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DEVELOPING COMPOSTING DRY TOILETS: A VITAL APPROACH TO SUSTAINABLE SANITATION IN GHANA

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ABBREVIATION

ADB	African Development Bank
ADBG	African Development Bank Group
AMA	Accra Metropolitan Assembly
AMCOW	African Ministers' Council on Water
DT	Dry Toilet
ECO	Ecological
ECO-SAN	Ecological Sanitation
ENPHO	Environment and Public Health Organization
EPA	Environmental Protection Agency
ESP	Environmental Sanitation Policy
GDP	Gross Domestic Product
GHG	Green House Gas
GH-GAMA	Ghana Greater Accra Metropolitan Area
GSS	Ghana Statistical Service
IMF	International Monetary Fund
JIT	Just In Time
JMP	Joint Monitoring Programme
KVIP	Kumasi Ventilated Improved Pit Latrine
MESTI	Ministry of Environment, Science, Technology and Innovation
MDG	Millennium Development Goals
MLGRD	Ministry of Local Government and Rural Development
NDPC	National Development Planning Commission
OECD	Organization for Economic Cooperation and Development
SDG	Sustainable Development Goals
SME	Small and Medium Enterprises
STMA	Sekondi-Takoradi Metropolitan Assembly
UN	United Nations
UNDP	United Nations Development Programme

VIP	Ventilated Improved Pit Latrine
WASH	Water, Sanitation and Hygiene
WC	Water Closet
WHO	World Health Organization
WSP	Water and Sanitation Programme

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1 GENERAL INTRODUCTION

1.1 Economics of Sanitation Initiative (ESI)

The Economics of Sanitation Initiatives is a program launched by the Water and Sanitation Program (WSP) to study the economic impacts of poor sanitation and the costs and benefits of improved sanitation options. The goal of the ESI is to provide concrete evidence for the need to increase investment in improved sanitation and to provide an improved evidence-base for efficient planning and implementation of sustainable sanitation and hygiene programs (WSP, n.d). Although there's widespread recognition of the human and social handicaps from poor sanitation typically in developing countries its economic losses was not well recognized. The ESI study attempts to provide economic estimates and losses from the adverse effect of inadequate sanitation to including related losses on health (deaths and diseases), welfare and tourism (WSP, n.d). The infographics below shows a big gap in sanitation and the economic losses from a global inadequate sanitation.

Figure 1. Economics of Sanitation Initiatives (WSP)

Globally 2.5 billion people lack access to improved sanitation representing 40 percent of the global population- in a simple breakdown there's 1 in 3 persons who lacks access to toilet according to Water.org (n.d). Access to safe sanitation and clean water is a basic human rights that everyone is entitled to and must be available for use at all times of the day and night and must be hygienic the UNW-DPAC (2015) adds, however,

significant proportion of the global population has no access to it. By ensuring adequate provision of safe sanitation and clean drinking water we not only impacting public health but contributing significantly to sustainable and socio-economic developments as well as promoting a healthy ecosystem (UNDESA, 2015).

According to the ESI and WHO publication 'Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage' it is estimated that about $260 billion monetary value is lost every year due to lack of safe sanitation and water which is equivalent to a 1.5 percent of combined GDP of developing countries. The areas of the world with least access to improved sanitation include 69 percent of the population of sub-Saharan Africa and 62 percent of those living in south Asia (WSP, n.d). By addressing the Economics of Sanitation Initiatives the study observes the limitedness of funds to resolve global sanitation gap giving that annual aid of water and sanitation amounts to $8 billion dollars which is far short of a $1 trillion needed to resolve this crisis and maintain its long term (Water.org, n.d). On a positive side there's a proof of increased investment in the sector has favorable socio-economic returns to households and society, contributing improved health, clean environment, dignity and quality of life among others. In addition estimates on economic returns is favorable- globally every $1 spent on improved sanitation returns $5.5 (WSP, n.d)

In the context of Ghana access to improved sanitation is a fundamental problem. In 2015 the Water, Sanitation and Hygiene (WASH) program of the UNICEF reported that only 15 percentage of Ghana's population have access to improved sanitation which is well short of the expected 54 percent planned for the Millennium Development Goals of 2015. Other report shows that 1 in 5 Ghanaians have no access to toilet and defecates in the open with a national average of 22.9 percent who engages in the act (UNICEF, 2015). According to same report there's evidence of high disparities in sanitation between rural and urban regions. In the Upper East region only 3 percent uses unshared and improved sanitation and about 90 percent practices open defecation in the region.

Ghana has one of the fastest growing population in the world according to Department of Economic and Social Affairs of the United Nations Africa, and its population growth continues to increase urbanization presenting huge sustainable and sanitation challenges

in cities of the country (United Nations, 2014). In a latest review of the country's urbanization in 2015 found that urban population of Ghana has more than tripled from 4 million to 14 million over the last three decades (Word Bank, 2015). The report emphasizes that although the growth has sparkled strong economic transformation evidenced in annual GDP growth averaging 5.7 percent its adverse effect from congestion, unregulated expansion and limited access to social amenities and services is high. It's ever more challenging for city authorities in the two biggest cities Kumasi and Accra to provide basic water and sanitation for everyone as a result of rapid urbanization according to a report by the Water & Sanitation for Urban Poor WSUP (2015).

Putting Ghana into perspective this research aims to address and review current state of sanitation coverage and challenges towards its development to understand key issues undermining sector developments whilst gaining insights on how to develop composting dry toilets a preferable option to existing toilets. The focus of the study is to outline and understand the nature of Ghana's sanitation by performing a clear analysis on access to household toilets. The case study is 'Kwesimintsim' a dense populated town in Takoradi which is the third largest region of Ghana. Sanitation and access to toilet in the area is grossly deficient and open defecation is high. Household toilets are typically pit latrines whilst majority use public and shared toilets. Undersized toilet facilities in the area as a result of negligence by STMA (Sekondi-Takoradi Metropolitan Assembly) and the government has led to high rate engaging in open defecation according to residents.

1.2 Location and Size

Ghana is West African country located along the Gulf of Guinea and Atlantic Ocean. It lies between latitudes 4° and 12°N, and longitudes 4°W and 2°E. It occupies land mass of about 238,535 km square and share borders with Ivory Coast in the west, Togo in the east, Burkina Faso in the north and Gulf of Guinea in the south. Ghana is divided into ten administrative regions with sub-divisions of 275 districts and each region has a capital Accra is the capital city of the Greater Accra and Ghana. According to 2010 Population and Housing Census Ghana's population is approximated to be 26 million (Ghana Statistical Service, 2013) with annual growth rate of 1.82%

Figure 2. Map of Ghana showing Kwesimintsim

1.3 Climate

Ghana has tropical climate which is strongly influenced by the West African Monsoon wind. It has two main seasons, wet and dry seasons with high temperatures throughout the whole year. Dividing Ghana into three climate zones the south eastern coastal belt is warm and dry whilst the south western corner is hot and humid and northern Ghana is hot and dry. Temperatures are generally hot with average temperatures ranging between 21°C to 28°C. There's significant variations of inter-regional precipitation, whilst in the north rainy seasons begins in March lasting until November, in the south rainy seasons is experienced from April to mid-November. According to studies evidential decreasing trends in rainfall can be observed from 1960's to 2000s with average of 2.3mm per month and (2.4%) per decade (McSweeney, n.d.)

1.4 Statement of the Problem

Poor management of wastes produced in most developing countries does not only affect social lives and health but it's a major cause of environmental pollution and depletion of natural (Human Development Report, 2006). Today sanitation still remains a major challenge in many countries around the globe, causing contagious diseases due to lack of access to improved sanitation of which Ghana is no exception. Ghana produces about 13000 tons of waste everyday (Appiah-Adjei et al, 2015) as population and urbanization continue on the rise whilst safe management and treatment of wastes is undersized. Lack of proper waste management and treatments, in addition to indiscriminate disposal

of wastes, puts the country at risk to water- and air-bone diseases and infant mortality (Water Aid, n.d). Although these problems affect everyone, children and pregnant women are the most vulnerable and the Global Health Observatory of WHO reports that approximately 50% of under-five year deaths (Child mortality) are due to infectious causes (World Health Organization, 2013). Defecation in open fields or plastic bags and throwing into bushes, gutters and backyards is widely practiced in Ghana and it's a crucial hazard to environmental and health (Water Aid, n.d). It is found that the practice is not only common in villages but including urban metropolis like Accra has about 45 percent people engaging in open defecation according to the Deputy Minister of Local Governments and Rural Developments (2015). A pre-interview conducted in NIMA which is dense populated town in Accra found that majority of its dwellers have no access to toilets. Open defecation in the area is very high, there are few shared public toilets and even un-sanitized. Its inhabitants complained of long queues typically in the mornings and the burden to walk several minutes to the public toilets is horrifying. On the other hand lack of waste management for collection, treatment and recycle is a major sanitation challenge for the country. Treatment of waste is very undersized, about only 10% of urban wastewater from domestic and municipal sources is disposed through sewage networks connected to a treatment plant (Obuobi et al, 2006). The Ministry of Local Government and Rural Development (MLGRD) has the responsibility for general waste management in Ghana through supervision of decentralized Metropolitan, Municipal and District Assemblies (MMDAs) (United Nations, 2004). Typically wastes are collected and disposed of at designated landfill and waste dump sites by public and private waste management firms, however low technical capacity, weak environmental regulations and policies among other things have compounded challenges in waste managements (African Reality Blog, 2012). Other challenges for solid waste management in Ghana include indiscriminate disposal of wastes in street corners, gutters and drains, inadequate containers and equipment for collecting and transporting wastes. There's again the problem of collection irregularities where wastes overflow in bins for weeks according to the African Reality Blog (2012). Lavender Hill is one of the biggest dumping sites in the capital where liquid waste is disposed into the Atlantic Ocean., Haphazardly, the dumping site is situated in a town and dwellers are constantly prone to stench and local children swim nearby (Zainabu, 2013).

1.5 RESEARCH OBJECTIVES

To review and address Ghana's sanitation and environmental challenges to understand key issues undermining developments in the sector and to gain insights on how to develop the concept of ecological sanitation in the country.

1.5.1 Specific Research Objectives

- To investigate on the rate of households' access to toilets
- To obtain insights on the issue of low access to sanitation
- To gather information to develop affordable composting dry toilets

1.5.2 Research questions

- What is the access to household toilets in Ghana?
- How has the Millennium Development Goals (MDG's) and Sustainable Development Goals (SDG's) supported long-term development in sanitation?
- How can Eco-san contribute to sustainable sanitation in Ghana?

2 LITERATURE REVIEW

2.1 Definition of Concepts

There have been various definitions for ecological sanitation over the past decades, however, the most recently and widely accepted definition is the one provided by Department of Natural Resources and the Environment, Stockholm Sweden. It defines Eco-san as often abbreviated, as systems that allow for the safe recycling of nutrients to crop production in a way that the use of non-renewable resources is minimized (Esrey et al, 1998). There are three fundamental principles of Eco-san:

I. Prevention of pollution rather than attempting to control it
II. Rendering the urine and feces for reuse and
III. Using the safe product for agriculture purposes.

Eco-san has a key approach to reducing contamination of the environment from human excretion by recycling feces and preventing diseases associated with excreta. It works on the principle that treats human excrement as a resource not a waste. Human excreta contains nutrients that can be used to fertilize land and boost agriculture. (Huuhtanen & Laukkanen, 2009) The idea of treating human excreta as a resource and not a waste (eco-san) may be implemented for various reasons as noted by Huuhtanen and Laukkanen. In their publication the 'Guide to Sanitation and Hygiene in Developing Countries' they reveal that such implementations may be for the need to reduce contamination of the environment caused by human excretion and the prevention of diseases deriving from excreta. In ecological sanitation pathogens are destroyed to allow the use of end product which is safe for boosting crop production. This happens as a process of nutrients recovery from excreta and utilization of the end product as fertilizer and soil enrichment material. Apart from reducing contamination of environment and prevention of related diseases to human excrement Eco-san contribute significantly in water conservation. In Ecological sanitation less or no water is used in the transportation of excreta comparative to conventional latrines (Esrey et al, 1998). According to Environmental Protection Agency of the United States about 27 percent of household use of water is used for flushing toilets in the U.S (EPA, 2008). The use of eco-san will not only contribute to conserving household water but carries large impact on saving water bodies. In many cases sewages are being released into rivers and oceans. The use of flush toilets is unhygienic if a toilet is not combined with reliable water supply, sewage treatment infrastructure, and treatment of sludge as expresses by Dengel (2011). Winblad (2004) also concludes that major components of water pollution in the world is caused by sewage discharges from centralized, water-borne collection systems expressing that only 300 million people in the world have end-of-pipe treatment of sewage to a secondary level before sewage is discharged into open bodies of water.

The approach of Eco-san aim to close the nutrient loop is characterized as 'sanitize-and-recycle' (Winblad et al. 2004). It treats human excreta as resource by providing hygienic option for excrement in a way excreta and urine is stored and treated for reuse in agriculture. Safely treated excreta serve as organic manure which is more sustainable for boosting crop production than the use of chemical fertilizers which rely on non-

renewable resources. In Eco-san practices the flow of nutrient is linear. This is because nutrients are taken up from the soil by the crop, transported to the market, eaten and discharged following a sustainable way of returning nutrients to the soil (Winblad et al. 2004). Ecological sanitation has been practiced for many decades and it's continuously gaining strong momentum on both local and global scale as sustainable sanitation system with scalable impacts to reducing pollution, minimizing resource use, boosting crop production and contributing to food security. Take for instance Haiti is among countries with low access to improve sanitation, over 75 percent of population lack access. In recently years SOIL a waste treatment operator in Haiti has impacted considerably on household access to toilets by supporting deprived households and communities. According to the operator they are serving about 2600 people with household eco-san including 5500 people with access to their public toilets. (SOIL, 2016)

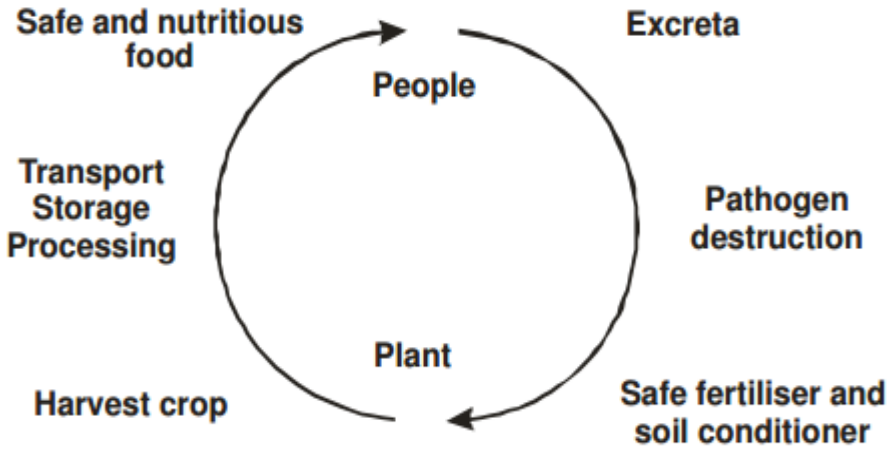

Figure 3. Principle of ecological sanitation (Esrey and Andersson, 2001)

Eco-san regards human excreta as a resource that can be recycled to be used as fertilizer for soil enrichment in farming. This process is known as 'nutrient cycle' as seen Figure 3. Humans and other herbivorous animals obtain direct nutrients and energy from plants in the food chain, in return when we defecate into the nature the unused nutrients are transferred back to soil for the use of plants for growth (Huuhtanen & Laukkanen, 2009).

2.2 Green Growth and Developing Countries

Green-innovation may be defined as the development and commercialization of new ways to solve environmental problems through improvements in technology, with a wide interpretation of technology as encompassing product, process, organizational, and marketing improvements (World Bank, undated). Around the world programmes and policies for environmental sustainability and 'going green' have been undertaken by governments and corporations to achieve environmental sustainability goals within certain frameworks of time (United Nations, 2015) such as the Millennium Development Goals, Sustainable Development Goals and the Climate Change Summit. The Millennium Development Goals is a framework that seeks to address, develop and achieve developments on three diverse areas that's human capital, infrastructure and human rights. Part seven (7) of the MDGs emphasizes on measures how to ensure environmental sustainability (United Nations, 2015).

Developing countries are key to achieving global green growth. The high growth population presents a crucial need for ecological ways of how we produce and consume according to OECD report on Green Growth and Developing Countries (2012). The Green Growth and Developing Countries is a publication by OECD is addressed to policy makers to see the need for going-green. The report is focused to developing countries and examine application of policy frameworks towards transition to green growth. The frameworks go beyond just environmental policies but include a broad range of economic and social policies that takes into account differences in natural resource endowments, levels of socio-economic development, sources of economic growth, and institutional capacity of different developing countries (OECD, 2012). According to the report developing countries are the most vulnerable to climate change and tend to be more dependent than advanced economies on the exploitation of natural resources for economic growth. Most of these countries are experiencing adverse environmental, health, water and sanitation problems evidential in climate change patterns, pollution and degradation of resources resulting in vulnerability of children, women and the poor according to a publication by National Academies Press (2009) on Global Issues in Water, Sanitation and Health. Lack of access to clean water and sanitation in most developing countries has devastating effects on daily lives- a child born in a developing country is over 13 times more likely to die within the first five

years of life than a child born in an industrialized country (UNPD, 2008). Between January – September 2014 an outbreak of cholera hit the WHO African region. A total of 74 127 were recorded including 1 154 deaths According to the report four countries namely Ghana, Nigeria, DR Congo and Sudan accounted for 98% of the overall outbreak of cholera in the region (WHO, 2014).

2.3 High Dependency and Adverse Effects of Water Closets

Many considers water closets as the only descent and safe toilets, however, costs of building and maintaining facility in addition to its adverse environmental impacts such as excess use of water for flushing and improper discharging of untreated fecal wastes into water bodies as often the case in developing areas argue the fact of water closet as ideal toilet facility. Various writers such as Narain has carried implicit reports on adverse effects of water closets on the environment. In her 'Down to Earth' article Vol. 10 she criticizes ''the flush toilet is ecologically mindless''. She explains that over 10 liters of water is used per single flush in India and worse the waste water ending up polluting water bodies. In the United States however, almost 27 percent of household use of water is used in the toilet according to a study by the American Water Works Association Research Foundation AWWARF.

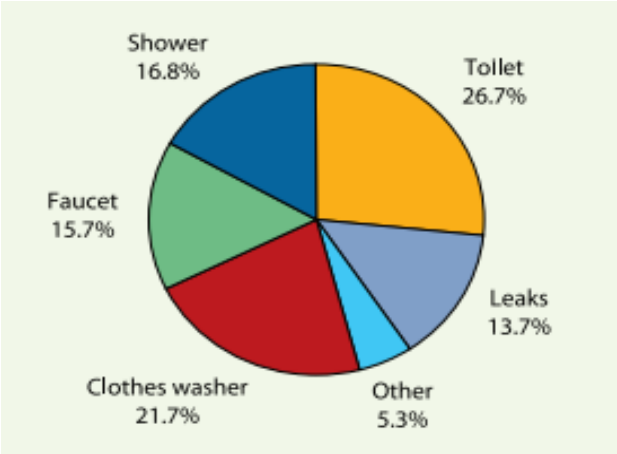

Figure. 4. Proportion of Household Use of Water in United States

Source: American Water Works Association Research Foundation, "Residential End Uses of Water," 1999

The above chart represents a proportion of household use of water in the United States. It's found that nearly 27 percent of indoor household use of water is used for flushing

toilet in the US giving that on the average 1.6 gallons water per flush whilst older toilets may consume as much as 3.5 to 7 gallons per flush (EPA, June 2008).

Secondly, water closets are expensive requiring water pipes and lots of space for building. This is one reason for low access to improved toilets in developing countries because of low incomes, however, affordable technology can be used to develop options that meet incomes and needs of low/middle income regions (Huuhtanen and Laukkanen 2009). They emphasize that the world's sanitation problems cannot be solved by building water latrines and sewerage systems in the sense that building and maintenance costs are too high and furthermore WC's cannot ensure clean environment. Again in the cases of inadequate waste water treatment even more severe health and environmental risks can be created than the use of bushes for open defecation. They establish the need to adopt composting dry toilets by addressing.

2.4 Dry Sanitation with Reuse

Dry sanitation is defined as the on-site disposal of human waste without the use of water as a carrier (Peasey, 2000). It is an attractive option for toilet because of its low cost and water conservation (National Academic Press, 2009). Dry sanitation with reuse on the other hand is promoted as a technology for community settings without sewerage and plentiful water according to Peasey (2000) Common dry sanitation facilities include pit latrines, Ventilated Improved Pits and SanPlats, etc. The reuse of end product as organic manure is enforced by dehydration and composting.

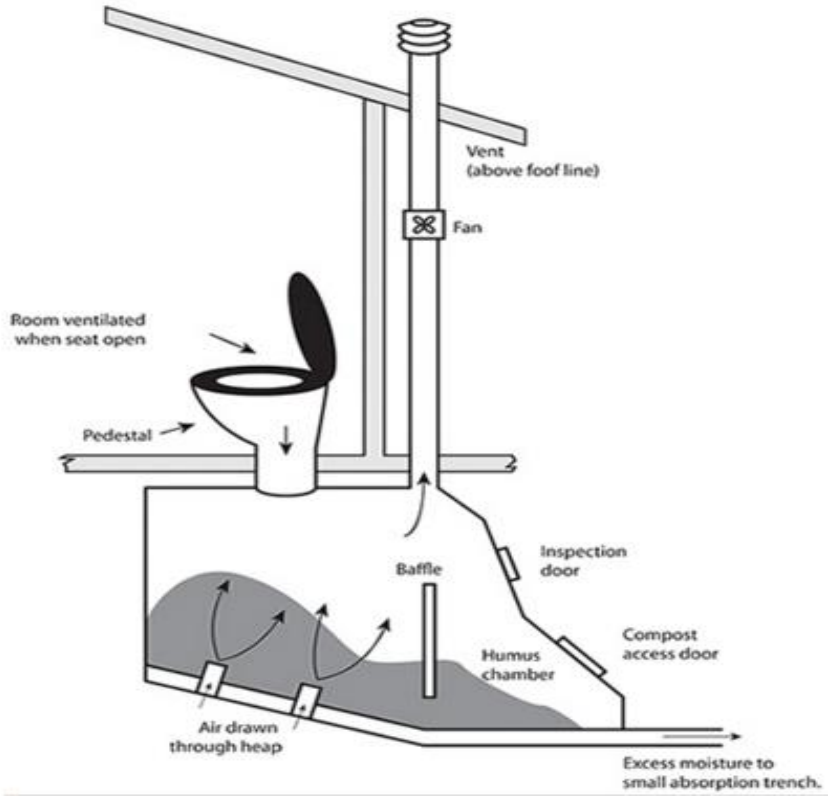

Figure 5. Typical Composting toilet

Although dry sanitation aim to reduce waste generation and sustain environment has become a preferred practice, composting dry toilet has received low awareness and adoption. This is because needed innovation to develop facilities at low prices hasn't been highly achieved and yet composting dry toilets are not affordable to average income earner in developing regions (WHO World Water Day Report, undated).

2.4.1 Advantages of Eco-san

According to findings one key sanitation challenge and toilet is inadequate water supply in rural areas of Ghana (WSP, 2015). Greater population use pit and septic latrines whiles water closets are only few. The KVIP's (Kumasi Ventilated Improved Pit Latrine) has become the most common toilet facility in urban and rural areas since its development in early 1970's. On the other hand due to high cost of sanitized toilet for low income earners open defecation becomes a common practice typically in towns and villages. Considering Ghana's sanitation status in regards to toilet access composting dry toilets will be of great impact on rural sanitation.

i. Environment

Composting dry toilets are considerably more environmental friendly than other toilets as water closet. In most cases they require no or less water for flushing. It's a toilet in which composting takes place i.e. fecal wastes are decomposed into manure which can be used in farming as organic fertilizer. It will play important role to reduce water pollution in areas where fecal wastes are dislodged into water bodies.

ii. Economical

There are various types and systems of composting dry toilets and the option one chooses depends upon how much money one wants to spend, where one lives, and how much involvement one wants in the compost-making process (Humanure Handbook, Chapter 6). Considering low maintenance costs, no use of water, sewage and drainage systems composting dry toilets are economical and will promote sanitation developments on a very large scale among low income families and communities in Ghana.

iii. Agriculture

Agriculture plays an important role in Ghana's economy, however, contribution from the sector shrunk to 22% to GDP in 2012 (Ghana Statistical Service, 2014). Instead of waste composting toilets produce reusable material which is enriched organic fertilizer that enhances crop growth and production. Compared to artificial fertilizers farmers will now have an alternative to cheap or no cost manure to boost farming outputs thereby, promoting the overall performance of the agriculture sector.

2.4.2 Disadvantages of Eco-san

Although Eco-san is considered as better alternative to conventional latrines in terms of sustainability on environment and health there are various reasons for its slow adoption. For instance the use of Eco-san latrines normally require high user responsibility and are more complex to maintain as compared to conventional latrines. Generally people prefer latrines where faeces cannot be seen and where no further handling by the user is required according to Smet and Sugden (2006). According to (Smet & Sugden, 2006) users tend to feel reluctant to secondary handling of faeces as they can even be ridiculed

by the rest of the community. Additionally operation and maintenance of eco-sans require greater awareness and technical knowledge for proper use to avoid related health threat, environmental pollution if excreta is not safely decomposed. Eco-san is yet new technology to most therefore, such related operation and maintenance problems must be addressed appropriately and to make users well aware on every aspect of the technology (Adhikar et. al, 2012)

There is again the problem of culture misconception and social behavior about use of latrine and compost manure from human excreta. Many tend to have the attitude known as faecophobic which is the fear of human faeces (Adhikar et. al, 2012). Smet and Sugden express that faeces in all cultures is regarded disgusting and to many people, the thought of using it for food production is repulsive (2006).

2.5 Sanitation status in Ghana

Wastes treatment in Ghana is lacking progress. Recently, the country was ranked the 7th dirtiest country in the world with worsened sanitation indicators – 5 million people defecate in the open aggravating the outbreak of diarrhea and cholera. It's also said that 7,500 children die from diarrhea every year in the country (Graphic Online, July 2015). Majority of people do not have access to sanitized or hygienic toilets rely on shared public toilets. High dependence on shared toilets is one of the key reasons for Ghana's poor performance on what is considered as improved sanitation by JMP report in 2015 illustrating Ghana's very likely to miss the target for sanitation given the predominant use of shared facilities (54 percent) which are considered unimproved according to the definitions used by the JMP (AMCOW, 2015). The existing toilet facilities in Ghana include pit latrines, septic tank latrines, VIP (Ventilated Improved Pit-latrine) and WC's (Water Closet). Sanitation in many parts of the Accra metropolitan area is grossly deficient, with population of 4 million occupying area of 3,200 square kilometers. In an interview with residents of the Nima community many people expressed epic discomforts for having to walk in middle of nights to visit community toilets, and to children and women, this is a nightmare. Again there are long queues in mornings and evenings where users will wait for several minutes to use facilities, and as a result people are impelled to defecate in the open. By far the greatest challenge to Ghana's sanitation is open defecation as reported by the 2015 JMP report of 20 percent

nationally and 34 percent in rural communities (AMCOW, 2015). In Accra densely populated city about 45 percent defecate in the open as stipulated by the Deputy Minister of Local Government and Rural Development, Nii Lante Vanderpuye (Citifm, July 15, 2015).

2.6 Sanitation Policies in Ghana

Ghana's water and sanitation sector has undergone major reforms to address weaknesses since early 1990 according to the second round of Country Status Overview (CSO2) report by the African Ministers' Council on Water AMCOW in 2015. Over the years initiatives for sanitation and environmental sustainability have been implemented to tackle challenging issues. Recently after the 2014 cholera outbreak in the country the Government of Ghana has legislated 'National Sanitation Day' for residents in various communities to participate in cleanup exercises to reduce filth and spread of contagious diseases according to a local newspaper (Joy News, January 2015). General waste management in Ghana is the responsibility of the Local Government and Rural Development. This body is responsible for provision of infrastructural and developmental projects including sanitation in all the ten regions of the country. However, its role for provision and monitoring of programmes is decentralized in metropolitan and district assemblies to facilitate sanitation at all levels such as the Accra Metropolitan Assembly which is the sanitation body in the Accra area.

The Ministry of Environment, Science, Technology and Innovation is the body that ensures regulations and policies for environmental and sanitation developments. Under the advocacy of the MESTI the Environmental Protection Agency EPA, established in 1994 (Act 490) works to regulate policies and implementations to strengthen sanitation developments and to ensure policies are consistent to national environmental development goals.

The Environmental Sanitation Policy ESP (Revised, 2009) which was developed in 1999 of a nation-wide consultation with various stakeholders addresses three key aspects, i. Presentation of the current context and situation of environmental sanitation in Ghana to cover national development priorities and broad principles guiding policy formation, ii. new policies to identify main challenges and constraints of the sector and

draw objectives as well as actions and measures to meet the challenges whilst adhering to basic principles, and iii. presentation of issues of policy implementation including institutional roles and responsibilities and broad specifications (MLGRD, 2010).

2.7 Sanitation developments

Over the past decades sanitation in Ghana has undergone major reforms to address challenging issues in the country (Kanton et al, 2010). Policies and projects designed to develop sanitation coverage and reduce open defecation have been implemented by government of Ghana and international organizations such as the WASH Project Ghana a four-year USAID funded initiative to improve water, sanitation and hygiene in rural and peri-urban communities. The ongoing Greater Accra Metropolitan Area (GH-GAMA) is a sanitation and water project funded by the World Bank and planned for 2013 to 2018 to support among other things the development of household sanitation in the Greater Accra Metropolitan Area (World Bank, 2015). The key objective of the GAMA project put emphasis on household sanitation for low-middle income communities within the GAMA by providing 50 percent financial support for beneficiaries to obtain improved household sanitation facilities (GAMA, 2015). The WSUP is another organization working in Ghana closely with local partners, harnessing expertise and sector leading knowledge of the private sector, NGOs and research institutions to develop water and sanitation programmes. The organization's contribution with the two metropolitan assemblies Accra and Kumasi has made remarkable improvement in provision of water and sanitation services in the two metropolises. Since 2010, approximately 68,761 people have had access to improved water services, 416,465 people having improved sanitation services whilst people with access to improved access to hygiene practices is estimated over a million (WSUP, n.d). Another significant contributor to water and sanitation development in Ghana is the Community Water and Sanitation Agency CWSA which focuses on the development and promotion of sustainability of water supply and related sanitation services in the rural settlements. The main work of CWSA is to provide technical expertise and giving standards and guidelines for water and sanitation projects in rural communities, and also involved in collaboration with district assemblies and international agencies in planning and execution of water and sanitation projects. Although Ghana has seen major projects

in water and sanitation for Millennium Development Goals in the last 15 years development in sanitation has not been greatly materialized as compared to goals attained for safe water provision (WaterAid, n.d). The most significant challenges to Ghana's sanitation development has been attributed to population growth, rapid urbanization and industrial pollution according to WaterAid. The report by WaterAid also shows that Ghana's population almost quadrupled between 1960 and 2011 and it's estimated to double in the next 40 years whilst urbanization has grown by 126 percent in the past 50 years.

3 SUSTAINABLE DEVELOPMENT FRAMEWORKS

There appears to be many definitions for sustainable developments including a landmark one which was developed in 1987 as ‘’Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations General Assembly, 1987, p. 43). In other words the concept of sustainable development aims to maintain economic advancement and progress whilst protecting the long-term value of the environment; it “provides a framework for the integration of environment policies and development strategies” (United Nations General Assembly, 1987). The key principles underlying sustainability development is the integration of environmental, social and economic concerns in decision making as we can see from Figure six (6)

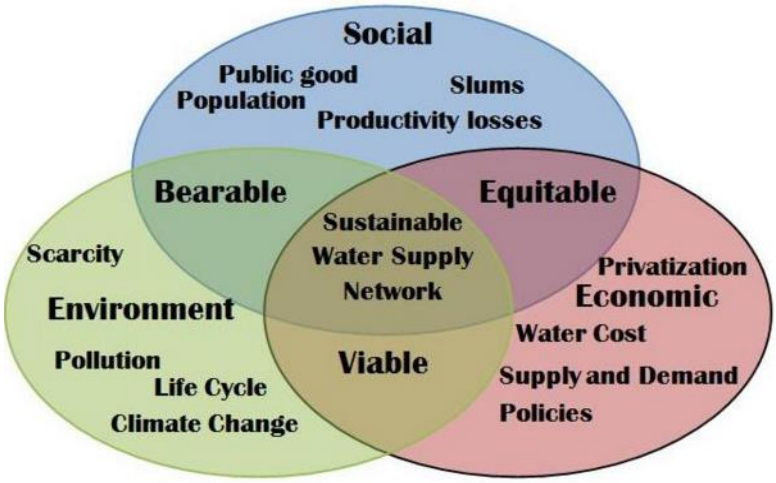

Figure 6. Principles of Sustainable Developments (Menemania, 2013

3.1 Millennium Development Goals (MDGs)

The MDGs are a development framework that was established following the Millennium Summit of the United Nations in in the year 2000 underlying a broad vision shaped by world leaders to fight poverty in its many dimensions (United Nations Report, 2015). Eight goals were set, 18 targets and 48 indicators envisioned towards progress for human developments and environmental sustainability. Goal 7 of the MDG emphasizes on concrete targets and guidelines to achieve environmental sustainability planned by 2015. The goal has a target for the integration of principles of sustainable

developments into country policies and programs and reverse the loss of environmental resource (Millennium Project, 2006). The goal to increase access to clean water and basic sanitation is addressed as target 10 of the MDG under the environmental sustainability goal. Specifically target 10 (under goal 7) of MDGs states that, *''*Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation'' (Millennium Project, 2006). ''The world has made remarkable developments since adoption of the MDG's in 2000. *''Hundreds of millions of people have been lifted out of extreme poverty and immense gains recorded in key indicators of social development. In addition, scores of developing countries have used the global framework to coordinate national efforts in a more systematic manner and expand policy and fiscal space for national development''* (UNDP Report, 2015).

Figure 7. The Millennium Development Goals (United Nations, 2015)

As seen in Figure 7 the goal seven (7) of the MDG is to ensure environmental sustainability. The goal to 'halve by 2015, the proportion of population without sustainable access to safe drinking water and basic sanitation' is emphasized in the target C' of the goal 7. According to the report there has been significant rise in the access to improved drinking water between 1990 and 2012 giving that the proportion of the world's population with access to an improved drinking water source rose from 76 percent in 1990 to 89 percent in 2012 (UNDP Report, 2015). Findings in the report shows that over 2.3 billion more people gained access to an improved source of drinking water over the same period (UNDP Report, 2015). In the context of Ghana remarkable achievement in meeting its goal to expand access to safe drinking water has been experienced. On the basis of 2010 Population and Housing Census estimates show

that the proportion of population having access to improved water sources was 81.6 percent in 2013 (UNDP, 2015). However, critical challenges still exist with regards to improved sanitation. Only a quarter of the population use improved sanitation facilities and the pace of sector development is slow (GSS, 2014). According to the report proportion of people who has access to improved basic sanitation increased from 4 percent in 1993 to 12.4 percent in 2008 which is far from the 52 percent target in 2015. For the urban population, the proportion increased from 10 percent to 18 percent over the same period as against 1 percent to 8.2 percent in rural areas (GSS, 2008) Different researches and reports show conflicting figures on Ghana's sanitation coverage regarding proportion of population with and/or without to improved sanitation. Disparities exist as a result of what is considered as improved sanitation and what is not. An improved sanitation facility is defined as one that hygienically separates human excreta from human contact. Thus, improved sanitation facilities are those that are not shared by multiple households. (WHO/UNICEF, 2013). Ghana's sanitation is underscored by the Joint Monitoring Programme by WHO and UNICEF. This is because most household toilets are shared and are not considered hygienic and improved sanitation.

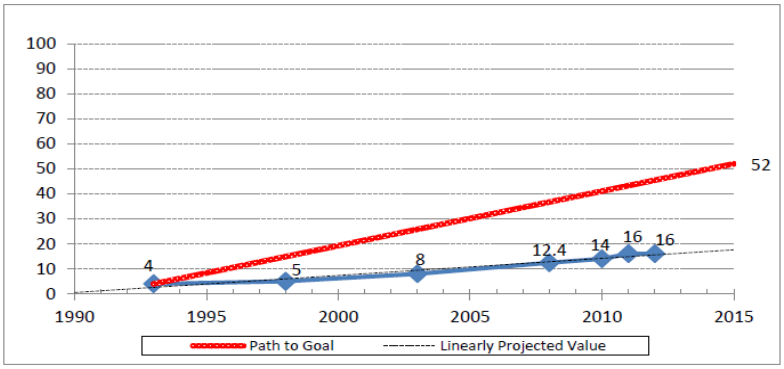

Figure 8. National Access to Improved Sanitation, 1993-2012 (%)

Source: GSS, various years; MLGRD, 2013

The figure above represents in percentage Ghana's national access to improved sanitation for period 1993 – 2012. One can easily identify a wide gap between its paths to goal marked in red against projected value marked in blue. In 2013 for instance only a quarter of the population had access to improved sanitation facilities (GSS, 2014).

Urban areas recorded 28.6 percent access to improved basic sanitation compared to 10.5 percent for the rural population in 2013. The GSS study also shows that household improved toilets are very limited and public toilets are the most used facility by highest proportion of Ghana's population.

Table 1. Toilet Facilities used by Households, 2013 (%)

Indicator	2013 (GLSS 6)		
	Rural	Urban	National
WC	2.3	23.3	13.9
KVIP	8.2	15.3	12.1
Pit latrine	24.2	15.0	19.1
Bucket/Pan	0.1	0.3	0.2
Public toilet (KVIP/WC/Pit/Pan)	32.1	38.7	35.7
No facility/bush/beach/field	32.9	7.4	18.8
Other	0.2	0.1	0.1
Improved sanitation facility	10.5	28.6	26.0

Source: GSS, GLSS6 of 2012/13

The table above shows in percentage of the national, urban and rural access to toilet facilities in Ghana in 2013. Urban areas have high dependence on public toilet of 38.7 percent followed by water closet. Among rural settlements, however, open defecation is the highest practice with almost 33 percent.

3.2 Sustainable Development Goals SDG's

As afore mentioned some 2.5 billion people lack access to basic sanitation and the effect expands to escalating contagious diseases such cholera and diarrhea especially among children. According to United Nations nearly 1000 children die due to water and sanitation related diarrhea diseases (2015). In a deeper view lack of access to sanitation and water impacts negatively on food security, livelihood choices and educational opportunities for poor families across the world (UN, 2015). At the United Nations Sustainable Development Summit on 25th September 2015, world leaders adopted the 15 years sustainable development agenda as a successor to the Millennium Development Goals (MDG's) that aspired from 2000 - 2015 to put the world on a more sustainable course.

The Sustainable Development Goals also referred to as the 2030 Agenda for Sustainable Developments intergovernmental set of aspirations to achieve 169 targets. According to

(Osborn, Cutter and Ullah, year) ‘’It is a common global vision of progress towards a safe, just and sustainable space reflecting a moral principle that no-one and no country should be left behind, and that everyone and every country should be regarded as having a common responsibility for playing their part in delivering the global vision’’ (Osborn et. al, 2015). The SDG’s is a successor to the post 2015 Millennium Development Goals MDG’s which was established in 2000 to achieve global goals from poverty eradication to promotion of primary education, gender equality and empowerment of women to ensuring environmental sustainability, etc. The SDG’s framework has a broader scope and is defined by goals that recognize the full economic, social and environmental dimensions of sustainable developments. There are 17 SDG’s to be achieved by 2030 however, for the purpose of this study part six (6) which focus to ensure availability and sustainable management of water and sanitation for all is emphasized.

Figure 9. The 17 Sustainable Development Goals

Source: United Nation, Sustainable Development Goals, 2016

<u>Goal 6 of the (SDG’s) states:</u>

‘’To ensure availability and sustainable management of water and sanitation for all’’.

Access to improved sanitation and safe drinking water is still a daily challenge for many parts of the globe, the focus to achieve sustainable management of water and sanitation for all as addressed in the Sustainable Development Goals is more concentrated to developing countries on how to support to close the loop in sanitation inequalities as proposed by Loewe and Rippin (2015). Loewe and Rippin advise that to be able to achieve the goal on sustainable management of water and sanitation for all implementations of such programmes will require: One, an expansion of international cooperation and capacity building support to developing countries in water and sanitation related activities. For example efforts to mitigate climate change and

strengthen Ghana's capacity in addressing energy, environmental and sanitation challenges the UNDP has been instrumental to supporting its long term goal towards a green economy and a low-carbon and climate resilient society. The SDG's have been adopted and incorporated into Ghana's own 40-year National Development Plan set for 2018 – 2057 (NDPC, 2015). Others include the 50-year Agenda 2063 of the African Union and the Ghana Shared Growth and Development Agenda (GSGDA) which is a medium term national development policy framework. The first policy framework (volume I.) was adopted between 2010 and 2013 with a key policy was aimed to expand access to portable water and sanitation and to ensure environmental sustainability in the use of natural resources through science, technology and innovation (NDCP, 2010).

A second requisite to achieving sustainable management of water and sanitation according to Loewe and Rippin (2015) is support and to strengthen participation of local communities for improving water and sanitation management. Operational policies and procedures for participation of the local communities will be highly required to achieve this purpose. The goal to ensuring availability and sustainable management of water and sanitation for all is shaped by (8) targets expected to be achieved in a decade and half by the end of 2030. For the purpose of the study only part 1 and 2 of the goal is discussed:

Part 1 of the goal addresses the aim of achieving universal and equitable access to safe and affordable drinking water for all. Access to water, sanitation and hygiene is a basic human right yet billions of people globally are faced with challenges for the access to safe drinking water and improved sanitation, as reported by United Nations (2016). Poor sanitation does not only impact or cost economy and GDP, in the Sub-Saharan Africa it costs an enormous 4.3 percent of GDP, however, majority of child diseases and infant mortality are highly related to improper sanitation and safe drinking water. According to the report nearly 1000 children die due to preventable water and sanitation related diarrheal diseases (United Nations, 2016).

The second target (6.2) also addresses adequate, equitable sanitation and hygiene however, it puts greater attention towards gender equality to sanitation access and emphasizing the need to end open defecation. It states therefore, ‘’by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation,

paying special attention to the needs of women and girls and those in vulnerable situations'' (United Nations, 2016). Poor sanitation practices such as open defecation is predominant in some cases causing pollution to water bodies and related health risks. Though considerable progress has been made to reduce open defecation there are still 1.1 billion people which is 15 percent of the global population who defecate in the open (WHO, 2010). For women and girls, inadequate sanitation facilities pose additional burden- often causing school dropout among girls so therefore, *''improving sanitation and achieving equitable access will mean schools should offer private and separate toilets for boys and girls as well as facilities for hand washing with soap which are better equipped to attract and retain students''* (WHO/UNICEF, 2008)

4 METHODOLOGY

Research was done by application of both quantitative and qualitative methods. A systematic approach to understanding the sector was achieved by analyzing sector specific data and interviewing experts of the field of various metropolitan, municipal and district assemblies including the Ministry of Local Government and Rural Development MLGRD to obtain national and regional insights on sanitation. After a pilot to build a two seater eco-san latrine was implemented in the Takoradi Senior High. It was very important to build a pilot to allow respondents of the case study to get familiar with the concept of eco-san technology as a preliminary interview revealed none of the respondents knew nothing about eco-san. Education was therefore given and respondents had the opportunity to use facility and interviews were conducted to obtain user feedbacks/comments. In later developments two other pilots were undertaken in a household and a metropolitan assembly purposefully for marketing and expansion into business, however, for the purpose of the study insights on such projects were not shared.

4.1 Research Design

Application of mixed method was used to explore needs and strategies to developing products and services to promote sanitation in Ghana. First the research brings into light the sanitation needs and challenges of the said country by analyzing indicators, reports, articles, publications from trusted academic sources. As a new concept for the majority and to test products three different piloting projects for a household, school and a metropolitan assembly were executed. Through project planning, observations and interviews first hand consumer insights were obtained to understand niche market and its characteristics. For instance practical insights on cost of production was easily captured through interaction with different suppliers whilst understanding economic health of target groups. Data obtained are monitored and incorporated into developing products that best meet the need of the customer.

4.2 Sample and Sample Technique

Interviews were organized for students of Takoradi High School and inhabitants of the Kwesimintsim area. In all 50 people participated in a structured interview of which 34

were females and 16 males. Respondents were interviewed face-to-face individually for the benefit to capture verbal and non-verbal ques and to really understand behaviors and perception on the topic. It was easy for respondents to discuss on the subject and give feedbacks after experiencing the pilot. Respondents were picked randomly in order to guarantee external validity selection, neutralize and reduce bias.

4.2.1 Sources of Data

The study makes strong use of both primary and secondary data sources. Local and primary insights from the study group was sought by personal interviews on general sanitation provision in their localities to understand the nature/status of sanitation and the need for strategic solutions. The case study which is the residents of Kwesimintsim area (50 participants) gave primary views on sanitation of the area and their personal ways and means of using sanitation facilities. To understand national sanitation coverage the Ministry of Local Government and Rural Development MLGRD which is the body and ministry responsible for infrastructure and sanitation developments on the national level was instrumental for scalable analysis. A pilot project of a composting toilet (Pentalet) was built for use by the Metro Health which is a sector under Accra Metropolitan Assembly AMA dealing with sanitation in the Accra area. The primary idea of the piloting was to offer user experience for the AMA unit and personnel to obtain recommendations for marketing purposes in the country at large.

Secondary sources provided macro analysis data for the study to understand past and current sanitation developments in the region. These include articles, books, academic thesis, reports, news among others to obtain sanitation related insights of the region by different authors and writers. Majority of secondary data used were obtained from Ghana Statistical Service which provide statistics, databases and links etc. on the scope of social, economic, national issues and developments. Other valuable secondary sources were the World Bank, UNICEF, WHO, United Nations, African Development Bank, Water and Sanitation Program WSP among others.

4.2.2 Data Collection Instrument

Initially literature search to understand the broad scope of sanitation in Ghana was precedent to the field study. Related online articles and case studies played meaningful

role to the understanding and development of the study. The topic was developed and endorsed in Research Methods studies and expanded to cover primary market analysis for practical experiment to develop range of composting dry toilets in Ghana. Observational study through piloting three different composting toilets was done not only to test product function but also to obtain clear observations and consumer characteristic of the focus group.

Interviews form greater part of the data collection. Qualitative research interview seeks to describe and the meanings of the central themes in the life world of the subjects (Kvale, 1996). Informants who are students and residents of Kwesimintsim area were directly interviewed to understand sanitation provision and status of the area. Interview was developed on a general theme of household toilet accessibility in a detailed sense to understand:

- Challenges with no or poor household toilet facilities
- Their needs and preferences
- Family structure, incomes and
- Financing planning to support families to afford household toilets.

Expanding access to household toilets has become a policy by the government of Ghana by urging every household to have own toilet. In the Accra Metropolitan area GH-GAMA Sanitation and Water Project is an ongoing project by the government and World Bank to support low income communities to obtain household toilets.

4.2.3 Data Presentation and Analysis

First an analytical study to understand the issue of sanitation of the region was performed, following the design of suitable topics and questions for the study. Secondary data and sources were investigated to ensure genuity and appropriate use of data and material relevance to the study was highly emphasized. Similar technique was applied for primary data collection with a familiarization of the case study and designing interviews. In all 50 people were interviewed with structured questions of whom 34 were females and 16 males. They were all interviewed with same questions from the type of household toilets they have, the challenges they have with household toilets to how much they invest into building household toilets etc. However for the

purpose of business the company advised the author not to include analysis of some data in this paper. Selected data analysis which are presented in this paper are quantitative indicating numerical and statistical values, proportions and percentages

5 RESULTS AND DISCUSSIONS

Based on results from interviews shown in percentages the access to household toilet, type of toilet facilities, prioritize needs, and gender of the respondent group. The representation of these characteristics on pie charts makes it easy to understand the overall difference and proportions to having access to household toilets. Interviews were conducted for 50 respondents of which 34 were females and 16 were males. There was no criteria for selecting between genders, however, closer observation shows that, more females than males were at home during the interview, and the females were more opened to express issues the issues of toilet in their homes.

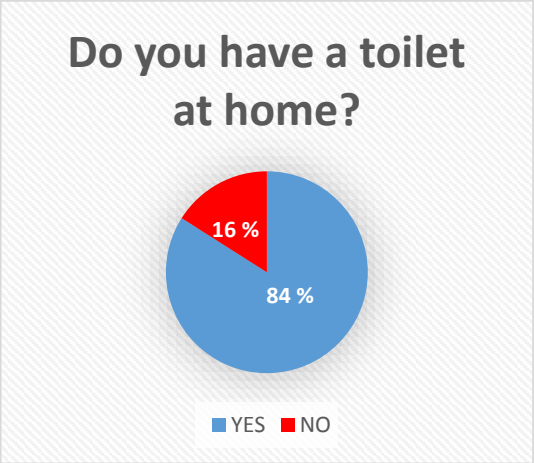

Figure 10. Access to household toilet

The Figure. 10 represents the access to household toilet by 50 residents of Kwesimintsim a township in Takoradi Ghana. The study shows that 84% of the respondents have access whilst the other 16% have no access with the option for having to use public shared facilities. Most of the respondents live in large families- 39 out of the 50 people interviewed live in households with more than 10 people. As a result of excess use and poor maintenance of household shared toilet users have problems to keep facility clean and sanitized. Respondent shared bitter insights not only the issue with lack of improved facility but lack of users' responsibility to keep facility clean.

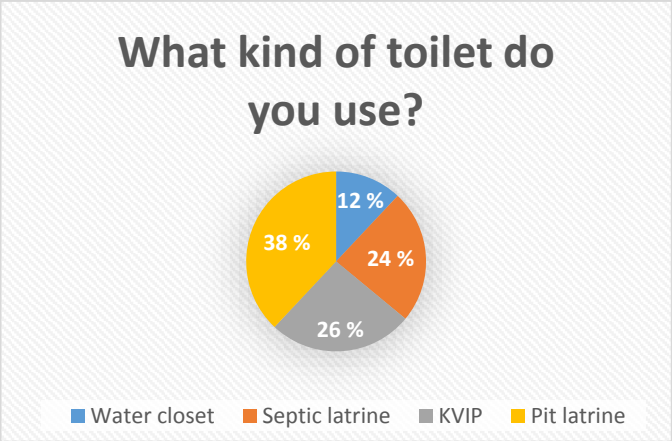

Figure 11. Types of toilet facilities

Figure 11 is elaboration of pie chart presentation for different kinds of household toilets of the respondent. Sampling reveals that pit latrines are the most common facility in the focus community with 38 percent of the case group. According to respondents pit latrines are cheapest household toilet and it requires easy construction. Traditional simple pit latrines have been the most used household and community toilets until the development of the Kumasi Ventilated-Improved Pit Latrines often abbreviated KVIP which was developed in 1970 by Albert Wright at Kumasi University of Science and Technology. KVIP's are twin-pit VIP latrines, which allow contents of one pit to compost while the other pit is in use. By the time the second pit is full, the contents of the first pit should be fully composted, and can therefore be removed manually and spread on fields without health risks (Thrift, 2007). They were first introduced as community toilets but later developments have made it suitable and preferred household toilets in both urban and rural communities.

In Ghana as in other parts of the world water closets are considered as the best household toilets, however inadequate supply water in the country and high maintenance cost put huge challenges for the use of such facility. Out of the 50 people who were interviewed 43 respondents constituting 86 percent preferred WC's to other options like dry toilet.

On an important note the study reveals very low awareness of ecological sanitation in the area. Out of the 50 people interviewed only 3 of them have knowledge of the concept composting toilets and how compost manure can be safely used in agriculture.

Therefore, awareness creation through educations and campaigns will play a vital role to promote ecological sanitation in the region.

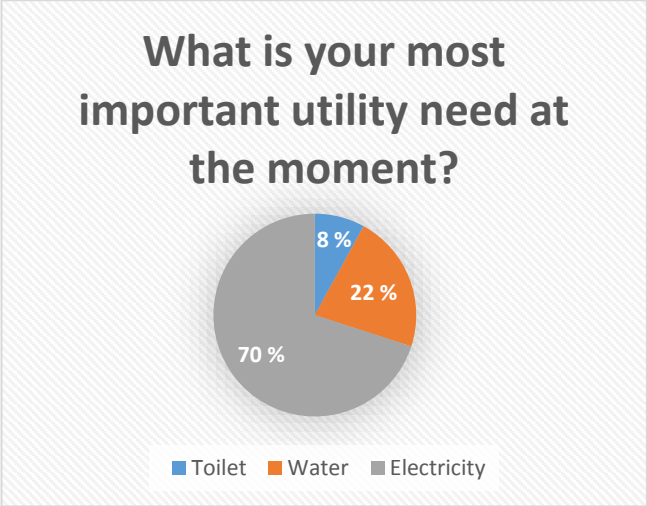

Figure 12. Basic Utilities of Respondents

The interview also seek to understand other basic and everyday needs of the study group, therefore respondents were asked to choose and arrange cards in order of priority that depicts three basic utility needs in Ghana i.e. water, toilet and electricity. Among the 50 people 35 making 70 percent of respondents expressed electricity is the most needed utility in their daily lives.

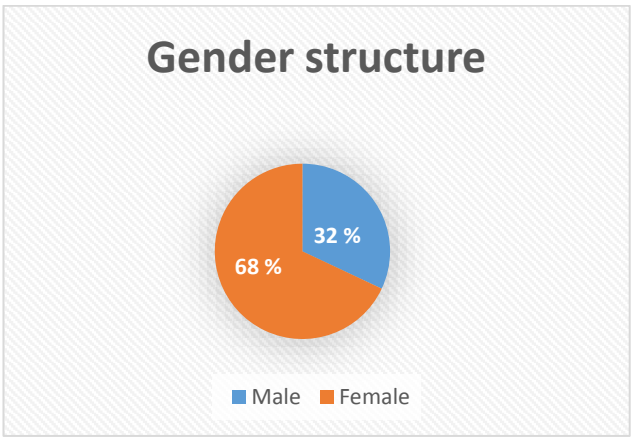

Figure 14. Gender of Respondents

The above figure 11 shows gender of the study group of 50 respondents- There were 34 females forming 68 percent whiles 16 males represent 32 percent. Respondents were selected randomly.

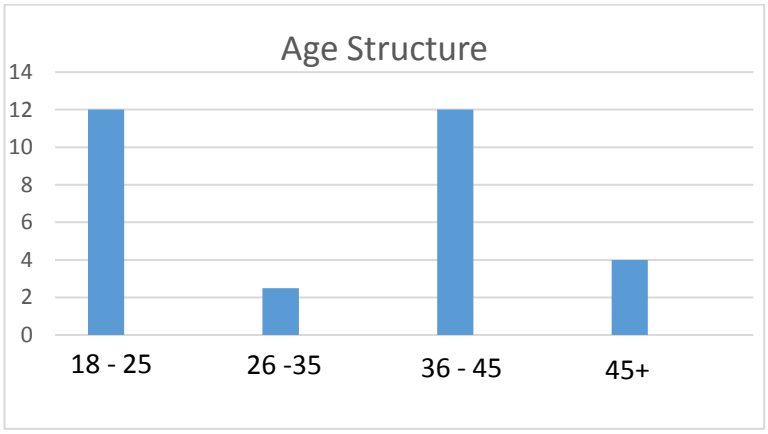

Figure 14. Age of Respondents

The age distribution of the respondents is represented on the above bar chart giving that 12 people were between the ages of 18 and 25, there were 2 people between ages 26 and 35, also 12 people between ages 36 and 45 and 4 people who are ages over 45. Again respondents were not chosen upon certain ages, however, 1 out of 5 respondents interviewed was a student. It was noted that most of the youths outside school didn't show great interest with others having little knowledge on the topic.

6 RECOMMENDATIONS AND CONCLUSION

6.1 Recommendations

The study highlights lots of first hand customer and experts of the field insights of sanitation in Ghana and study can highly be used in the development of suitable and sustainable eco toilets or related solutions in the sector. It's clearly noted that majority of the low and middle income are without access to safe and improved sanitation for a striking fact of low purchasing power. In most cases the costs involved for installation, operation and maintenance of facilities becomes expensive for the average income family. In other ways supports in various forms from international agencies and governments have contributed immensely towards sustainable sanitations in the country, however, experiential developments haven't been accomplished, and often downsized development in the sector is attributed to number of reasons including weak government and sector policies and low financing, and involvement of local players will make significant impacts on sanitation (Kanton et al, 2010). In this study the issue of low access to sanitation is addressed in a different way. One main challenge to sanitation in Ghana is due low contributions from local organizations and the private sector as noted by Kanton in their publication *'Urban water and Sanitation in Ghana: How Local Action is making difference'*. There's has been failure to give attention to indicators, financial mechanisms and institutions designed by local organizations at local levels Kanton expresses that the dominant response for development in the sector has been to look to internationally comparable indicators to monitor improvements and international financial mechanisms to fund projects. He adds that there are innovative and inspiring examples of local initiatives that can contribute to development of water and sanitation provision in deprived areas. Similarly the main goal of this study was to research on how locally designed eco-san latrines can contribute to increasing access to household toilets and sanitation development in general. I strongly believe development of eco-sans can have great impacts and contributions to sustainable sanitation in many ways as expressed earlier having the benefits to reduce the amount of water in the transportation of human wastes and the recycling/reuse of end product to boost agriculture outputs among other things.

6.2 Conclusion

Access to improved household toilets in Ghana is very low and majority of households' toilets are shared among multiple people which considered by the Joint Monitoring Programme as unhygienic or unimproved. Approximately 80 percent of residential toilets are shared between more than one household. Households' dependence on public toilets is high among low and middle income families and in my close observations most houses in the cities have no spaces in the house to construct toilet facilities. For such reasons majority of the city dwellers rely on public toilets which are not sanitized. Worse open defecation is an alarming practice in Ghana with about 19 percent of population. The rates are high among rural and peri-urban settlements. The local newspaper Daily Guide (2015) recently reported Ghana is the second in the world after Sudan for the highest rates of open defecation. Consequently, these issues of lack of improved sanitation and high practice of open defecation causes the spread of diseases such as cholera and diarrhea. These two sanitation related diseases are major causes of infant mortality, diarrhea alone causes 25 percent of deaths in children under age of 5 according to Water.Org (2015). Although Ghana made remarkable developments in the provision of safe drinking water towards the Millennium Development Goals agenda for achieving 81.6 percent access in 2013, its goal to expand access to sanitation was far from reach, only a quarter of Ghanaians had access to improved sanitation at the end of MDG's according to Ghana Statistical Services (2014). Among other reasons the major challenges for low sanitation coverage in Ghana as addressed in the Millennium Development Goal report are due to rapid urbanization, low investment in sanitation delivery and weak environmental sanitation systems for enforcement and monitoring (MDG's, 2015). Considering the current state of low access to improved toilets and indiscriminate disposal of wastes in Ghana eco-san could be a pragmatic solution in addressing issues. This is for the fact that eco-sans are ecological minimizing the use of water for transporting human wastes and wastes produced are recycled in eco-san implementations. Additionally recycled wastes which becomes a valuable compost manure is used to boost agriculture output. It was identified that awareness of eco-san in Ghana is very low, therefore, programmes and campaigns should be aimed to educate and sensitize people and communities on the challenges of sanitation and how eco-san can contribute to sustainability. This will require wider participation by not only

government institutions but including the private sector, individual entrepreneurs and enthusiasts to accelerate the pace. And last but not the least the sector must be encouraging for private sector in the form of government supports, incentives and tax alleviation especially for small and medium sized companies.

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8 APPENDIX

8.1 Interview Questions

1. Do you have toilet at your home?
   Yes
   No
2. How many people live in your household?
   1-5
   6-10
   11-20
   20+
3. What kind of toilet do you use?
   Water Closet
   Septic latrines
   KVIP
   Pit latrines
4. What challenges do you have using toilet?
5. What kind of toilet do you want to have?
   Water closet
   KVIP
   Dry toilet
6. How much does a sanitized toilet cost?
7. Can you save to buy a toilet?
   YES
   NO
8. What is your important need at the moment?
   Toilet
   Water
   Electricity
9. What other sanitation problems do you have in your area?

10. Do you know composting toilet?
    YES
    NO
11. Age
    18-25
    26-35
    36-45
    45+
12. Gender
    M
    F