

Chapter 1: Introduction

Poor sanitation has serious consequences for health (WHO/UNICEF, 2000), a fact easily seen in the impacts of water and sanitation related diseases on human health. For example, diarrhoeal diseases alone cause over two million deaths every year (Parry-Jones and Kolsky, 2005), most of these in children (WHO, 2006). 21% of all mortality in children under five in developing countries is attributable to diarrhoea (Kosek, 2003), equivalent to one child dying every twelve seconds (Parry-Jones and Kolsky, 2005). Other health issues such as intestinal helminth infections affect 133 million people with 9400 deaths every year (WHO, 2004), while an estimated 160 million people are infected with schistosomiasis, causing tens of thousands of deaths every year, in sub-Saharan Africa (WHO, 2004).

Although grievous the situation is not without hope. Improved sanitation alone reportedly reduces diarrhoea morbidity by 32% and schistosomiasis by up to 77%, with even higher rates in combination with improved water supply and hygiene (WHO, 2004).

What is sanitation? The term ‘sanitation’ has been given various definitions by different authors and researchers most of which generally encompass all conditions that affect health – water, wastewater, personal and food hygiene, public health, etc., this description though right is rather broad. For the purpose of this work the term sanitation will refer specifically to wastewater management i.e. the treatment and disposal of sewage from domestic sources and is used interchangeably with ‘wastewater management’ unless indicated otherwise.

1.1 Urban Sanitation

Sanitation as we know it in the developed world today has its origins in the public health disasters of the 1800s when people died of diseases caused by exposure to faecal contamination e.g. the cholera epidemics that swept across Europe. The first major epidemic in Europe reportedly killed over a million people between 1830 and 1832 (Wyn-Jones, 2000). In some cities, public streets were awash with (excrement) as many homes discharged their waste into overflowing cesspits and in some cases onto streets. When in 1854 John Snow’s connection between the cholera deaths in London and sewage-polluted water sources, was established (Cooper, 2001), the focus of the intervention measures then was to transport the waste material away from people and dwellings, which in essence gave birth to modern sewers. The sewage collected was simply dumped into water bodies, the idea was that the sewage would be diluted and dissipated. However, problems arose when the rivers also became polluted due to very high sewage loads; this occurrence and attempts at water pollution control eventually led to the development of treatment systems for sewage which has consequently grown into the conventional sanitation approach as we know it today.

“There are hundreds, I may say thousands, of houses in this metropolis which have no drainage whatever, and the greater part of them have stinking, overflowing cesspools, and there are also hundreds of streets, courts and alleys that have no sewers; and how the drainage and filth are cleaned away and how the miserable inhabitants live in such places it is hard to tell... I have visited very many places where filth was lying scattered about the rooms, vaults, cellars, areas, and yards, so thick and so deep that it was hardly possible to move for it. I have also seen in such places human beings living and sleeping in sunk rooms with filth from overflowing cesspools exuding through and running down the walls and over the floors... the effects of the effluvia, stench and poisonous gases constantly evolving from these foul accumulations were apparent in the haggard, wan and swarthy countenances and enfeebled limbs of the poor creatures whom I found residing over and amongst these dens of pollution and wretchedness...Morality, and the whole economy of domestic existence is outraged and deranged by so much suffering and misery.” (Phillips, 1847)

This quote depicting living conditions in the city of London in the not too distant past could easily fit the situation in many of the world’s developing countries today. Life especially for the urban poor can be very hard. It is common knowledge that the rate at which urbanisation is occurring throughout the developing world is not commensurate with that at which housing, infrastructure and services - all basic necessities, are being provided. Rapid urban population growth and the inability and in some cases unwillingness of developing country governments to provide improved housing and basic services has hitherto intensified the development of slums (peri-urban /squatter settlements) in and around many urban centres. These settlements are known to be among the worst of polluted places in the world (Hardoy et al., 2001) as a result of inadequate sanitation services stemming from factors such as inadequate financial resources, insufficient water, lack of space, difficult soil conditions, and limited institutional capabilities (Esrey et al. 1998), and the situation is expected to worsen as population increases.

However these problems are not limited to squatter settlements; indeed when one considers the scale of problems that exist in planned ‘legal’ settlements one can only wonder at what the “illegal” slum settlers who often live outside government recognition, on land no one else wants, and in amazingly appalling conditions, must face on a daily basis, as they struggle to take their place on this earth we all call home.

The situation in most developing countries as regards sanitation has been in the best case scenario to adopt the same approach as obtains in the developed world – conventional sewerage sanitation with the hope of replicating similar benefits. The problem with this approach is that many developing countries simply end up importing technologies for which they lack the required finances, technical expertise or institutional capabilities to operate and sustain. The implications of such decisions are negative for both human and environmental health. Examples abound of situations where such systems have been implemented and have failed. In other cases the ‘do nothing’ or ‘drop and store’ approaches are common. In addition to examining sanitation conditions in the peri urban

areas, this study will relate the experience of the new capital city of Nigeria, Abuja with the conventional sanitation approach.

1.2 The Role of Sanitation in Sustainable Development

In recognition of the importance of sanitation to the objectives of sustainable development which the Brundtland Commission in its 1987 report defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (UN, 1987), the MDG goals on sustainable developments has as one of its targets (goal 7) ‘to **reduce** by **half** the proportion of people without **sustainable** access to safe drinking **water** and **sanitation** by **2015**’, a laudable ambition no doubt. However, according to the mid-term assessment of progress on reaching the MDGs – ‘Meeting the Millennium Development Goals (MDG) drinking water and sanitation target’, more than 2.6 billion people - over 40 per cent of the world's population - do not have access to basic sanitation and more than one billion people still use unsafe sources of drinking water (WHO, UNICEF, 2004). The majority of these people reportedly live in the developing world particularly in sub-Saharan Africa, in countries with annual per capita incomes as low as 107 USD (IMF, 2006), where many live on less than one dollar a day, in places rife with poverty, disease.

According to the same report, which details the progress of countries, regions, and the world between 1990 and 2002, sub-Saharan Africa “has the lowest percentage of people with access to basic sanitation facilities – 36%, an increase of just four percent since 1990”. Worldwide only 49% are reported to have access to adequate sanitation facilities in developing countries in comparison with 98% for the developed countries.

The report further asserts that based on the current pace of advancements, global sanitation targets will be missed by about “half a billion people - most of them in Africa and Asia - allowing waste and disease to spread, killing millions of children and leaving millions more on the brink of survival” (WHO, UNICEF, 2004). The situation is obviously dire and discouraging.

Even if the conventional sanitation approach worked in developing countries, the challenge of meeting the sanitation target of the MDG goal 7 requires providing adequate sanitation access to an estimated 95,000 people per day worldwide (Rockström et al., 2005), this of course requires huge amounts of investment if conventional sanitation is considered. Simply put, for most developing countries installing conventional sanitation means debt, more debt than they already have and certainly more than they can afford. It means paying great prices for systems that are almost bound to fail or that at best will not be sustainable in the long term due to costs among a variety of factors further discussed in Chapter 2. The implication of this is that eventually more people will lack access to sanitation with even greater negative impact on human and environmental health as populations grow and untreated wastewater is discharged into the environment.

For rural dwellers and the urban poor who often lack services and have to rely on water sources (rivers and streams) that serve as sinks for wastewater, the consequences are potentially disastrous – ill health, inhibited productivity or inability to work and consequent poverty. There is a cycle in motion in the lives of the urban poor. They are poor so they live in unhealthy conditions (slums and squatter settlements) and consequently get sick; being sick means they cannot work to earn enough to improve their living conditions or move to better places as such they remain poor and in these environments all their lives and many never break out of the grip of poverty. To people in this situation sustainable development remains an incomprehensible and unrealistic concept.

1.3 Goal Seven and the Urban Poor

Lack of access to adequate sanitation is a huge problem, with a potential for causing extensive damage to health, environmental, economic and social aspects of life, particularly in urban areas as many cities in the developing world are over-populated resulting mostly from extensive rural–urban migration and unbridled population growth.

The UN-Habitat's report *The Challenge of Slums: Global Report on Human Settlements 2003*, estimates about 900 million people – approximately one in three of the world's urban population – live in slums. The situation appears to be most grave in sub-Saharan Africa where the proportion of urban slum dwellers is highest at 71.9% (UN-Habitat, 2003).

To say that the living conditions for the urban poor are unhealthy is not only stating the obvious but also a gross understatement. In most of these places, the lack of means to dispose of human waste, household sullage and solid waste (Sinnamtaby, 1990), means there is often a presence of pathogenic microorganisms (especially from excreta) in the living environment. This coupled with a lack of basic services such as access to good quality drinking water, basic health care, malnutrition and a lack of knowledge of basic disease prevention strategies, means many of the diseases that result in a high death rate are endemic in these areas.

The health problems prevalent in most developing countries according to the WHO, are infectious and parasitic diseases, which according to the World Health report of 1998 represented the highest cause of death in developing countries, 43% of all deaths in 1997 alone (WHO, 1992, 1998). UNICEF (2004) child mortality figures indicate, *Infant Mortality* rates of 101 babies per 1000 live births in Nigeria compared to 4 in Germany, while *Under Five Mortality* is an estimated 197 deaths in Nigeria and 5 in Germany. Other sources on child mortality also indicate that poverty plays a role in the observed mortality figures – a twenty-fold difference between rich and poor (DFID, 2005).

Following the epidemics in Europe, links between living conditions, infrastructure, services and disease were made by experts of the time. Edwin Chadwick, strongly advocating improving the lot of the urban poor in the city of London, called for strong

executive bodies to solve the problems of sanitation in his report to the United Kingdom parliament on the dastardly living conditions of the urban poor at that time. In the report, he recommended intervention strategies to improve the health of the urban poor such as water supply and sewage collection systems (Chadwick, 1842 at <http://www.victorianweb.org/history/chadwick2.html>). Even today, the provision of infrastructure, basic services, sanitation systems, which meet the requirements of users technically, socio-culturally and economically alongside the promotion of good hygiene practices, is proving to be one of the most effective ways to improve health by preventing or limiting communicable diseases (Sarmento, 2001).

1.4 Conventional Sanitation vs. Sustainable Sanitation

One of the ways the sanitation problem has been addressed in developed countries is through the use of conventional sewerage; one of the main impacts of this on the environment is the over exploitation of natural resources. The operation of these systems is simply too resource intensive for them to be the sustainable choice for all. The abuse resulting from improper operation and use will ultimately lead to irreversible degradation of natural resources such as soil and water. There are some who believe future wars will be fought over natural resources such as water as the world supply of water becomes limited due to overuse and degradation of quality (Segerfeldt, 2005).

The shortcomings of the conventional approach are coming to the fore even in the developed countries, and experts are beginning to acknowledge that the approach of using huge amounts of water of drinking quality to transport small fractions of waste to a treatment facility only to expend huge amounts of energy and effort in an attempt to separate the waste mixed into the water in the first place may not be the best at all; further, treatment is not always guaranteed. In many cases where conventional sewer systems are available, there are no treatment facilities and wastewater is discharged untreated into water bodies, a situation that many researchers agree is prevalent in most developing countries; 95% of the total amount of sewage in developing countries is discharged untreated (WRI, 1998). The same scenario is found even in some European cities; according to a 2001 press release from the EU Commission on Environment, 37 European cities still discharged wastewater untreated into the environment; the statement further asserts that many other cities discharged only partially treated effluents (http://ec.europa.eu/environment/nsf/city_sewage.htm). The implication of this practice is of course the pollution of water bodies with consequent degradation of water quality.

With the advancement of science and technology, research gives evidence of some potentially severe consequences arising from conventional sanitation. An example is the release of recalcitrant substances among which are those that acts as endocrine disruptors into water bodies, which as shown by some studies is causing feminisation of some aquatic species, (Blaise et al, 2003 and Cone, 1998).

The question is with knowledge of all these, should developing countries follow the same path knowing they might face the same issues in future without the capabilities developed countries have at their disposal? Indeed sanitation bears rethinking in both developed and developing countries, with issues of costs, resource availability/consumption and potential for environmental degradation, conventional sanitation is not a one stop solution to the world's needs.

Sustainable technologies must be the focus for developing countries in the bid to provide access to sanitation. It is understood that prestige, convenience and affordability are among the most significant factors in people's choice of sanitation systems, there are non conventional technologies already available that will meet the conditions of the most discerning of users. However, there is not enough information disseminated about such technologies and this must be rectified. Adopting locally sustainable sanitation technologies requires the dissemination of information to local decision-makers as well as developing the technical capacities required for installation, operation and maintenance of such technologies in local conditions.

Many authors have given various definitions to sustainable sanitation. In general however, sustainable sanitation may be described as that which is most appropriate to the purpose and local conditions (institutional, socio-cultural, economic, and technical) of its intended users. Factors such as low costs, low maintenance requirements, local availability of installation, operation and maintenance materials, resources and skills as well as adequate institutional capabilities and social acceptance among others determine the appropriateness hence sustainability of a technology.

Non conventional sanitation alternatives (low cost, low tech) exist that are likely to be more suited to the situations in most developing countries. Examples of these include 'ecological sanitation' (EcoSan) systems and those that could be termed 'low cost conventional' systems (discussed in Chapter 2).

Ecological sanitation may be described as a closed-loop system, which views human waste as a resource rather than a waste and recognizes that it is essential to sanitize human excreta before its reuse. 'Low cost conventional' sanitation systems have also been applied in many developing countries. Proponents of low-cost conventional sanitation have put forward their case on the benefits of installing such systems in terms of health improvements, low cost (construction, operation, maintenance, and water consumption) and their applicability especially in urban areas even in high-density conditions.

1.5 Meeting the Sanitation Target

Projections and statistics regarding the MDG sanitation targets imply that with the status quo these targets will not be met unless some very radical measures are taken. Currently global efforts are neither meeting the needs of the present population, as only 36% of the

population in sub-Saharan Africa are currently served with sanitation services, and the needs of future generations is unlikely to be met if the present trends continue (UNICEF/WHO, 2004).

The challenge presented by lack of access to sanitation is not new, but it is huge and growing. Its impact on the dignity and quality of life especially of the urban poor can be debilitating – a gripping cycle of disease, poor health and poverty from which escape seems almost impossible.

The combination of poverty and poor health is a problem not only for the affected individuals but also for whole countries. No country is able to achieve significant growth and development with a huge proportion of its productive workforce enervated by disease. The direct costs associated with disease both to individuals, who when poor are unlikely to be able to afford appropriate or effective treatments, and to governments who may lack the resources to deal adequately with the large-scale public health problems resulting from or exacerbated by water and sanitation related issues can be overwhelming. As the UN Secretary-General, Kofi Annan, correctly observed “we shall not finally defeat AIDS, tuberculosis, malaria, or any other infectious diseases until we have also won the battle for safe drinking water, sanitation and basic health care” (WHO, 2004).

1.6 The case of Abuja, Nigeria

Abuja the new capital city of Nigeria has a huge and growing population due to massive and continuous rural–urban migration of people coming into the city in search of a ‘better’ life. These people are not catered for in the original plan and due to the city’s exorbitant living costs, are forced to live outside the “mainstream” community in unplanned and illegal peri-urban settlements. The result is that slums are fast developing around the once pristine city, which is now a source of concern for the authorities.

After trying the usual strong arm tactics of dealing with squatter settlements the local authorities have begun to acknowledge that the situation needs to be handled in a better, more constructive way, which will present beneficial possibilities to both the populace and the authorities. This has led to discussions about possible intervention strategies to create opportunities for the development of areas outside the main city, thereby encouraging a spread rather than the current concentration of development in and around the main city; plans are focused on resettlement rather than legalising existing illegal settlements through introducing various land /home ownership schemes and providing basic infrastructure and services to the people in these areas.

Conventional sanitation is not a sustainable option for most communities in the developing world for various reasons (discussed in Chapter 2); the Abuja case is no exception especially considering the costs of expanding the existing infrastructure to include those without access as in this situation.

Considering the dangers of lack of access to sanitation facilities, improper wastewater management practices, and the drawbacks of conventional sanitation, it is imperative that locally appropriate strategies (technology and management) be adopted for the case of Abuja and not simply a replication of unsustainable solutions from the developed world. To reiterate an earlier point, the MDG 7 points to sanitation as a key element in sustainable development. In the context of sanitation, sustainable development would mean, access to sanitation for all that does not withdraw more fresh water resources than necessary if at all, and which does not pollute soil, surface or groundwater, and also allows for the essential nutrients in human waste to be recycled back into the environment in a way that will not adversely affect human health.

Abuja is currently served by various conventional systems, the main ones being: centralised sewage transport and offsite treatment, or onsite collection and storage, all of which have local human and environmental implications. In this research work, wastewater management practices in Abuja and its peri urban settlements will be examined; non conventional alternatives - 'ecological sanitation' (EcoSan) systems and 'low cost conventional' systems will also be examined for their suitability and feasibility in the local context. A field study carried out in Abuja is incorporated into this study, with the findings (current local issues, impacts, user preferences, etc.) inputted into the selection of potentially feasible sanitation technologies and from these, sanitation scenarios were developed; costs for each scenario are estimated to determine its economic feasibility.

1.7 Outline of the Report

Details of the work done during this research study are presented in this thesis as follows: **Chapter 1**, the current chapter, presents an introduction to the subject of the research. An overview of sanitation, its role in development, its problems and impacts are briefly discussed. **Chapter 2** presents a review of the research issues discussing sanitation and related issues (importance, approaches, impacts, technologies); background information about the study area and an overview of the water and sanitation sector in Nigeria are presented; the problem of squatter settlements in the study area is also discussed. **Chapter 3** discusses the significance of the study, its purpose, objectives and limitations. In **Chapter 4**, the methods applied in the fieldwork and other parts of the research study are described. **Chapter 5** presents and discusses the results of the research focussing on the findings of the fieldwork. The proposed sanitation scenarios and associated costs are presented in **Chapter 6**. The conclusions of the study and recommendations are discussed in **Chapter 7**.

Chapter 2: Review of Research Issues

This chapter presents a review of the research issues, discussing sanitation – its importance, approaches in sanitation, and impacts of lack of sanitation; it gives a brief overview of sanitation technologies as well as other related issues. Background details of Nigeria and in particular the study area are also presented.

2.1 The Importance of Sanitation

Access to sanitation is an important indicator of development as denoted by its inclusion in the MDGs for sustainable development. At the local or community levels, sanitation or a lack of it has direct and concrete impact on people and the environment in which they live. Appropriate and safe management (collection, treatment and disposal) of wastewater (excreta and sullage) is essential for the protection of human and environmental health, and also offers important social benefits to communities (Scott et al., 2003). Some of these benefits include:

Human health: the impact of lack of sanitation is seen primarily in the area of health. Links between sanitation and health have long been established; a host of debilitating and deadly diseases are associated with lack of sanitation and may be reduced or prevented with sanitation interventions; health benefits of sanitation can be seen in the reduction of diseases in communities where sanitation facilities are present. WHO figures assert that while improved water supply reduces diarrhoea morbidity by between 6% and 25%, improved sanitation reduces diarrhoea morbidity by 32% with the reduction levels rising up to 45% when hygiene interventions are provided (WHO 2004). Myint and Aye (1988) in a study of nine villages in Myanmar, report a 60% reduction in diarrhoea attributed to the provision and use of latrines. As Dr Jong-wook Lee, aptly puts it, “*Water and Sanitation is one of the primary drivers of public health. I often refer to it as “Health 101”, which means that once we can secure access to clean water and to adequate sanitation facilities for all people, irrespective of the difference in their living conditions, a huge battle against all kinds of diseases will be won*” (WHO, 2004).

Environmental health: as noted in chapter one, the cholera epidemics in Europe led to links being made between living conditions and disease prompting the development of intervention measures first to transport the waste away from the living environment and subsequently to treat the wastewater before disposal. According to the WHO Expert Committee on Environmental Sanitation in 1954, the provision of sanitation is among the first basic steps that should be taken towards ensuring a safe environment (WHO, 1954). The release of untreated excreta into the environment is a significant factor in the pollution and degradation of both water and soil quality. The effects of this can be seen in developing countries as most of the generated raw wastewater is discharged into surface water bodies; an example is Lagos, Nigeria where many of the water bodies have either become acrid due to organic pollutant overload, or as reported by Iwugo et al. (2003) polluted by pathogenic organisms and heavy metals from industrial discharges.