moderate level of overall OCTAPAC scores in all the sample banks. Saxena and Tiwari (2009) did an empirical study of HRDC in selected public sector banks. Their study showed that the HRDC in the public sector bank is average. They also found no difference in the perception of the employees on the basis of gender, qualification, designation but the perception of the employees differs on the basis of change.

Many research studies have emphasized the need for HRD for improving the quality of human resources and higher education in India. Rao (1999) has laid emphasis on development of teaching and non-teaching staff. He suggests development of both the staffs is very important for the organization to deliver effectively, as its effectiveness depends on how well these two groups perform their roles. Shakeel (1999) has explored the HRD climate in Indian universities and the importance of its implementation in Indian universities. He argues that universities play a crucial role in shaping the socio-economy of the country, so a proper HRD intervention forms to be the need of the hour. Mufeed (2001) has explained the urgency of HRD intervention in the university system. He has laid emphasis on the development of teaching and nonteaching staff including ministerial staff of the universities by much scientific intervention (HRD intervention). The coordination and association among the two groups is decisive of what will be the nature of HRD climate in an organization. Mufeed & Gurkoo (2006) attempted to study the whole gamut of HRD climate in universities and other equivalent higher level academic institutions by eliciting employee perceptions on HRD climate for which the University of Kashmir, Srinagar is selected as the main focal point of study and it was found that HRD climate was poor and employees were dissatisfied with the prevailing HRD practices in the University.

It is inferred from the literature discussed above that HRD Climate affects Employee engagement positively and significantly.

1.3. Objectives of Study

The general objective of the study is to examine the effect of HRD climate on Employee Engagement in the selected public universities in Ethiopia. To this end, the specific objectives of the study are:

- To examine the extent of HRD climate perceived by the employees within the selected public Universities in Ethiopia.
- To examine the employee engagement level of employees in the selected public Universities in Ethiopia.
- To study the relationship of HRD climate and its dimensions on employee engagement in selected public Universities in Ethiopia.
- To examine the impact of HRD climate on the Employee engagement in the selected public Universities in Ethiopia.

In view of the objectives set for the study, following null hypotheses was formulated:

HO1: Employees do not significantly differ in their perception about the HRD climate within the Universities.

HO2: Employees do not significantly differ in their perception about the General climate within the Universities.

HO3: Employees do not significantly differ in their perception about the HRD Mechanisms within the selected public Universities.
HO4: Employees do not significantly differ in their perception about the OCTAPACE culture within the selected Public Universities.
HO5: There exists no significant relationship between HRDC and Employee Engagement in selected public Universities.
HO6: There is no significant impact of HRDC on Employee Engagement

2. The Research Design and Methodology of the Study

2.1. Sources and Tools for Data Collection

Since survey is a widely used technique in social science to collect data, (Saxena and Mishra, 2007), based on the literature review as well as the nature of the research problems, objectives and hypotheses set for this study, the survey method or descriptive-analytical research design is used in this study. Data are collected from two sources, primary and secondary; and both are used in the study. The primary data is collected through personally administered questionnaire from respondents (University community- academic and admin staff).

The HRD Climate Survey instrument (tool) developed and standardized by Rao (1986) at the Centre for HRD, Xavier Labour Relations Institute (XLRI, India) is used to assess HRD climate with slight modification. This tool consists of 38 items and scaled based on Likerts 5-point scale ranging from 5 (always almost true) to 1 (not at all true). After applying factor reduction method using factor analysis, the number of items was reduced to 30 items. These items assess the elements of HRD climate such as the General Climate (11 items), the OCTAPACE Culture (8 items), and the HRD mechanisms (11 items). Similarly, Employee engagement (EE) was measured using the Utrecht Work Engagement Scale (UWES) developed by Schaufeli *et al.* (2002). The scale consists of three subscales; absorption (five items, e.g., "I am immersed in my work", "When I am working, I forget everything else around me"), vigor (four items, e.g., "At my job I feel strong and vigorous", "When I get up in the morning, I feel like going to work"), and dedication (four items, e.g., "My job inspires me", "I am enthusiastic about my job"). In the same way the items were reduced from 17 to 13 using factor reduction method. All the 13 items were rated on a 7-point Likert scale (0 = Never, 6 =always true).

2.2. Reliability

Though the survey tools used are standard, the reliability of the final questionnaire when computed based on the pilot study and the main data, it was found that the coefficient of Cronbach alpha for HRD climate 0.970 and for Employee Engagement .942. These indicate a very high internal consistency based on average inter-item correlation.

2.3. Sampling and Sample Size

This study examines the prevailing condition of HRD climate and employee engagement perceived by both academic and administrative employees in the selected public universities in Ethiopia. The universities are selected by judgmental (non-probability) sampling method based on their age and proximity to each other. Five (5) universities with relatively similar characteristics and experience are selected for this study.

The target population comprises of all university staff (academicians and administrative) working within the selected universities. The samples are the university employees those selected in each universities by systematic random sampling (probability) technique based on the employees' list obtained. A total of 750 employees were chosen randomly from the selected public universities keeping in view their total strength and range of activities in both academic and non-academic. Out of 750 questionnaires distributed to the respondents, 576responses were collected making a response rate 76.8% which is acceptable for this particular study.

2.4. Statistical Tools

The raw data gathered from primary sources is first processed (edited, classified, coded, tabulated) and then analyzed using statistical techniques such as means, standard deviation, percentage, frequency, and one way analysis of variance (ANOVA) to explain or describe the characteristics of respondents, and to determine the significant mean differences between and among respondents' views on HRD climate as well as employee engagement. All the above mentioned quantitative

techniques are computed using the Statistical Package for Social Science (IBM SPSS statistics) version 20 and Microsoft excel-2010.

3. Data Analysis and Results

3.1. HRD Climate Analysis:

The Item wise HRD Climate mean scores of the total sample of 576 employees are presented in the Table 1. Since the questionnaire used 5 point scale, average mean score of around 3 indicates a moderate tendency on that dimension. Scores around 4 indicate a fairly good degree of existence. Here, the overall HRD Climate is 2.677(41.925%) which indicates the existence of below average degree of HRD Climate. Examining the three major components of HRD Climate i.e., General Climate, HRD Mechanisms and OCTAPAC Culture the results indicates:

In the first category of General climate, most of the items have shown below average response. The overall general climate mean score counts to be 2.7309and the standard deviation 0.91072, which reveals below average and poor existence of general climate in the organization. The overall OCTAPAC Culture existence is poor with a mean score of 2.8160, and the standard deviation of 0.86248.

HRD mechanism overall stands at 2.5742 mean score and the standard deviation of 0.85856 revealing a negative picture of its working among the employees. Out of the three dimensions of HRD Climate, OCTAPAC culture has relatively higher mean value (2.8160) followed by General HRD climate (2.7309). On the other hand, of the three dimensions of HRD Climate, the successful implementation of HRD mechanisms(performance appraisal system, promotion, training and development policies, recruitment and selection was found to have the lowest average mean score of 2.5742 (39.35%).

Again if we look at the item-wise analysis of the 30 items of the HRD Climate questionnaire, "Delegation of authority to encourage juniors to develop handling higher responsibilities is quite common in this organisation" was found to have the highest average mean score of 2.94 whereas; "There are mechanisms in this organisation to reward any good work done or any contribution made by employees" scored the lowest with the average mean score of 2.29.

Summing up, the overall HRD Climate mean score stands at 2.677and the standard deviation of the same at 0.86248, which highlights that the climate in the sample organizations is below average and the employees are not being treated in a friendly and cooperative manner. There exists a poor level of team-spirit in working of employees which provides them no space of working and exposing their creativity and talent. Thus, there is an urgent need to improve HRD climate elements in the selected universities. So that, the top management's relentless effort is very crucial to bring dynamic change.

The hypotheses set for overall HRD climate and for each HRD climate elements are verified accordingly.

As shown in Table 3, for overall HRD climate the computed F-value (F = 3.777; df = 4 and P =.005) suggests that the variation in the mean scores is *statistically significant* at the 0.05 significance levels. This indicates the null hypothesis is *rejected* and alternative hypothesis is accepted. Therefore, it is concludedas 'employees differ in their perception about

Table 1. Mean and Standard Deviation Results of 30 item- HRD Climate survey responded by 576 employees of selected public Universities.

Items	Mean	Std. Deviation
The top management of this organization goes out of its way to make sure that employees enjoy their work	2.6226	1.22006
The top management believes that human resources are an extremely important resource and that they have to be treated more humanly.	2.7909	1.27327
Development of the subordinates is seen as an important part of their job by the managers/officers here.	2.9255	1.13932
The personnel policies in this organization facilitate employee development.	2.7837	1.12424
The top management is willing to invest a considerable part of their time and other resources to ensure the development of employees.	2.5889	1.18699
Senior officers/executives in this organization take active interest in their juniors and help them learn their job.	2.6466	1.14603
Employees lacking competence in doing their jobs are helped to acquire competence rather than being left unattended.	2.6490	1.12663
Officers in this organization believe that employee behaviour can be Changed and people can be developed at any stage of their life.	2.8293	1.14795
The psychological climate in this organization is conducive to any employee interested in developing himself by acquiring new knowledge and skills.	2.6971	1.18813
The top management of this organization makes efforts to identify and utilize the potential of the employees.	2.5385	1.23541
The organization's future plans are made known to the managerial staff to help them develop their juniors and prepare them for future.	2.7837	1.19892
General Climate[11 items]	2.7309	0.91072
Seniors guide their juniors and prepare them for future responsibilities/roles they are likely to take up.	2.7139	1.13749
Promotion decisions are based on the suitability of the promote rather than on favoritism.	2.7500	1.23210
There are mechanisms in this organization to reward any good work done or any contribution made by employees.	2.2981	1.12693
When an employee does good work his supervising officers take special care to appreciate it.	2.3654	1.15170
Performance appraisal reports in our organization are based on objective assessment and adequate information and not on favouritism.	2.8365	1.16462
Employees are sponsored for training programmes on the basis of genuine training needs.	2.8317	1.14935
Team spirit is of high order in this organization.	2.5216	1.11702
When problems arise people discuss these problems openly and try to solve them rather than keep accusing each other behind the back.	2.4279	1.13630
Career opportunities are pointed out to juniors by senior officers in the organization.	2.6803	1.12204
This organization ensures employee welfare to such an extent that the employees can save a lot of their mental energy for work purposes.	2.4303	1.10854
Job-rotation in this organization facilitates employee development.	2.4327	1.15760
HRD Mechanisms[11 items]	2.5742	0.85856
Employees are encouraged to experiment with new methods and try out creative ideas.	2.6731	1.16116
When any employee makes a mistake his/her supervisors treat it with understanding and help him /her to learn from such mistakes rather than punishing or discouraging him/her.	2.6779	1.16250
Employees returning from training programmes are given opportunities to try out what they have learnt.	2.8846	1.15379
Employees trust each other in this organization.	2.8534	1.12374
Employees are not afraid to express or discuss their feelings with their superiors.	2.5505	1.18315
Employees are encouraged to take initiative and do things on their own without	2.8510	1.08967

having to wait for instructions from supervisors.		
Delegation of authority to encourage juniors to develop handling higher responsibilities is quite common in this organization.	2.7236	1.13138
When seniors delegate authority to juniors, the juniors use it as an opportunity for development.	2.9399	1.11236
OCTAPAC Culture [8 items]	2.8160	0.86248
Overall HRD Climate(Mean Average)	2.677	

HRD climate within the selected public universities. Similarly, forHRD climate elements as shown in Table 3, the F-statistics corresponding to:

- The General climate (F = 5.161; df = 4 and P = .000) suggests that the variation in the mean scores is statistically significant at the 0.05 significance levels. Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted. This means "there is significant difference in the perception of employees about the General climate with respect to the selected Public Universities"
- The OCTAPACE culture (F = 3.645; df = 4 and P = .006) suggests that the variation in the mean scores is statistically significant at the 0.05 significance level. Hence the null hypothesis is rejected and the alternative hypothesis is accepted. This means, "the OCTAPACE culture differs within the selected public universities".
- The HRD mechanism (F = 2.270; df = 4 and P = .061) reveals that the variation in the mean scores is statistically insignificant at the 0.05 significance level. Hence, the null hypothesis is accepted and the alternative hypothesis is rejected. This implied, "there is no significant difference about the perception of HRD mechanisms by employees within the selected public universities in which they belong".

3.2. Employee Engagement Analysis:

The Item wise Employee Engagement mean scores of the total sample of 576 employees are presented in the Table 2.Here, the overall Employee Engagement is 4.4436and the standard deviation1.16434, which indicates fairly good degree of existence level of engagement for the employees in the organizations under study. However there is substantial scope for improvement. This may be because of the low scores on the vigor and absorption dimensions. Examining the three major components of Employee Engagement i.e., Vigor, Absorption and Dedicationthe results indicates;

- In the first category of Vigor, most of the items have shown an above average response. The overall Vigor means score counts to be 4.4416, and the standard deviation 1.23105, which reveals a fairly good degree of existence in the organization.
- The overall Absorption existence is good with a mean score of 4.2760 and the standard deviation of 1.28850.
- Dedication overall stands at 4.5975 mean score and the standard deviation of 1.29714 is revealing a positive picture of its working among the employees.

Out of the three dimensions, dedication was found to have the highest average mean score of 4.5975, followed by vigor with average mean score of 4.4416. If we go for the item-wise analysis of means "I feel happy when I am working intensively" with average score 4.7380 and "It is difficult to detach myself from my job" scored the lowest with the average mean score of 3.996 which clearly highlights the high dedication level of executives in relation to their work. Also, these are the items which contributed to the highest score on the dedication dimension and to lowest score on the absorption dimension.

Table 2. Mean and Standard Deviation Results of 13 item- Employee engagement survey responded by 576 employees of selected public Universities.

Item	Mean	Std. Deviation
Time flies when I am working.	4.4660	1.41026
When I am working, I forget everything else around me.	4.0360	1.65535
I feel happy when I am working intensely.	4.7380	1.49594
I am immersed in my work.	4.4040	1.47279
It is difficult to detach myself from my job.	3.9960	1.71869
Overall Absorption[5 items]	4.2760	1.28850
I find the work that I do full of meaning and purpose.	4.5880	1.50159
I am enthusiastic about my job.	4.6780	1.47195
My job inspires me.	4.4320	1.59953
I am proud of the work that I do.	4.7260	1.56199
Overall Dedication[4 items]	4.5975	1.29714
At my job, I feel strong and vigorous.	4.5500	1.41969
When I get up in the morning, I feel like going to work.	4.6260	1.60477
I can continue working for very long periods at a time.	4.3940	1.53476
At my work, I always persevere, even when things do not go well.	4.1280	1.58892
Overall Vigor[4 items]	4.4416	1.23105
Overall Employee Engagement(Average)	4.443	1.16434

Table 3. Analysis of Variance (one way ANOVA).

		Sum of Squares	df	Mean Square	F	Sig.
HRD Climate	Between Groups	10.081	4	2.520	3.777	.005
	Within Groups	380.324	570	.667		
	Total	390.405	574			
General HRD climate mean variable	Between Groups	16.628	4	4.157	5.161	.000
	Within Groups	459.082	570	.805		
	Total	475.710	574			
OCTAPAC culture mean variable	Between Groups	10.622	4	2.655	3.645	.006
	Within Groups	415.223	570	.728		
	Total	425.845	574			
HRD Mechanisms	Between Groups	6.623	4	1.656	2.270	.061
	Within Groups	415.839	570	.730		
	Total	422.462	574			

3.3. HRD Climate and Employee Engagement

Correlation analysis was performed to determine the relationship between engagement level and HRD Climate in the organizations. As shown in table 4, HRD climate correlates with employee engagement by $r = .418$, $p<.01$ at the 0.01 level of significance. Similarly, employee engagement correlates with the General climate dimension by ($r = .394$, $p<.01$), with the OCTAPAC culture ($r = .780$, $p<.01$) and with the HRD mechanism ($r = .842$, $p<.01$) at the 0.01 level of significance. These results reveal that all the study variables correlate positively and significantly with one another at the 0.01 significance level. These results reveal that all the study variables correlate positively and significantly with one another at the 0.01 significance level. Besides, the correlation between HRD climate and employee engagement is statistically significant at the 0.01 level of significance. Therefore, it makes it clear that higher scores on developmental climate of the organization are associated with higher employee engagement score.

Also from the Table 4 it can be seen that HRD Climate correlates positively with all the three dimensions of employee engagement. HRD Climate correlates most highly with the dedication dimension of engagement (r=.431, p<.01), followed by Vigor (r=.382, p<.01).

Table 4.Correlation Results between Employee engagement and HRD Climate, its Components (General Climate, OCTAPAC Culture and HRD Mechanisms).

	GHRD climate	OCTAPAC culture	HRD Mechanisms	Vigor	ABSOR	DED	HRDC	EE
General HRD climate	1	.780**	.842**	.369**	.337**	.412**	.940**	.394**
OCTAPAC culture	.780**	1	.840**	.356**	.358**	.403**	.916**	.399**
HRD Mechanisms	.842**	.840**	1	.339**	.321**	.384**	.953**	.370**
Vigor	.369**	.356**	.339**	1	.829**	.811**	.382**	.942**
Absorption	.337**	.358**	.321**	.829**	1	.789**	.366**	.926**
Dedication	.412**	.403**	.384**	.811**	.789**	1	.431**	.925**
HRDC	.940**	.916**	.953**	.382**	.366**	.431**	1	.418**
EE	.394**	.399**	.370**	.942**	.926**	.925**	.418**	1

***. Correlation is significant at the 0.01 level (2-tailed).*

N= 576.

From Table 4 it can also be noticed that out of the three dimensions of HRD Climate, OCTAPAC Culture dimension correlated most highly with employee engagement (r=.399, p<.01), indicating that OCTAPAC Culture have the relatively highest potential influence on employee engagement. HRD mechanisms stood second(r=.394, p<.01) in influencing employee engagement. Hence, organizations need to focus on developing the HRD mechanisms to develop human resources in the organisations. On the other hand, the results highlight that the overall HRD Climate and the different components of HRD Climate are positively and significantly correlated with each other.

In sum, HRD climate and its elements have significant contribution to overall employee engagement of employees. The high score of HRD climate fairly associates with the moderately high employee engagement score. This finding supports the study results of Benjamin (2012); Richa Chaudhary, *et al.,* (2012*)*;Nawab Ali Khan and Sheema Tarab (2012); Birajit Mohanty, Susmitaparija and Ghasyamsahu (2012), Solkhe and Chaudhary (2010). They reported the existence of positive relationship between organizational climate or HRD climate and job satisfaction, and HRD Climate correlates positively with job satisfaction, organizational effectiveness and productivit**y.**

3.4. Impact of HRD Climate on Employee Engagement

Regression analysis was performed to explain the impact of HRD Climate on Employee engagement i.e. the amount of association. The regression analysis (Table 5) above reveals that the calculated F-value (F=121.766, P < .05) suggests the variations in the mean scores are statistically significant at the 0.05 significance levels. Thus, the null hypothesis is rejected and the alternative hypothesis is accepted. This means, the HRD climate variables do have a significant and positive impact on the employee engagement in the selected universities. The model summary also indicates 17.5% of the total variation of employee engagement is explained by the HRD climate within the higher Learning Institutions.

In this analysis, the individual impact of HRD climate dimensions on employee engagement is not interpreted because of the existence of multi-co linearity and high inter-item correlation, which may affect the results. However, it can be concluded that employee engagement is influenced by the HRD climate elements, i.e., the General climate, HRD mechanism and OCTAPAC culture of the organization in general.

Table 5. Results of Regression Model of HRDC on Employee engagement.

Coefficients	Independent Variables	Un-standardized Coefficients		Standard coefficients	T	Sig.
		B	Standard Error	Beta		
	(Constant)	2.850	0.151		8.874	.000
	HRD Climate	0.590	0.053	0.418	11.035	.000
Model Summary	R	R2	Adjusted R2	Standard Error of the Estimate	Durbin-Watson	
	0.418	0.175	0.174	1.05848	1.584	0.000
ANOVA	Model	Sum of squares	Df	Mean Square	F	Sig.
	Regression	136.424		136.424	121.766	0.000
	Residual	643.097	574	1.120		
	Total	779.521	575			

Dependent variables: Employee Engagement; Predictors (Constant), HRD Climate.

Table 6. Hypotheses Verification

Null Hypothesis	Statement	P-Value		Result
HO1	Employees do not significantly differ in their perception about the HRD climate within the Universities	3.777	P<0.05	Rejected
HO2	Employees do not significantly differ in their perception about the General climate within the Universities	5.161	P<0.05	Rejected
HO3	Employees do not significantly differ in their perception about the HRD Mechanisms within the selected public Universities	2.270	P<0.05	Rejected
HO4	Employees do not significantly differ in their perception about the OCTAPACE culture within the selected Public Universities	3.645	p>0.05	Accepted
HO5	There exists no significant relationship between HRDC and Employee Engagement in selected public Universities		P<0.05	Rejected
HO6	There is no significant impact of HRDC on Employee Engagement	121.766	P<0.05	Rejected

4. Discussion

Profile of the respondents: The sample respondents from the targeted five Universities are Addis Ababa University (26.74%), Jimma University (17.71%) Hawasa University (18.23%), Arbaminch University (17.53%) and Dilla University (19.62%).Most of the respondents in the study were males. Out of total of 576 respondents 89 were females and 487males (84.55%). The age of all the respondents' lies in the range of 23 to 60 years. In fact, more than 50% of the respondents were in the age group of 25-34 years. The educational qualifications of the respondents ranged from Graduates, diploma, Postgraduates and other higher qualifications. In fact, more than 50% of the respondents were Graduates& Postgraduates (87.96%). The experience in the universities ranged from one year to more than 10 years. In fact, the majority of the respondents (35.478%) have served between 2.5 and 5.5 years on the average whereas only 12.174% of the respondents have served for more than 10 years. The status of the employment of the respondents shows that the majority of the respondents were academicians (58.68%) whereas only 22.24% are working in the administration. Surprisingly, about 19.09% of the respondents work both in the academics and

administration. The academic rank of the respondents ranges from Technical Assistant to Professors .In fact, more than 50 % of the respondents were in the rank of Lectures (50.35%).

The overall HRD climate: There is significant difference by employees about the perception of HRD climate within the Universities. 'Employees differ in their perception about HRD climate within the Universities.

The HRD climate elements: There is significant difference by employees about the perception of HRD climate elements, such as the General climate, the HRD mechanisms and the OCTAPACE culture with respect to the Universities. In other words, the General climate, the HRD mechanisms and the OCTAPACE culture differ within the Universities.

Association between HRD climate and Employee engagement: There is significant relationship between HRD climate and Employee engagement in the selected public Universities. The HRD climate variables correlate strongly, positively and significantly with one another. HRD climate and its elements have significant contribution to overall job satisfaction of employees. This finding is supports the study results of Forh and and Gilmer, (1988); Litwin and Stringer, (1968); Richa Chaudhary, *et al.,* (2012*)*; Nawab Ali Khan and Sheema Tarab (2012); Birajit Mohanty, Susmitaparija and Ghasyamsahu (2012), Solkhe and Chaudhary (2010).

In addition, the findings of the study are in resemblance with many research findings where various job resources i.e. physical, psychological, social and organizational aspects of the job like supervisory support, autonomy, feedback and social climate etc. were reported to relate positively with employee engagement (Bakker & Demerouti, 2007; Hakanen, Bakker & Schaufeli, 2006; Xanthopoulou *et al*., 2007; Bakker *et al*., 2003; Demerouti *et al.,* 2001, Friedman, 1991; Kremer-Hayon & Kurtz, 1985). Also Saks (2006) reported perceived organizational and supervisory support to be significant antecedents of employee engagement. Schaufeli and Salanova (2007) suggested that one of the keys for keeping employees engaged is to develop them continually throughout their career which clearly highlights the importance of a developmental climate for building an engaged workforce. Gruman & Saks (2010) highlighted the importance of fairness and justice in implementation of performance appraisal process in enhancing the engagement level of employees. This study also reported successful and fair implementation of HRD mechanism to be a significant predictor of employee engagement.

Impact of HRD climate on Employee engagement: The HRD climate variables do have a significant and positive impact on the Employee engagement in the selected public universities.

5. Conclusion

The higher education is undergoing rapid changes in Ethiopia. It is being realized that Universities play a crucial role in nation building. The motive of the universities is to serve the nation and help those who need any kind of help in the form of training, counseling, advice, knowledge imparting, etc., at any place and time. Thus, the job of the universities and their employees is becoming challenging and dynamic for achieving the objectives. This calls for reviewing the policies and procedures related to the HRD in universities and creating conducive working environment so that the university employees can work effectively and contribute significantly in the nation building.

The basic objective of this empirical research was to examine the impact of HRD Climate and its various dimensions on engagement level of employees in selected public universities in Ethiopia. It is identified that HRD Climate and its dimensions are at a very poor level in the selected public universities. The correlation analysis of the study variables revealed that HRD Climate and all its dimensions were positively and significantly correlated with employee engagement. The regression analysis reveals that the calculated F-value ($F=121.766$, $P < .05$) suggested that there is a significant, strong and positive correlation exists between HRD climate and Employee engagement.

Thus, the universities and the Ministry of education need to work in close coordination to ensure development of superior HRD climate in the Ethiopian universities. While it is the responsibility of the universities and the Ministry of education to create infrastructure and promote development of superior HRD climate in the universities, university employees need to put themselves in the continuous learning process and cooperate with the administration to put superior HRD climate and engagement in work place.

6. Suggestions and Policy Implications

The study suggests that public universities in particular and other institutions in the country should foster employee engagement by embedding a positive HRD culture of Openness, confrontation,

Trust, Autonomy, Pro-action, Authenticity, and collaboration(OCTAPAC) into their organizational culture. In order to improve the HRD climate in Ethiopian universities, the following suggestions based on the findings of this study are recommended:

1. The top management's commitment should be increased towards HRD and HRD climate in all endeavors because the mean score of the items dealing the General climate register is 2.7309(43.27%) which is below average, and indicating very poor level of the General climate within the Universities..
2. The management should explore the existing HRD mechanisms to improve the implementation because as seen the mean score is far below average, i.e., 2.5742 (39.35%) for the items of HRD mechanisms.
3. The management should create and nurture HRD culture (OCTAPACE) within the universities because the study reveals that OCTAPACE culture is 2.8160(45.40%) which is also below average indicating a very poor level within the Universities.
4. The top management needs to develop a helping attitude for employees and try to address their problems quickly and hold regular formal/informal interactive sessions with the employees of the university and encourage them to discuss the problems/issues related to the university.
5. The officers/Department Heads should hold interactive sessions with their subordinates quite often so that it enhances communication between different groups of employees and must have a balanced approach in dealing with their juniors, so that a superior friendly environment is developed at the departmental level.
6. Job rotation among the non-teaching employees in the university system needs to be implemented effectively through a well-designed policy mechanism and special need-based training programs should be conducted for non-teaching staff/employees in order to make them abreast of the latest technology development.
7. The universities should focus on developing effective personnel policies, keeping in view the profile of the employee. The performance appraisal standards needs to be well defined and implemented effectively, and the feedbacks need to be given to the teachers and the non-teaching employees regarding their performance on 360-degree based employee appraisal system with the objective to make appraisals free from biases, likes and dislikes, and human errors.
8. The officers/ Department Heads need to show more concern towards employees and their development. In fact, sufficient funds must be earmarked for training and development of the employees, and they must be encouraged to participate in training programs/workshops organized by different institutions.
9. The universities need to create separate HRD department for catering the employee development throughout. These departments need to focus on facilitating congenial HRD climate in the universities for the overall development of staff as well as universities.
10. The universities must focus on developing a culture of openness and trust where employees feel free to discuss their ideas, activities and feelings among themselves. They should be trusted and allowed to enjoy freedom to work independently within the overall university statues.

The president, vice presidents and other important officers of the universities must visit each department/college frequently and discuss the issues/problems of the department/college. This will enable the faculty members to discuss problems and developmental issues of their departments. While the faculty members will feel encouraged and motivated, the administration will get the feedback and can focus on the strategic issues effectively.

Moreover, the administration should constantly obtain feedback about the satisfaction of their employees regarding opportunities for learning, job-related motivational factors, chances to accept responsibilities, promotional opportunities and employees' helping attitude/supportive climate. Here, it is imperative to mention that effective change in attitude of teachers towards work is possible by providing information about their job properties, making pragmatic organizational policies and practices. Also, there is a need to create an environment where employees are encouraged to do experiments and good work is appreciated and rewarded. The universities should promote entrepreneurialism by giving their employees a learning opportunity through tolerating mistakes.

7. Research Limitations and Future Directions

The present study has certain limitations that offer opportunities for future research. The data is based on individual opinion, which may bring in some bias. In this study, the survey has been conducted among 576 employees of five public universities in Ethiopia and the findings may not be the same all over Ethiopia, since the perception of employees are likely to vary depending upon the environment. To establish the generalization of the results, within the context of Ethiopian higher education, it needs to be surveyed among other employees and other universities in higher education sector. Since this study was carried out in reference to higher education institutions, the findings of the study are not applicable to make conclusions in other types of organizations or sectors.

The present study included only cross-sectional information on the relationships between human resource development climate and engagement. Longitudinal and experimental studies should be undertaken in this direction to establish the cause and effect relationship between the studies variables. The present study analyzed the impact of HRD Climate on employee engagement though there are many other variables which may influence the engagement level of employees. Using more variables can also reveal certain interaction effects and the capacity of one variable to moderate the effect of others. Also the study did not control for the effects of demographic variables which can have their role in influencing engagement among workers. Future studies should focus on the role of demographic variables as well. The study considered the impact of only organizational level variables on employee engagement although in the literature personal factors are also found to be significant predictors of various job attitudes and behaviours. Thus a research can be made to study the impact of both the personal, job related variables and the various demographic variables on employee engagement. Thus the scope is wide open for future studies to explore several of the issues which remain unaddressed here.

8. References

Bakker, A. B. & Demerouti, E. 2007. The Job Demands-Resources model: *state of the art. Journal of Managerial Psychology*, 22: 309 - 328.

Bakker, A.B., Demerouti, E., Schaufeli, W. B. 2003. Dual processes at work in a call center: an application of the job demands-resources model. *European Journal of Work and Organizational Psychology* 12:393 - 417.

Benjamin 2012. "Human Resource Development Climate and Employee Commitment in Recapitalized Nigerian Banks" *International Journal of Business and Management* Vol. 7, No. 5; March 2012.

Benjamin Akinyemi. 2012. "Human Resource Development Climate as a Predictor of Citizenship Behaviour and Voluntary Turnover Intentions in the Banking Sector". International Business Research Vol. 5, No. 1; pp-110-119.

BirajitMohanty, Susmitaparija and Ghasyamsahu.2012. "An empirical study on HRD climate and its impact on Job performance in private insurance companies in odisha" *International Journal of Multidisciplinary research*, Vol.2 Issue 5,ISSN 2231 5780;pp 15-27.

Catteeuw F, Flynn E, Vonderhorst J. 2007.′Employee engagement: boosting productivity in turbulent times′, *Organization Development Journal*, 25 (2): 151 - 157.

Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. 2001. The job demands-resources model of burnout. *Journalof Applied Psychology,* 86: 499 - 512.

Friedman, I. A. 1991. High- and low-burnout schools: School culture aspects of teacher burnout. *Journal of Educational Research*, 84: 325 - 333.

Gruman, J. A., & Saks, A. M..2011. Performance management and employee engagement, Human Resource Management Review. 21: 123-136.

Gupta Deepakshi; Malhotra Neena.2012. "Human resource development climate in information technology organizations" *GianJyotie Journal, Volume* 2, Issue 3;pp-35-52.

Hakanen, J. J., Bakker, A. B., & Schaufeli, W. B. 2006.Burnout and work engagement among teachers.*Journal of school psychology*, 43, 495-513.

Karunesh Saxena and Pankaj Tiwari.2009. HRD Climate in Selected Public Sector Banks: An Empirical Study. 9th Global Conference on Business & Economics ISBN: 978-0-9742114-2-7, October 16-17, 2009, Cambridge University, UK

KhurramShahzad, Sajid Bashir and Muhammad I Ramay.2008. 'Impact of HR Practices on Perceived Performance of University Teachers in Pakistan', International Review of Business Research Papers, Vol. 4 No.2 March 2008 Pp.302-315.

Kremer-Hayon, L., & Kurtz, H. 1985.The relation of personal and environmental variables to teacher burnout. Teaching and Teacher Education, 1, 243 - 249.

Mishra, M. etai.1999. "Job Satisfaction as a Correlate of HRD Climate (An Empirical Study)," *Indian Journal of Training and Development*, Vol. XXIX No.2, p. 5.

Mufeed, S. A..2001. HRD in universities: A fresh look. Business Review, 7 (1 & 2), 67 - 80.

Mufeed, S.A., and Gurkoo, F. A. 2006.Enhancing Educational Institutions Effectiveness through HRD climate: An Empirical Study, Management and Change, Vol. 10, No.2, pp 25-64.

Nawab Ali Khan and Sheema Tarab.2012. "An Empirical Presentation of HRD Climate and Employee Development in Telecommunication Industry -A Case Study of Indian Private Sector" *International Journal of Trade and Commerce-IIARTC* January-June 2012, Volume 1, No. 1, pp. 1-10 ISSN-2277-5811.

R. Riyaz, "HRD Climate in Commercial banks: An Empirical study", The Business Review, Vol. 9, No.1, 2002.

Rao, T.V. 1999. HRD audit. New Delhi: Response Books (A Division of SAGE Publications).

Rao, T. V. and E. Abraham.1986. "Human Resource Development Climate in Indian Organisation," in Rao, T.V. and Pereira, D.F. (Ed.), Recent Experiences in Human Resource Development, Oxford & IBH, New Delhi, pp. 70-98.

Richa Chaudhary, Santosh Rangnekarand Mukesh Kumar Barua. 2013 "Relation between human resource development climate and employee engagement: Results from India" *Europe's Journal of Psychology*, 7 (4), pp. 664-685. Available at www.ejop.org accessed on 1-3-2013.

Robert J. Vance, Employee Engagement and Commitment A guide to understanding, measuring and increasing engagement in your organization. 2006.p3. SHRM Foundation.

Saks, A. M. 2006. Antecedents and consequences of employee engagement. *Journal of Managerial Psychology*, 21, 600 - 619.

Saraswathi S. 2010."Human Resources Development Climate: An empirical Study" International *Journal of Innovation, Management and Technology*, Vol. 1, No. 2, pp-174-179.

Saxena, K. and P. Tiwari, 2009."HRD Climate in Selected Public Sector Banks: An Empirical Study", 9th Global Conference on Business and Economics. October 16 – 17, 2009. Cambridge University, UK.

Schaufeli, W., & Salanova, M. 2007. Work engagement: An emerging psychological concept and its implications for organizations. In S. W. Gilliland, D. D. Steiner, & D. P. Skarlicki (Eds.), Managing social and ethical issues in organizations (pp. 135 - 177). *Greenwich, CT: Information Age Publishing.*

Schaufeli, W.B., Salanova, M., Gonzalez-Roma, V. and Bakker, A.B., 2002. The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness Studies*, 3, pp. 71-92.

Shakeel, A. 1999. HRD in universities. *New Delhi*: *ABH Publishing House.*

Solkhe, A. and Chaudhary, N. 2010. HRD Climate and Organizational Performance with focus on Job Satisfaction as a Correlate: Exploratory Analysis. *Technia Journal of Management Studies*, Vol. 5, No.1, April-September, pp.47-63.

Smith, R. L. 1988. Human Resource Development: An overview. ERIC/CAPS, Ann Arbor, Michigan.

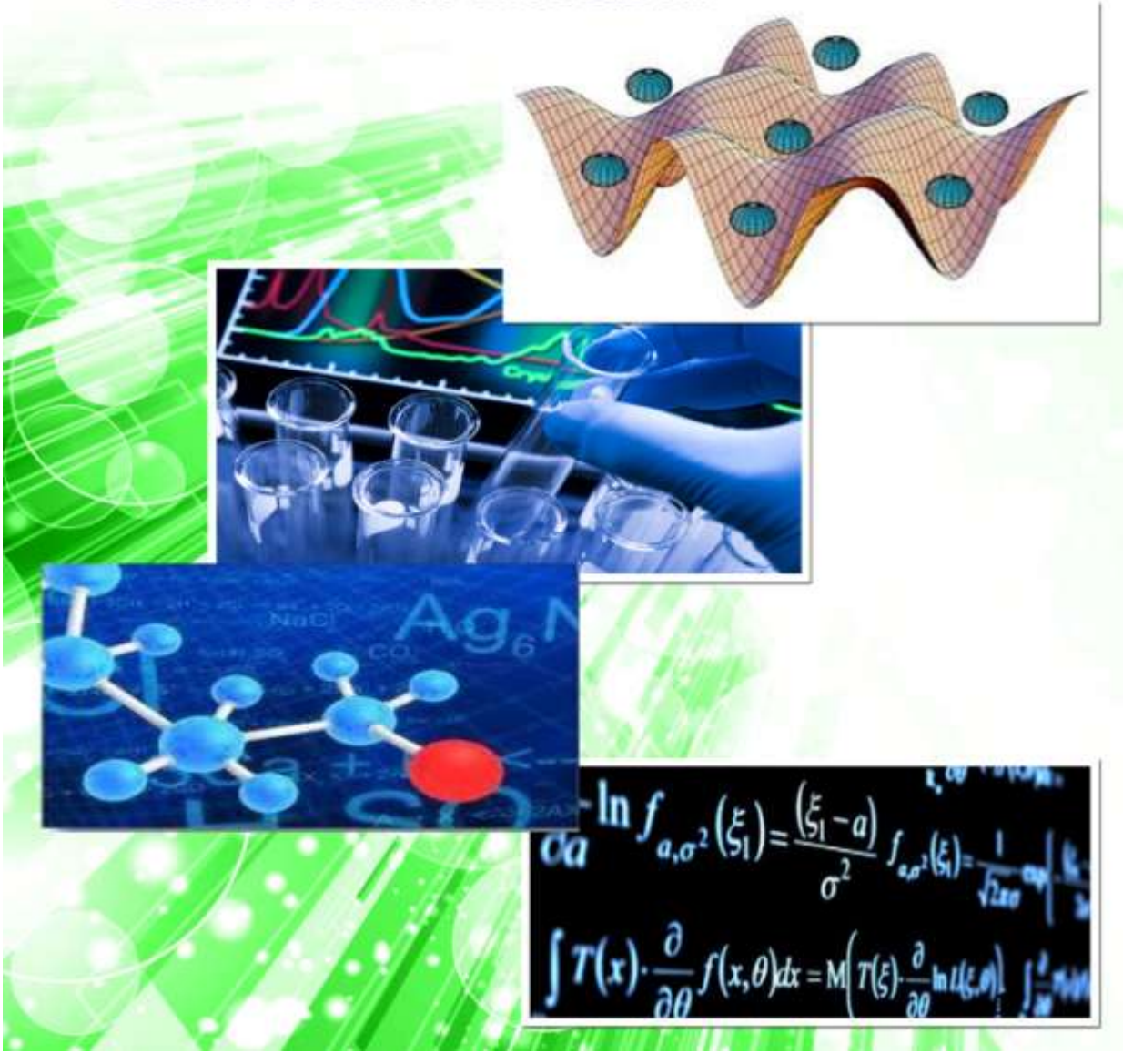
Subramani, A.K. and Akbar Jan, N. 2011. Organizational Climate Changes in IT Industry. *International Journal of Commerce,* Vol.III, Issue.28, pp.40-41.

Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. 2007.The role of personal resources in the job demands-resources model. *International Journal of Stress Management*, 14, 121–141.

Theme VI

32nd Annual Research Bulletin

Basic Science Research



Theme 6

1. The Potential of *Aloes* to Contribute in the Ethiopian Economy: Opportunity to Support The Emerging Food Processing, Cosmetics and Pharmaceutical Industries

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Abstract: Ethiopian plants have shown remarkably effective medicinal, cosmetic and nutritional values for many centuries. This study evaluates the potential of Aloes to support the emerging food processing, cosmetics, and pharmaceutical industries. Thirty systematically selected informants including ten key informants have participated in this study. Semi-structured interviews, group discussions, and guided field walk were part of data collection methods. Samples of Aloes for leaf extract and exudates were collected for nutrient and biochemical analysis as well as verification of the Aloe species identity. The folk taxonomy put Aloe species of the study area into three groups, viz. hargessaguracha (dark green Aloes), hargessaadii (light green Aloes) and Hargessaburee (spotted Aloes). However, scientific taxonomic method split them into eight species. Of the eight species, *Aloepirottae* is the most popular and highly valued medicinal plant in Babile Wereda. It is a species endemic to Ethiopia and valued as a remedy for malaria, tropical ulcer, gastro-intestinal parasites, gallstone, eye diseases and snake bite. The jel extracted from it is known to serve as colon cleaner. Biochemical analysis showed that a good yield of Barbaloin was found in *A. Mcloughlini* that makes it promising for commercial purpose in pharmaceutical industries. In addition, aloin/aloinoside, which is used as a stimulant and laxative was found in *A. mcloughlinii*, *A. Harlan*, and *A.Pirotae*. The jel of *Aloe pubescence* is used as a popular anti-acid in the community and reach in carbohydrate (58%) that makes it promising for the industrial production of carbohydrates in the food processing industries. This underscores the importance of genus Aloes for the people living in the area and the potential of the resource for development. Consequently, the study area deserves urgent conservation priority coupled with mechanisms for the protection of the associated indigenous medical lore.

Keywords: Aloe sap; Aloe jel; endemic Aloes; ethno-medicine; folk taxonomy

1. Introduction

The genus *Aloe* L. was described by Linnaeus in 1753 and belongs to the family Aloaceae. There are 7 genera of this family in Africa but in East Africa only one genus, i.e., the genus Aloe exists. There are over 450 species of *Aloes*, in which 200 are concentrated in the eastern and southern Africa (Reynolds, 1996; Newton, 2003). The plants are easily recognized by their rosettes of large, thick, succulent leaves, which are sometimes spotted. They are perennial plants with and without a woody trunk. The leaf margin is almost always armed with sharp teeth. The inflorescence is usually branched (occasionally simple), the lower branches sometimes branching again. Each flower is supported by a bract, the shape and size of which are important for the identification of the species. Flower colouration is most often red, orange or yellow, rarely white.

The Genus *Aloe* collectively known as ERET in Amharic and HARGESSA in Afan Oromo has many extracts used by food processing, cosmetics, and pharmaceutical industries in many countries including Africa. *Aloes* have high international market demand for their products of aloe extracts like, aloe jel, aloe latex (aloe juice), aloe gum and aloe sap, which are used in food processing,

cosmetics and pharmaceutical industries in Africa, Europe, middle east and Asian countries (Wabuyele, 2006). That is why, aloe jel and aloe sap harvesting for export supports thousands of poor inhabitants in Eastern Africa (Wabuyele and Kyalo, 2008). For example, Uganda, Karamoja district has the potential of exporting about 10,000 tons of crude aloe gum and Kenya about 2,200 tons. Going by the current price of USD 5/kg, Uganda can easily earn about USD 50,000,000 and Kenya USD 11,000,000 from sales of aloe crude gum (Mukonyi *et al*., 2007). This shows how sustainable utilization of *Aloe* resources is capable of contributing to the improvement of livelihood and economic development.

Some *Aloe* are used as health drinks and tonics. *Aloe vera* juice in South Africa is used for a long time in *folk* medicine for the treatment of constipation, burns and dermatitis (WHO, 1999, 2001). In addition, the leaves of *Aloes* are applied on wounds to assist healing, sap is drunk as an appetizer and anti-emetic, diluted leaf sap is drunk as a cure for malaria, typhoid fever, diarrhoea, oedema, swollen diaphragm, nosebleed, headache, pneumonia, chest pain and used as a disinfectant. The exudate/sap is applied to the eyes to cure conjunctivitis. In Ethiopia, the bitter exudate is applied to nipples to wean children. The basal parts of the leaves are used in the fermentation of local beer by several tribes in East Africa (Wabuyele and Kyalo, 2008). The leaves are pounded and added to drinking water for preventing or treating coccidiosis and Newcastle disease in poultry.

In Ethiopia and Eritrea, 40 species of *Aloe* were known during the first edition of Volume 6 of Flora of Ethiopia and Eritrea in 1997 and six more species (*A.benishangulana*, *A. clarkei*, *A. elkerriana*, *A. ghibensis*, *A. welmelensis* and *A. weloensis*) have been described in the last seven years making a total of 46 species so far (Sebsebe and Nordal, 2010). Out of these, about 25 *Aloe* species are endemic to Ethiopia (e.g., *A. camperi*, *A. debrana*, *Aloe elegant*, *A. harlana*, *A. pulcherrima*, *A. pirottae*,*A.mcloughlinii*, *A. gilbertii*, *A. otallensis*, *A. friisii*, *A.kefaensis*, *A. ghibensis*, *A. trichosantha*, etc.) (Edwards *et al*., 1997). There are obviously several interesting aspects of the Ethiopian *Aloe* species that need further studies, and the endemic Ethiopian aloes represent an economic potential (Sebsebe and Nordal, 2010).

However, there is little baseline information for their promotion of commercial production in Ethiopia while the country has a huge potential of commercial *Aloe* in east Africa. Some research works done in Ethiopia indicate that there is a huge potential of *Aloe* spp. in the wild and the local communities make use of them for traditional medicines to treat major health problems such as malaria, tropical ulcer, etc. (Anteneh *et al*., 2012). In addition, they make use of some *Aloe* spp. for soil conservation/compaction, food and cosmetics/beauty therapy. However, none of them are domesticated and utilized on the large scale for commercial purpose. For example, *Aloeharlana*is an endemic species found in the Dengego valley, around Harla (the small village found between Dengego and Dire Dawa, Eastern Ethiopia) (Edwards *et al*., 1997), which is used by the local community as a traditional medicine (Anteneh and Negussie, 2014).

The fact that the highlands and lowlands of eastern Ethiopia (Oromia and Somali regions) are well known for huge potential of various species of *Aloe* (Sebsebe *et al.,* 2000) this study was aimed to investigate the potential of the genus *Aloes* (ERET) to contribute to the Ethiopian economy using the current opportunity of an emerging food processing, cosmetics, and pharmaceutical industries. The study focused on the wider habitats of the mountain chains of east and west Hararghe zones, Daketa to Gobelle Valley complexes, and the Dengego-Kersa drainage basin towards Dire Dawa. The tendency of *Aloe* spp. to grow on less fertile, rocky and non-agricultural area may help in the rehabilitation of the degraded areas of the east Harargie highlands and lowlands, and Dire DawaDawa areas through large scale cultivation for commercialization. Therefore, the study on a comprehensive indigenous knowledge and taxonomy of aloes, Aloe jel, and sap quality, and chemical composition is paramount importance for commercialization of *Aloes* from eastern Ethiopia. Therefore, this study was conducted to identify and document the various *Aloe* spp. together with the indigenous knowledge of the local people on their traditional use, and analyze and compare the chemical composition and qualities of *Aloe* spp. collected from different parts of eastern Ethiopia and compare with the international standard of traded Aloes

2. Methodology

2.1. Study Area Description

The study was conducted in eastern Ethiopia (Oromia and Somali regions). It includes areas of WOINADEGA and KOLA agro-ecologies dominated by the genus Aloes. The landscape ranges from mountains and gorges to open plains, which are not naturally used for agricultural purpose due to its

rocky surface feature, but suitable habitat for *Aloe* species. The study focused in the wider habitats of the mountain chains and gorges of east Hararghe zone, Dire Dawa council and some parts of Shinille areas, i.e., Daketa to Gobelle Valleys, and Dengego-Kersa drainage basin towards Dire Dawa, stretching to Shinille.

2.2. Reconnaissance Survey

Prior to actual data gathering, a reconnaissance survey was conducted to identify all stakeholders, determine the major center of the study, sampling areas/sites, informant sampling, etc.

2.3. Ethno-botanical Data Collection

Ethno-botanical data were collected in two different seasons, from September to November 2013, and June to August 2013/14. Participatory Rural Appraisal (PRA) techniques (Martin, 1995; Cotton, 1996) were employed to collect data. Ethno-botanical information was collected from 30 informants (10 of them were key informants of traditional healers). Purposive sampling technique was used for selection of key informants, whereas stratified random sampling was employed for the others. The informants were grouped into three age groups; young (20-40), adult (41-60) and elderly (above 60) to see how the knowledge varies with age.

Before carrying out the interviews and group discussions, an oral Prior Informed Consent (PIC) was sought from every respondent. Semi-structured interviews and group discussions were administered in the local languages (Oromo and Somali) to collect basic information on the Indigenous Knowledge (IK) and use of *Aloe* species including their local names and traditional classification, diseases treated or controlled, part used, conditions and method of preparation, part administered, dosage used and major drawbacks. In addition, practical observation sessions and guided field walks with key informants were employed to collect voucher specimens of each *Aloe* species. Most of the interviews were made in the field in order to avoid the risk of a confusing identity of *Aloe* species by repeated inquiries, at least three times with the same and different informants so as to confirm the validity and reliability of the recorded information.

2.4. Specimen Collection

Complete set of each specimen was collected following botanical/taxonomic methods for identification. For quantification total and sample, count was used at every selected site. In all cases, modified cluster sampling technique was adopted. The cluster was chosen because *Aloes* are known to grow in clamps. The sample plots were established randomly within a cluster site and *Aloes* were counted in each circular plot of 6.5 m radius following Mukonyi, (2003).

In some selected site in the field, leaves of *Aloe* species were harvested for jel/sap and collected in a plastic basin. After 30 minutes, the volume of sap released was measured using a calibrated measuring cylinder. Other characteristics of the sap such as color, viscosity and scent were analyzed. In addition, vegetative propagation experiments were done. Nursery life span, management, and early performance were studied in a small plot at HU.

Preliminary identification was done in the field. Voucher specimens of all species of aloes were collected, numbered, pressed, and dried for further identification. Further identification was done following the published volumes of Flora of Ethiopia and Eritrea (Edwards *et al*., 1997; Sebsebe and Nordal, 2010), and by comparing with authentic specimens at the National Herbarium (ETH) Addis Ababa University and Haramaya University. On each plot and specimen collection sites, data on altitudinal range, grid references, and habitat notes were collected with Garmin 48 GPS.

2.5. Phytochemical Analysis in *Aloe*Extracts

Phenolic compounds, saponin, alkaloids and flavonoids were determined based on methods of analyzes described by AOAC (1990) from both dried leaf samples and sap/exudates extracted and freeze-dried using ALPHA 1-2 LD plus freeze dryer.

2.6. Nutrient Analysis

The leaves of selected aloes were air dried under the shade for one week and pulverized into fine powder using a grinder and stored in a clean polythene in a refrigerator until analysis. Proximate analysis was performed in animal nutrition laboratory of Haramaya University. Moisture, ash, crude protein, fat, crude fiber and carbohydrate were the parameters analyzed following the methods described by AOAC (1990) and Indrayan *et al*. (2005).

2.7. Data analyses

The data were organized in the Excel Database System and analyzed using both qualitative and quantitative methods. The quantitative data were computed using SPSS software package and graphs and tables were generated using excel data sheet.

3. Results and Discussion

An Ethno-botanical study conducted with the local community indicated that *Aloe* species are traditionally categorized into three groups (folk taxonomy), i.e., HARGESSA GURACHA (dark green aloes), HARGESS AADII (light green aloes) and HARGESSA BUREE (spotted aloes) (Figure 1).

Figure 1. The three broad categories of aloes as HARGESSA GURACHA, HARGESSA ADII and HARGESSA BUREE from left to right.

However, such broader classification makes confusion among the users since there are different species under each of them with different traditional uses, nutrient, and phytochemical compositions. For example, the folk taxonomy of the locality considers all spotted aloes as the same species of HARGESSA BUREE while there are five different spotted aloes identified in the study areas (Figure 2).Similarly, the light green aloes locally known as HARGESSA ADII also have about four species with different uses and habitat distribution ranging from lowland to highlands. These species are *Aloe megalacantha*sub sp. *alticola, A. retrospiciens, A. megalacantha*sub sp.*megalacantha*and *A. pubescence*. There was only one deep green aloe (HARGESSAGURACHA) identified in this study known as *A. harlana.* Among these aloes, four of them (*A. harlana, A. pirpottea, A. mcloughlinii,* and *A.retrospiciens*) are endemic to Ethiopia (Edwards *et al*., 1997; Sebsebe and Nordal, 2010).

Aloe macrocarpa

Aloe rugosifolia

Aloe pirottea

Aloe sp.

Aloe mcloughlinii

Figure 2. The different species of spotted aloes identified in the study areas.

This study revealed that the local communities in all study areas make use of aloe species for traditional medicines to control and treat various kinds of human ailments (Table 1). The dried and powdered sap of *Aloeharlana* and *A. megalacantha*, were found sold in the open local marketplaces.

Table 1. List of *Aloe* species and their traditional medicinal values.

Aloe species	Disease treated	Part used	Preparation and PA
Aloe harlana	Snake bite, colon cleaner, snake bite, liver swelling and spleen swelling/Splenomegaly	Leaf	Crushed and filtrate taken orally in all cases
	Colon cleaner	Sap	Crystallized, powdered and juice taken orally
	Skin fungus, hair fungus & skin inflammation	Jel, leaf	Concocted together and used as ointment and wash the hair
Aloe mcloughlinii	Eye infections	Sap, jel	Extract the sap and drop in the eye
Aloe megalacantha	Colon cleaner/SIIBRI	Sap	Crystallized & Juice made/SIIBRI, taken orally
Aloe retrospiciens	Colon cleaner/SIIBRI	Sap	Crystallized and juice made/SIIBRI taken orally
A. pirottea	Malaria, tropical ulcer, gastro-intestinal parasites, gallstone, eye diseases, and snake bite.	Leaf, sap	Crushed and filtrate taken orally in all cases, drop the sap in infected eye

A. pirottea was reported to be used for the highest number of ailments and followed with *Aloe harlana* treating swollen body part locally called GOFLA, colon cleaner, snake bite, liver swelling, spleen swelling/splenomegaly, fungal infections and inflammation of the skin.

Aloeharlana was reported to be used for the highest number of ailments that treat swollen body part locally called GOFLA, anti-poison for snake bite, liver swelling, spleen swelling, colon cleaner, skin and hair fungus and skin inflammation. Another study (Gelila *et al*., 2011) on *A. harlana* indicated that the Oromo people in Harla have been used it for the treatment of various infectious and inflammatory diseases. It has a considerable role in the primary healthcare system of the community. It is an endemic plant species known only in this study area and the specific epithet "*harlana*" refers to the prehistoric Harla, locality of type specimen. Until the time of this study, the community in Harla didn't know that the famous and endemic traditional medicinal plant known as *A. harlana* is only found in their vicinity and nowhere else. Its sap extraction was dried, crystallized and powdered for the preparation of a popular traditional colon cleaner locally known as SIIBRI (Oromo language), a product name on local marketplaces. Indeed, this result will encourage local communities to further conserve and safeguard such valuable medicinal plant species within their ongoing wide-scale conservation activities.

The result on the depth of comprehensive ethno-medicinal knowledge of aloe among different age groups indicated that elderly people (above 60 years) had much profound knowledge (binomial test, $p = 0.003$). Whereas, an ethno-medicinal knowledge test in the age group ranging from 20 to 40 showed the least value (binomial test, $p = 0.009$). There is a significant difference in the depth of ethno-medicinal knowledge of aloe between age category ranging from 20 to 40 and age category above 60 ($p > 0.05$). It was observed that many young people in the study area are less knowledgeable about the variety and value of indigenous medicinal plants. This might be attributed to the current expansion of education and health centers to kebele level which has resulted in the young generation focusing on modern medicines. Similar results were reported in some other cultural groups in Ethiopia (Yineger *et al*., 2008) that showed the deterioration of indigenous knowledge on medicinal plants throughout the generations.

The Biochemical compounds of commercial interest in aloes species are basically Aloin, Barbaloin, Aloinoside, Aloe-emodin, anthraquinone, Aloe chrysone, etc. The bitter leaf exudates or latex of most Aloes are known to have various medicinal uses and used in the preparation of different types of drugs including the laxative aloe drug.List of compounds in *A. megalacantha* leaf exudates are Aloinoside, Barbaloin (aloin), Aloe-emodin, Preanthraquinone and Aloe chrysone are among the major. The aloes in our study were compared with the well-known aloes of commerce. Thus, barbaloin, which represents the bitter and purgative principles of the drug aloe is present in good yield in *A. megalacantha*. In addition, aloinoside which is one of the principal constituents of commercial aloes of S. Africa is also found in *A. megalacantha*. It could be a promising aloe for commercial purpose in pharmaceutical industries. In addition, species producing aloin/aloinoside are *Aloe mcloughlinii*, *A. harlana, and A. pirotae*. These species have aloin/aloinoside to the level of global standards for commercial purpose. Aloin, also known as Barbaloin, is a bitter, yellow-brown colored compound noted in the exudate of many *Aloe* species making between 3% and 35% of the total exudate (Wabuyele and Kyalo, 2008). This compound was found 25-30% in *A. pirotae*and5-12% in *A. megalacantha*. It is used as a stimulant-laxative, treating constipation by inducing bowel movements

The jel of *Aloe pubescence*is used as a popular anti-acid in the community. In addition, its jel is reach in carbohydrate (58%). This indicated that this species could be promising for industrial production of carbohydrates in the food processing industries which is comparable with the traded aloes known as *A. barbadensis* (carbohydrate is 73%)(Adesuyi *et al*., 2012) as a source of carbohydrate.

Most of the endemic aloes have good sap yield and yellow sap crystal color (Table 2), which is similar to the traded yellow crystal of aloes known as aloe bitter.

Table 2. Sap yield and color variation per leaf between *Aloe* species.

Species	Mean sap yield in ml/leaf	Sap color/ crystal color
A. pirottae	47 ± 3.23	Brown sap and yellow crystal
A. harlana	45 ± 3.16	Yellow sap and yellow crystal
Aloe mcloughlinii	41 ± 3.06	Brown sap & yellow crystal
Aloe pubescence	62 ± 5.2	Light yellow sap
Aloe megalacantha sub sp. megalacantha	25 ± 2.3	Yellow sap/ light yellow crystal

The result on the population density showed that the three endemic species i.e. *Aloe pirottae, A. trichosantha* sub sp. *longiflora* and *A. harlana*are locally threatened. This might be related to overuse of these two species for medicinal purpose. Some popular works on the Ethiopian plants indicated that many endemic plant species are highly threatened (Sebsebe and Nordal, 2010).

Table 3.Population of the aloe species in the corresponding study areas.

Species	Locality of a species	Mean ± S.E. individuals ha^{-1}	Minimum individuals ha^{-1}	Maximum individuals ha^{-1}
A. pirottae	Erer valley of Babile	31 ± 9.93	4	117
Aloe rugosifolia	Dengego valley	5 ± 1.1	1	11
A. pubescence	Kulubi to Chelenko	65 ± 14.4	33	235
A. mcloughlinii	MelkaJebdu	85 ± 18.2	12	243
A. harlana	Harla area	12 ± 2.76	2	24
A. megalacantha	Dengego mountains	419 ± 83.3	64	1043
A. macrocarpa	Dengego mountains	15 ± 3.4	2	35
A. retrospiciens	Shinille	11 ± 3.1	4	23

As we can see from the table above, the populations of most aloe species are highly endangered in the natural habitat. Therefore, the ongoing conservation practices within the watersheds of all the study areas should consider the *Aloe* species as part of the biological work. Especially locally endemic aloe species, *A. harlana,* needs an urgent call for conservation before it is too late.

4. Conclusion

A. megalacantha is found with promising commercial compounds in its exudate, aloin, and barbaloin, but the percentage is less as compared to the two endemic species, of course, it is within the global range of 3% and 35%. In addition, two endemic species (*A. pirotae*and *A. harlana*) a promising volume and quality for aloe bitter trade, comparable with internationally traded aloe bitter. However, the population status in the wild is highly endangered may be due to local trade and illegal trading. Taking into consideration utility value, commercial demands and bio-cultural importance may be anticipated to sustain the need for and add to the efficacy of the conservation of Aloes.

5. Recommendation

- There is a need to communicate with the respective Weredas natural resource conservation units in order to foster the integration of an endangered *Aloe* species (e.g., *Aloe harlana, A. pirottae, A.retrospiciens)* within their ongoing water shade management and conservation activities.
- Community awareness raising must be emphasized to reduce potential illegal aloe trading that leads to the endangerment of the most important endemic aloes in the study areas.

- There is a need to work on the potential toxicity, if any, for high carbohydrate potential aloe, e.g., *A. pubescence* which could be promising for food processing industries.
- To establish domestication trial center for lowland aloes in Babile research center, especially for those endemic but endangered aloes.
- Endemic aloes like, *Aloe harlana* and *A. pirottae* were found promising with the quality and quantity of aloe bitter for commercial purpose, but the population in the wild are highly endangered. Therefore, there should be primary work on the mechanism of boosting the population in the wild and further domestication before planning for commercialization.
- There is a need to give further recognition for Harla village due to *A. harlana* which is only found in Harla village in the world. It can be used as a keystone species for the development of Harla village.

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7. References

Adesuyi, A.O., Awosanya, O. A., Adaramola F.B. and Omeonu A.I. 2012. Nutritional and Phyto-chemical Screening of Aloe barbadensis. *Current Research of Journal Biological Science* 4 (1): 4 - 9.

Anteneh Belayneh and SebsibeDemissew.2011. Diversity and Population Structure of Woody Species Browsed by Elephants in Babile Elephant Sanctuary, eastern Ethiopia: an implication for Conservation. Ee-JRIF Vol 3, No 1 2011 - Agriculture and Forestry issue: pp (20-32).

Anteneh Belayneh, Zemede Asfaw, Sebsebe Demissew and Negussie F. Bussa. 2012. Medicinal plants potential and use by pastoral and agro-pastoral communities in Erer Valley of BabileWereda, Eastern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 8:42.

Anteneh Belayneh and Negussie Bussa. 2014. Ethno-medicinal plants used to treat human ailments in the prehistoric place of Harla and Dengego valleys, eastern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 10:18.

AOAC. 1990. Official Methods of Analysis. 15th Ed, Association of Official Analytical Chemists, Washington, DC., Arlington, Virginia, USA., ISBN: 0-935584-42-0.

Cotton, C.M. 1996. Ethno-botany: Principles and Applications. John Wiley and Sons, New York, 412pp.

Edwards, S., Demissew, S. & Hedberg, I. 1997.Flora of Ethiopia and Eritrea, Vol. 6. The National Herbarium, Addis Ababa University, Addis Ababa & Department of Systematic Botany, Uppsala University, Uppsala.

Gelila A, Bisrat D, Mazumder A, Asres K. 2011. In vitro antimicrobial and antioxidant activities of anthrone and chromone from the latex of aloe harlana Reynolds. *Phytother Res*, 25: 1756 - 1760.

Indrayan, A. K., Sharma, S., Durgapal, D., Kumar N. and Kumar, M. 2005. Determination of nutritive value and analysis of mineral elements for some medicinally valued plants from Uttaranchal. *Curr. Sci.*, 89: 1252 - 1254.

Martin, G.J. (1995). Ethno-botany: A method Manual. Chapman and Hall, London. Pp. 265-270.

Mukonyi, K. W., Situma, C. A., Lusweti, A., Kyalo, S. and Erik, K. 2007. Commercial wild Aloe Resource Base in Kenya and Uganda Dry-lands as Alternative Livelihoods Source to Rural Communities. Discovery and Innovation, Vol. 19. Pp. 220 - 230.

Mukonyi, K. W. 2003. Tapping Wealth from Aloes. Aloes bio-prospecting through communities in Kenya Semi-arid lands. Progress report I, II, and III for the Research Program on Dry-lands (RPSUD), Under National Museum of Kenya.

Newton, E. 2003. A Checklist of Kenyan Succulent Plants, Succulanta East Africa-EANHS, Nairobi, Pp. 40.

Reynolds, G. W. 1996. The Aloes of tropical Africa and Madagascar. Aloes Book Fund, Mbabane. Pp. 537.

Sebsebe Demissew, Edwards S, Mesfin Tadesse (eds) 2000. New species of Aloes from the Ethiopian Drylands. Kew Bulletin, www.encyclopedia.com

Sebsebe Demissew and Nordal I. 2010.Aloes and other Lilies of Ethiopia and Eritrea. Shama Books, Addis Ababa, Ethiopia.

Wabuyele, E. N. 2006. Studies on Eastern Africa Aloes: Aspects of Taxonomy, Conservation and Ethno-botany. PhD Thesis, University of Oslo.

Wabuyele, E. and Kyalo, S. 2008. Sustainable Use of East African Aloes: The case of Commercial Aloes in Kenya. NDF workshop case study, Nairobi, Kenya.

WHO. 1999. Monographs on selected medicinal plants Vol. 1 - 3, World Health Organization, Geneva.

WHO. 2001. Monographs on selected medicinal plants Vol. 1 - 3, World Health Organization, Geneva.

Yineger H, Yewhalaw D, Teketay D. 2008. Ethno-medicinal plant knowledge and practice of the Oromo ethnic group in southwestern Ethiopia. *J EthnobiolEthnomed*, 4: 11.

2. Use of Human Urine as Fertilizer for *Solanumlycopersicun* and *Betavulgaris* Cultivation

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Abstract: Human urine contains high amount of Nitrogen (N) and is comparable to synthetic chemical fertilizer in terms of the nature of N content. This paper reports the fertilizer value of human urine for tomato and beetroot cultivations under greenhouse conditions. Both vegetables were grown in a pot filled with agricultural soils treated with synthetic chemical fertilizer (SCF) or Human urine (HU). Fertilizers were applied at a rate of 135kgN/ha of SCF, HU and their double dose for tomato, and at a rate of 133kgN/ha of SCF and HU and their double dose for red-beetroot cultivation. In both cases controls were neither fertilized by SCF nor HU. The microbial quality of the cultivated tomato fruits and beetroot samples was also assessed. Results show that the yield and other measured agronomic parameters of both vegetables fertilized with urine were found to be higher than that of unfertilized vegetables. However, the effect of urine fertilization was found to be similar with that of SCF in most of the variables measured. There was no significant difference between treatments in hygienic quality of the edible portions of both vegetables. This suggests that urine can be used to fertilize tomato and red-beetroot with no negative impact on human health.

Keywords: Beetroot; Fertilizer; Human Urine; Microorganisms; Nitrogen; Tomato

1. Introduction

Human urine is a waste released into the environment by every household. It is estimated that 1-1.5L of urine will be released by an adult person per day, though its chemical composition varies with feeding and drinking habits, physical activities, body size and other environmental factors (Kirchmann and Pettersson, 1995). Pure urine from a healthy person contains very few enteric microorganisms unless there is fecal contamination (Heinone-Tanski *et al*., 2007). Human urine contains high amount of nitrogen (N) and adequate amounts of phosphorous (P) and potassium (K) (Schouw *et al.,* 2002). Human urine and artificial chemical fertilizer (ACF) are comparable in terms of the nature of N content. In both cases, 90-100% of N is either in the form of urea or ammonium (Kirchmann and Pettersson, 1995). In human urine, about 75-90% of N is excreted as urea while the rest is in ammonium form. Urea in human urine will rapidly degrade into ammonium and water, and elevates the pH value up to 9. This rise in pH negatively affects the survival of most harmful bacterial populations making urine safer for use as fertilizer (Pradhan *et al*., 2007). The P and K contents of urine are almost (95-100%) in an inorganic form that are directly plant-available. For instance, the phosphate plant availability from urine has been demonstrated to be as good as that of artificial phosphate (Hargrove, 2008).

In developing countries, particularly sub-Saharan Africa, most agricultural lands are over-utilized and poor in plant nutrients. The poor soil nutrient content coupled with recurrent drought rendered these countries to be less productive. As a result, millions of people in these countries are exposed to food shortage and diseases due to malnutrition. To curb these problems, soils need to be fertilized highly, and in most cases, fertilization is dependent on synthetic chemical fertilizer (SCF). Nowadays, the demand for SCF has been increasing with increasing demand for food to support high population size of developing countries. However, synthetic chemical fertilizers are so expensive and may not be affordable to the poor people (Hargrove, 2008). Thus, other cheap and safer fertilizer source must be sought. In this regard, stored pure human urine, which is known to be rich in primary plant macro nutrients, particularly N, and harbors less microbial contaminants, can be a good alternative to cultivate crops/vegetables. Storing human urine for a few weeks greatly reduces the number of enteric microbes, and makes it safer fertilizer than animal manure, which needs more than 6 months for decomposition (Chandran *et al*., 2009). Some researchers have demonstrated fertilizer value of stored human urine for cultivation of barley (Kirchmann and

Pettersson, 1995); maize (Heinone-Tanski *et al*., 2007); wheat (Tidäker *et al*., 2007) and cucumber (Heinone-Tanski *et al*., 2007). Apart from its fertilizer value, the use of human urine as fertilizer will also help to sanitize the environment as people are no more urinating openly everywhere. In Ethiopia, people are not aware of the fertilizer value of urine, which otherwise could have been used to boost agricultural products. Especially, urine can be effectively used to fertilize vegetables that can be cultivated in small scale in home gardens or back yards. Thus, local people can easily fulfill their daily nutritional requirements and support their economy through the sale of vegetables. This study was therefore conducted to evaluate the fertilizer value of pure human urine for the cultivation of vegetables commonly grown in East Hararghe , Ethiopia.

2. Materials and Methods

2.1. Plant material and urine collection

Seeds of tomato (*Solanumlycopersicun* L. variety chali) were obtained from Melkassa Agricultural Research Center, Ethiopia. Red-beetroot (*Betavulgaris*) seeds were purchased from local seed sellers. Human urine was collected from students of Haramaya University, Ethiopia in a jerrycan and stored for 8 weeks before chemical analysis. Nitrogen content of urine was determined using Kjeldhal method and found to contain 9.3gN/L of urine.

2.2. Cultivation Experiments and Experimental Design

The selected tomato variety and red beet-root were separately planted in pots (one seed/pot) of 380cm^2 (surface area) in greenhouse. After germination, seedlings were randomly assigned to 4 fertilizer treatments, namely, no N supplementation (control), supplementation of N in a form of synthetic chemical fertilizer (urea) at a recommended rate (135kg/ha) for tomato and 133kgN/ha for red-beetroot, supplementation of N in a form of urine at a rate of 135kg/ha and 133kgN/ha for tomato and red- beetroot (urine fertilization 1x), respectively, and supplementation of N in a form of urine at a rate of 270 kg/ha and 266kgN/ha for tomato and red-beetroot (urine fertilization 2x), respectively. After well establishment of the seedlings, fertilizers were added into the soil around the root distributing over 5 periods of application to achieve the amount to be applied for each treatment group. Plants were regularly irrigated with tap water to keep soil always moist.

2.3. Microbial Analyses

The presence and levels of microbes that serve as indicator for fecal contamination and selected microbial pathogens (Total coliforms, Faecal coliforms, *Staphylococcus* spp., *Salmonella* spp., Enterococci and Clostridia) were determined to evaluate the hygienic condition and safety of vegetable samples using standard methods (Downes and Ito, 2001; Mosupye and Vonltoly, 1999; Mahale *et al*., 2008; Mudgil *et al*., 2004).

2.4. Data Analysis

Statistical analyses were conducted employing the statistical packages SPSS for Windows 16.0 (SPSS; Chicago, IL, USA). Data were first checked for normality of distribution and logarithmically transformed as necessary. One-way ANOVA was used to analyze greenhouse agronomic data and laboratory microbial quality data. The differences between means were considered to be statistically significant at $P < 0.05$.

3. Results

3.1. Agronomic Traits of Tomato (*Solanumlycopersicum* L. Variety Challi) Grown under Greenhouse Condition

The different agronomic traits and yield responses of tomato under greenhouse condition are shown in Table 1. Compared to the control, plant height was significantly higher when fertilized with synthetic chemical fertilizer or urine fertilizer. However, there was no significant difference between synthetic chemical fertilized and urine fertilized plants. Number of branch per plant was significantly higher when fertilized with synthetic chemical fertilizer or urine at a double dose (2x), but no difference was seen between control and urine fertilization at a recommended dose (1x).

Urine and synthetic chemical fertilizers enhanced more leaf formation than the control. However, difference was not seen between urine and synthetic chemical fertilizer in terms of number of leaves when applied at a recommended dose (i.e., 135kgN/ha), though there was a slight difference between double dose urine fertilizer and recommended dose of synthetic chemical fertilizer.

Unfertilized plants took longer time to produce flowers than the fertilized ones. However, there was no difference between unfertilized and fertilized plants in terms of the number of flowers produced. Compared to the control, fertilization increased the number of fruits produced per plant, and no difference was seen between chemical fertilizer and urine fertilizer (1x) or urine fertilizer (2x). However, number of fruits per plant was slightly lower when fertilized with urine (1x) than urine (2x) fertilizer. Both synthetic chemical fertilizer and urine fertilizer significantly increased fruit yield of tomato when compared with unfertilized ones. However no variation was seen between urine and synthetic chemical fertilizer in terms of fruit yield. Compared to control, total fresh plant biomass (fresh shoot + root + fruit) was significantly higher under synthetic chemical fertilizer and urine fertilizer. No significant difference was observed between synthetic chemical fertilizer and urine (1x), and between synthetic chemical fertilizer and urine (2x). Shoot dry weight was significantly higher under all types of fertilization than control, but its value under urine (2x) was higher than both synthetic chemical fertilizer and urine (1x), though no difference was seen between synthetic chemical fertilizer and urine (1x). Likewise, root dry weight was significantly increased under all types of fertilization, but no significant difference was seen between synthetic chemical fertilizer, urine (1x) and urine (2x) with respect to root dry weight.

3.2 Agronomic Traits of Red-Beetroot (*Beta vulgaris* L.) Grown under Greenhouse Condition

Compared to the control plant, all measured parameters (plant height at harvest, number of leaves per plant, root fresh weight and fresh total biomass) were significantly higher when fertilized by synthetic chemical fertilizer or urine. However there were no significant differences between synthetic chemical fertilizer and both doses of urine fertilization in all of the parameters measured (Fig. 1).

3.3. Analysis of Microbial Quality and Assessment of Visible Leaf Injury

Edible portions of both vegetables were analyzed for the presence of some pathogenic and indicator microorganisms. The results showed that enterococci, staphylococcus and salmonella were not detected in both vegetables cultivated using urine and synthetic chemical fertilizer. Moreover, there was no significant difference between vegetables of the different fertilizer treatments with respect to total coliforms, fecal coliforms and clostridia (Tables 2 and 3). In both vegetables, we continuously inspected if urine fertilization induces any visible leaf injury such as necrotic and chlorotic spots. However, we did not find any difference between the treatments.

Table 1. Agronomic responses of tomato (*Solanumlycopersicum* var. Chali) to nitrogen supplementation through synthetic chemical fertilizer (SCF) and recommended dose (1x) of human urine fertilizer at a rate of 135Nkg/ha and double dose (2x) of human urine fertilizer at a rate of 270KgN/ha.

Agronomic responses	Control	SCF	Urine fertilizer 1x	Urine fertilizer 2x	*F*-Value	*P*-value
Plant height at harvest	48.57±3.29b	65.85±2.99a	68.57±4.69a	71.57±2.26a	10.66	<0.01
Number of branch/plant	5.43±0.20c	8.71±0.84a	7.14±0.26bc	8.00±0.22ab	8.98	<0.01
Number of leaves/plant	20.00±2.05c	41.86±2.65b	47.57±2.58ab	56.57±5.58a	20.62	<0.01
Days to flower	52.71±0.42a	46.57±0.20c	48.28± 0.18b	46.43±0.20c	148.82	<0.01
Number of flower	3.14±0.26a	3.29±0.42a	3.71±0.52a	3.29±0.57a	0.28	>0.05
Number of fruits/plant	2.00±0.38c	5.29±0.53ab	4.29±0.43b	5.57±0.48a	14.47	<0.01
Fruit weight (g)	34.44±3.95b	50.46±1.42a	46.53±2.31a	50.10±0.98a	7.81	<0.01
Total plant fresh biomass (g)	97.80±15.74c	335.96±30.46ab	279.21±20.76b	383.15±31.86 a	32.12	<0.01
Shoot dry weight	5.05±0.82c	9.35±1.64b	10.63±1.60b	16.63±1.70a	12.23	<0.01
Root dry weight	1.06±0.13b	2.04±0.29a	2.19±0.27a	2.10±0.20a	7.12	<0.01

Values are mean ± SE, n=7. Values with different letters in a row are significantly different at P<0.05 (one-way ANOVA) while those with the same letters are not significantly different.

Table 2.Quantification of some pathogenic and indicator microorganisms per one gram of tomato fruit. (Values are log_{10}mean± SE, n=3).

	Fertilization treatments			
Microorganisms	Unfertilized	SCF	Urine fertilizer 1x	Urine fertilizer 2x
Total colifotms	3.18±0.06[a]	3.32±0.12[a]	3.32±0.12[a]	3.36±0.24[a]
Fecal coliforms	6.14±0.11[a]	5.82±0.74[a]	6.15±0.13[a]	6.07±0.08[a]
Clostridia	5.84±0.75[a]	5.75±0.10[a]	5.79±0.07[a]	5.83±0.37[a]
Entrococci	Ldl	Ldl	Ldl	Ldl
Salmonella	Ldl	Ldl	Ldl	Ldl
Staphyloccus spp.	Ldl	Ldl	Ldl	Ldl

The samples were analyzed from each pot. Ldl = less than detection level, detection level = 10 CFU/g (Colony forming unit per gram). Values with the same letter within a row are not significantly different at $p<0.05$ (one-way ANOVA).

Table 3.Quantification of some pathogenic and indicator microorganisms per one gram of red-beetroot. (Values are log_{10}mean± SE, n=3).

	Fertilization treatments			
Microorganisms	Unfertilized	SCF	Urine fertilizer 1x	Urine fertilizer 2x
Talcolifotms	4.04±0.07[a]	4.32±0.09[a]	4.36±0.05[a]	4.32±0.09[a]
Fecal coliforms	5.86±0.16a	6.12±0.13a	6.00±0.01a	6.05±0.64a
Clostridia	6.05±0.05a	6.11±0.01a	6.05±0.03a	6.15±0.04a
Entrococci	Ldl	Ldl	Ldl	Ldl
Salmonella	Ldl	Ldl	Ldl	Ldl
Staphyloccus spp.	Ldl	Ldl	Ldl	Ldl

The samples were analyzed from each pot. Ldl= less than detection level, detection level = 10 CFU/g (Colony forming unit per gram). the means indicated with the same letter within a row do not differ statistically significantly ($P < 0.05$). Values with the same letter within a row are not significantly different at $p<0.05$ (one-way ANOVA).

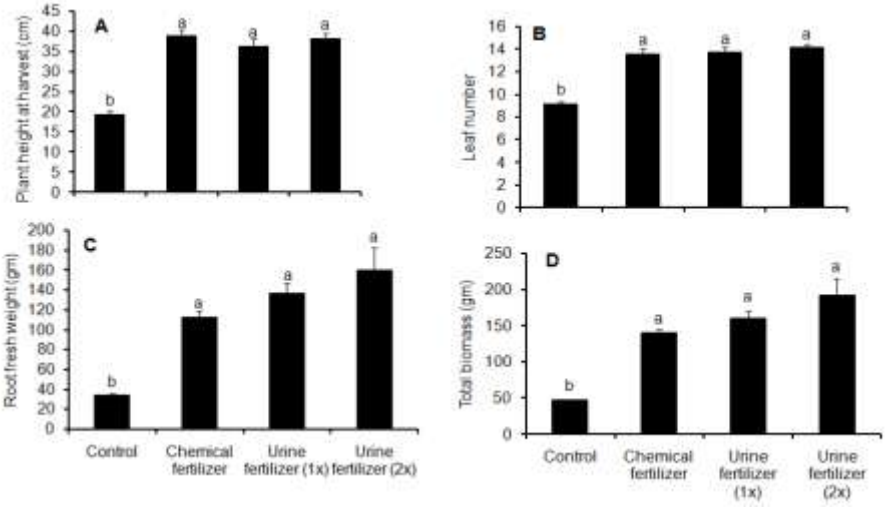

Figure 1.Agronomic responses of beetroot to different levels of nitrogen fertilization. Plant height at harvest (A), Leaf number at harvest (B), Root fresh weight(C) and Total fresh biomass (D). Values are mean ± SE, n=7.Error bars with different letters are significantly different at $p<0.5$ while those with the same letters are not significantly different. Note: Chemical fertilizer and urine fertilizer (1x) are supplementation of nitrogen at a rate of 133kg/ha. Urine fertilizer (2x) is double of urine fertilizer (1x).

4. Discussion

Results of greenhouse experiment showed that supplementation of nitrogen at a rate of 135kgN/ha through human urine fertilization increased number of fruits/plant, number of leaves/plant, total fresh biomass, shoot and root dry weight of tomato at least by twofold when compared with that of control. Average tomato fruit weight and plant height at harvest each were also increased by about 40%. Likewise, supplementation of nitrogen through synthetic chemical fertilizer and human urine significantly increased plant height at harvest, number of leaves per plant, root fresh weight (commercial yield) and total fresh biomass of red- beetroot when compared with unfertilized ones. Commercial yields and nearly all other measured agronomic traits of both vegetables cultivated using urine fertilizer at a rate of 135 kg N/ha (for tomato) and 133 kg N/ha (for red- beetroot) were the same as synthetic chemical fertilizer applied at the same dose. This result suggests that human urine, which is released into the environment as waste can serve as an alternative to an expensive commercial fertilizer to cultivate both vegetables. From their experiment on other tomato variety (Pradhan *et al.*, 2007), reported that human urine and commercial fertilizer result in the same amount of tomato yield. Fertilizer value of human urine has also been reported for other crops such as cucumber (Heinone-Tanski *et al.*, 2007) maize (Guzha *et al.*, 2005) , cabbage (Pradhan *et al.*, 2007), wheat (Tidaker *et al.*, 2007).

The Nitrogen in human urine is largely (75-90%) in a form of urea and the rest exists as ammonium (Pradhan *et al.*, 2007). Upon application to the soil, the urea will rapidly decompose into ammonia and carbon dioxide. Ammonia is prone to rapid loss into the atmosphere by volatilization unless appropriate management is taken. Apart from the necessary management taken, we also doubled to compensate for any loss of ammonia from urine and compared the two doses of urine fertilizer. Except number of fruits/plant, total fresh biomass and shoot dry weight of tomato, all other agronomic traits did not significantly vary between normal and double dose application of urine, suggesting less loss of nitrogen from the soil in this experiment. The fact that no much significant differences were observed between double dose and recommended dose of urine fertilization may also show that plants take up that amount of nutrients needed to support their growth, and the remaining nitrogen of double dose fertilized soils might have remained in the soil. In both vegetables, we continuously inspected if urine fertilization induces any visible leaf injury such as necrotic and chlorotic spots or bruises commercial yield. However, we did not find any difference between the treatments.

The microbial analysis showed no *Enterococcus*, *Staphylococcus* and *Salmonella* spp. in any of the samples (detection level = 10 CFU/g) indicating that using proper application and storing the urine for some time reduces the probability of contamination of vegetables by pathogenic microorganisms and makes the urine safe for use as a fertilizer. This result is in line with earlier reports of Schonning (2001). WHO (2006) indicate that urine fertilization does not introduce pathological contamination to agricultural fields if used properly; The result of this study also accords with that of Pradhan *et al.* (2009), who used stored human urine in pumpkin cultivation. Jonsson and Vinneras (2007) reported that storage of urine increases the pH to the alkaline state (pH 9) and results in significant reduction of the numbers of enteric microbes. However, it is always important to note that application of urine should be done with great care not to directly contact with any part of the plant, since besides the risk of microbial contamination; urine may also cause physical damage to plants (Pradhan *et al.*, 2009).

5. Conclusion

In conclusion this study revealed that human urine, when applied to provide nitrogen nutrient at a recommended rate for both vegetables, can result in more yield than the unfertilized ones, and the same yield as that of synthetic commercial fertilizer. The hygienic quality of urine fertilized, synthetic chemical fertilizer fertilized and unfertilized vegetables showed no difference, suggesting urine can be used as an alternative fertilizer to cultivate both vegetables. However, great care must be taken with urine fertilization not to directly contact with plant parts to minimize contamination and avoid salt build up in the soil.

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7. References

Chandran, A., Pradhan, S. K., Heinonen-Tanski, H. 2009.Survival of enteric bacteria and coliphage MS2 in pure human urine. *J. Applied Microbiol.* 107: 1651 - 1657.

Downes, F.P. and Ito, K. 2001. Compendium of Methods for the Microbiological Examination of Foods, 4th Ed., APHA, Washington, D. C.

Guzha, E., Nhapi, I., Rockstrom, J. 2005. An assessment of the effect of human faces and urine on maize production and water productivity. *Phys. Chem. Earth*. 30: 840 - 845.

Hargrove, T., IFDC, 256-381-6600, 2008. http://www.eurekalert.org/pub_releases/2008-08/i-tft082508.php

Heinone-Tanski, H., Sjöblom, A., Fabritius, H., Karinen, P. 2007. Pure human urine is a good fertilizer for cucumbers. Bioresour. Technol. 98: 214 - 217.

Jönsson, H., Vinnerås, B. 2007. Experiences and Suggestions for Collection Systems for Source-separated Urine and Faeces. *Water Science and Technology* 56 (5), 71 - 76.

Kirchmann, H., Pettersson, S. 1995. Human urine chemical composition and fertilizer use efficiency. *Fert. Res*. 40: 149-154.

Mahale, D. P., Khade, R. G., Vaidya, V.K. 2008. Microbiological Analysis Of Street Vended Fruit Juice From Mumbai City,India. *InternetJournal of Food Safety*. 10: 31 - 34.

Mosupye, F. M., Von A. and Holy A. 1999.Microbiological Quality and Safety of Ready-To-Eat Street-Vended Foods in Johannesburg, *SouthAfrica. Journal of Food Protection* 5: 1278 - 1284.

Mudgil, S., Aggarwal, D., Ganguli A. 2004. Microbiological analysis of street vended fresh squeezed carrot and kinnow- mandarin juices in Patiala City, India. *Internet Journal of Food Safety* 3: 1 - 3.

Pradhan, S. K., Pitkanen, S., Heinonen-Tanski, H. 2009. Fertilizer value of urine in pumpkin (Cucurbita maxima L.) cultivation*", J. Agric. and Food Sci*, 2009, Vol.18, 57 - 68.

Pradhan, SK., Nerg, AM., Sjoblom, A., Holopainen, JK.,Heinonen-Tanski, H. 2007. Use of Human Urine Fertilizer in cultivation of Cabbage (Brassica oleracea) - Impact on chemical, Microbial, and Flavor Quality. J. *Agric. Food Chem*.55, 8657 - 8863.

Schönning, C. 2001. Recommendation for the re-use of urine and faeces in order to minimize the risk for disease transmission. Swedish Institute for Infectious disease control. Stockholm, Sweden.

Schouw, N.L., Danteravanich, S., Mosbaeck, H., and Tjell, J. C. 2002. Composition of human excreta, a case study from Southern Thailand.*The Sci. of the Total Environ*. 286: 155 - 166.

Tidäker, P., Mattson, B., Jönsson, H. 2007. Environmental impacts of wheat production using human urine and mineral fertilizers- a scenario study. *J. Cleaner Prod.* 15: 52 - 62.

WHO. 2006. Guidelines for the safe use of wastewater, excreta and grey water use in agriculture and aquaculture Socio cultural, environmental and economic Aspects, World Health Organization, 3, 7. Online access 2006-10-26). www.who.int/sites.