A REVIEW OF SANITATION AND HYGIENE IN TANZANIA

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EXECUTIVE SUMMARY

Tanzania is not on track to meet its Millennium Development Goal of 62 % improved sanitation coverage by 2015. This failure is due to population growth characterised by rapid urbanisation which the Government of Tanzania is unable to service due to limited capacity, resources and lack of coordination of the other implementing stakeholders. Inadequate sanitation and hygiene results in morbidity and mortality for Tanzanian's due to endemic infections resulting in diarrhoea and other illnesses. This review summarises all the available literature to provide the current status of sanitation and hygiene and an overview of projects and programs in Tanzania. Finally, gaps have been identified in the current knowledge and recommendations made on how to improve sanitation and hygiene in Tanzania.

This review identified the current stakeholders in sanitation and hygiene in Tanzania to include; office of the Prime Minister, three government ministries, local government areas, 12 donor and multilateral agencies, 5 private donors, 13 international non-government organizations (NGO), 18 local NGO, 2 faith based organizations, 2 networks as well as numerous actors from community based organisations and the commercial sector. Stakeholders interact through the policy process, funding, implementation, research, evaluation, networks and partnerships.

The health burden due to poor sanitation and hygiene is significant. Diarrhoea in the preceding two weeks is reported on average in 15 % of children under five years of age and results in 9 % of all mortality for this age group. Cholera and Typhoid is endemic in some areas of Tanzania and outbreaks are common. Then there is the ever present problems of water related parasitic infections such as malaria and schistosomiasis. Prevalence of these infections in Tanzania has been scientifically linked to poor sanitation and hygiene; in particular a access to latrines, poor hand washing behaviour, and inadequate drainage.

Across Tanzania it is estimated that 93 % of the population has access to a latrine. However, when assessing access to improved sanitation that figures drops to 24 %, depending on the definition of improved sanitation used. There are differences between urban and rural areas with urban areas particularly in Dar es Salaam reporting lack of access to affordable sanitation due to costs of construction, high water table and desluding expenses. In urban areas lack of solid waste collection and poor drainage combined with extensive use of pit latrines make for very poor hygiene conditions. Hygiene behaviour in Tanzania varies, although hand washing is widely practiced except not always with soap nor at critical times such as before preparing food or after disposing of children's faeces. Programs and projects implemented across Tanzania vary in their scale. Large government run multi-donor programs such as the Water Sector Development Program (WSDP) operate on a national scale. WSDP has brought together a number of the stakeholders. However, the program has only a fraction of its budget allocated to sanitation and hygiene projects with the majority focused on water supply. Up-scaling of the World Bank funded Water Sanitation Program (WSP) using a market led approach to hand washing and sanitation adoption has been shown to be successful in reaching large a number of people in the community although quantifying the impacts of the program was not achievable.

International and local NGO are conducting programs and projects on smaller scales across most regions of Tanzania. Affordable improved sanitation and safe sustainable pit latrine emptying practices in urban areas are examples of such projects. The projects vary in their approaches and some focus on the needs of specific groups such as pastoral tribes, women and children, refugees, schools and health care clinics. Hygiene education programs through schools have been shown to be effective at changing behaviour. The results from this work varies from ineffective or un-measurable outcomes to sustained up-take and changed behaviour. The challenge is the replicate the results seen at small project level at scale through national sustainable programs.

Within the literature reviewed there were gaps identified in knowledge of sanitation and hygiene in Tanzania. For sanitation there is a lack of information regarding the markets for sanitation in urban areas. In comparison to sanitation there was less information available about the state of hand washing hardware and behaviour. There was also very little information about oral, anal washing or menstrual hygiene practices.

Recommendations on how to improve sanitation and hygiene in Tanzania are centered around adoption of participatory approaches between all the stakeholders. However, this requires the Tanzanian Government to have clear policies and regulations with respect to sanitation and hygiene. Hence, it is of paramount importance that the draft policy on sanitation is accepted promptly. Further, there needs to be more investment into sanitation and hygiene at all levels of government. NGO and community based organizations have a role to play in both driving this policy but also assisting the government in implementation and efficient use of resources. Tanzania will not reach its 2015 Millennium Development Goal for sanitation. Now that attention has been directed to the importance of sanitation and hygiene a change of direction characterised by a coordinated response between all the stakeholders is needed for real improvements.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADB	African Development Bank
AFD	Agence Française de Développement (French Development Agency)
AGENDA	Agenda for Environment and Responsible Development
AMREF	African Medical Research Foundation
ARU	Ardhi University
AWSETEC	Agriculture, Water & Sanitation Education Training & Environment Conservation
BORDA	Bremen Overseas Research and Development Association
CBHCC	Community Based Health Care Council
CBO	Community Based Organisations
CEMDO	Community Environmental Management and Development Organisation
CLTS	Community Led Total Sanitation
CSO	Civil Society Organisations
CSUPPU	Citywide Slum Upgrading and Prevention Programme Unit
CWSSP	Community Water Supply and Sanitation Program
DALY	Disability Adjusted Life Years
DANIDA	Danish International Development Agency
DAWASA	Dar es Salaam Water and Sanitation Authority
DAWASCO	Dar es Salaam Water and Sewerage Corporation
DFID	United Kingdom Department for International Development
DWSSP	Dar es Salaam Water Supply and Sanitation Project
ECO-SAN	Ecological sanitation
EEPCO	Environmental Engineering and Pollution Control Organisation
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Development Organisation)
GPS	Global positioning system
HAPA	Health Actions Promotions Association
HESAWA	Health Through Sanitation and Water
HNCDA	Hanna Nassif Community Development Association
iWASH	Integrated Water, Sanitation and Hygiene Program
JEMA	Joint Environment Management Action
JMP	Joint Monitoring Programme
KfW	Kreditanstalt fur Wiederaufbau (Germany Bank for Reconstruction)
KIWODET	Kisutu Women Development Trust Fund
LGA	Local Government Authorities

MAMADO	Maji na Maendeleo Dodoma
MAPET	Manual Pit Emptying Technology
MCC	Millennium Challenge Corporation
MDG	Millennium Development Goal
MKUKUTA	Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania (National Strategy for Growth and Poverty Reduction)
MoEVT	Ministry of Education and Vocational Training
MoHSW	Ministry of Health and Social Welfare
MoWI	Ministry of Water and Irrigation
MSABI	Maji Safi Kwa Afya Bora Ifakara (Safe Water for Better Health)
MWAUWASA	Mwanza Urban Water and Sewerage Authority
NBS	National Bureau of Statistics
NEHHASS	National Environmental Health, Hygiene and Sanitation Strategy
NGO	Non-Government Organisations
NHBS	National Household Budget Survey
NSGPR	National Strategy for Growth and Poverty Reduction (see MKUKUTA)
PHAST	Participatory Hygiene and Sanitation Transformation
PMO - RALG	Prime Ministers Office - Regional Administration and Local Governments
PRA	Participatory Rural Appraisal
ROSA	Resource Orientated Sanitation concepts for peri-urban areas in Africa
SAWA	Sanitation and Water Action
SHARE	Sanitation and Hygiene Applied Research for Equity
SHIPO	Southern Highlands Participatory Organisation
SIDA	Swedish International Development Corporation Agency
SNV	Stichting Nederlandse Vrijwilligers (Netherlands Development Organisation)
TaWaSaNET	Tanzania Water and Sanitation Network
TDCF	The Desk and Chair Foundation
TESCO	Tanzania Environment and Sanitation Conservators
TWESA	Tanzania Water & Environmental Sanitation
TZS	Tanzanian Shilling
UN HABITAT	United Nations Human Settlements Programme
UN HCR	United Nations Refugee Agency
UNICEF	United Nations Children's Fund
USAID	United Stated Agency for International Development
USD	United States Dollar

VEFDA	Victoria Environmental and Fishery Development Association
VIP	Ventilated Improved Pit Latrine
VSO	Voluntary Services Overseas (Tanzania)
WASACODE	Water and Sanitation for Community Development
WASH	Water, Sanitation and Hygiene
WB	World Bank
WHO	World Health Organisation
WRBWO	Wami/Ruvu Basin Water Office
WSDP	Water Sector Development Program
WSP	Water and Sanitation Program



Figure 2. Unimproved sanitation - a typical pit latrine with earth floor and privacy screen made from hessian and palm fronds.

DEFINITIONS

Key terms	Definition	Reference
Informal urban settlements	Areas in an urban environment that are both unplanned and un-serviced. They can be further defined as high, medium or low density settlements.	(United Nations Human Settlements Programme <i>et</i> <i>al.</i> , 2010)
Improved sanitation	A latrine that is connected to a sewer, septic tank, ventilated improved pit latrine, ecological sanitation, pour flush latrine or pit latrines with a washable floor and a complete super-structure.	(Ministry of Health and Social Welfare, 2008)
Non Government Organisation	A legally constituted organisation that operates independently from any form of government on a not - for - profit basis.	(World Bank <i>et</i> <i>al.</i> , 2011)
Improved Water Point	The point at which water is intended to emerge from an improved water supply, such as a tap or a pump	(Stichting Nederlandse Vrijwilligers, 2010)



Figure 3. Waste water stabilisation pond

1. INTRODUCTION

1.1 Tanzania

Tanzania has a population of 44.9 million people (Tanzania National Bureau of Statistics, 2013). The average population growth rate in 2012 was 2.7 % although in the country's largest city, Dar es Salaam, the growth rate was 5.6 % (Tanzania National Bureau of Statistics, 2013). In 2013 it is estimated that 27.8 % of Tanzania population lives in urban areas (World Health Organisation and United Nations Children's Fund, 2012). The population of the 20 largest cities in Tanzania is estimated to increase by 50 % this decade (9.2 million people in 2010 to 13.8 million people in 2020) (Pauschert *et al.*, 2012). By 2025 it is projected that the urban population will have doubled to 21 million (Abebe, 2011). Rapid urbanisation in Dar es Salaam has resulted in 70 - 80 % of the population living in informal settlements and 50 % of these people live off less than US\$ 1 a day (Chaggu *et al.*, 2002; Ndezi, 2009; United Nations Human Settlements Programme, 2010).

Despite quadrupling of funding for water and sanitation since 2002, Tanzania is not on track to meet the Millennium Development Goal (MDG) for sanitation provision; 62 % of population with access to improved sanitation by 2015 (World Bank *et al.*, 2011). Population growth and rapid urbanisation are confounding factors in this failure to meet this MDG (World Health Organisation and United Nations Children's Fund, 2006). In Tanzania is has been estimated that inadequate sanitation costs 301 billion Tanzanian Shillings (TZS) each year (US\$ 206 million) (Water and Sanitation Program, 2012). This is equivalent to 1 % of Tanzanian gross domestic product (GDP) and US\$ 5 per person (Water and Sanitation Program, 2012). The economic losses are directly related to loss of time for people having to find places to defecate, premature death, productivity losses whilst sick and money spent on health care (Water and Sanitation Program, 2012). In order to find the best approaches to improve sanitation and hygiene in Tanzania a thorough understanding of the current status of sanitation and hygiene and the programs and projects that have been or are currently being implemented is needed.

1.2 Methodology

This reviews aims to collate and summarise the available literature on sanitation and hygiene in Tanzania. The review reports on:

- the health impacts of poor sanitation and hygiene;
- the current status of sanitation and hygiene;

- completed sanitation and hygiene programs and projects;
- current sanitation and hygiene programs and projects;
- knowledge gaps in sanitation and hygiene; and
- recommendations to improve sanitation and hygiene.

The methodology for this literature review consisted of an initial stakeholder analysis (Annex 1) through reviewing the current actors and also internet searches. Then a systematic review of the published literature was conducted using select databases and search terms with the geography restricted to Tanzania (Annex 2). Nonpublished literature was sourced from the identified stakeholders by contacting them directly or through established networks such as Tanzania Water and Sanitation Network (TaWaSaNET) (Annex 1). A selection of practitioners currently working in sanitation and hygiene in Tanzania (Table 2) where interviewed on their perspectives using semi-structured interview questions (Annex 3). Finally, recommendations and conclusions were made based on all the material reviewed.

1.3 Stakeholders

An overview of identified Tanzanian sanitation and hygiene stakeholders are presented as a schematic (Figure 4) and are described in detail with a list of current programs and head office locations in Annex 1. Presently active in sanitation and hygiene policy and programs are: the Prime Ministers Office, three government ministries, local government, 12 donors/multilateral agencies, 5 private foundations, 13 International non-government organisations (NGO), 18 local NGO, 2 faith based organizations, 2 networks and numerous actors from community based organizations and commercial sector. The Tanzanian Government provides policy and regulations for sanitation and hygiene with input into the policy process from the other stakeholders. The Tanzanian Government, donors/multilateral organisations and private foundations give funding and direction for programs and projects. These programs and projects are then implemented by Tanzanian Government, international NGO, local NGO, faith based groups, community based organisations (CBO) and the commercial sector. All these stakeholders also interact, to varying degrees, through networks, partnerships, research and evaluation.



Figure 4. Schematic of current stakeholders in sanitation and hygiene in Tanzania

2. SANITATION AND HYGIENE IMPACTS ON HUMAN HEALTH IN TANZANIA

2.1 Mortality

Diseases caused by inadequate water, sanitation and hygiene (WASH) result in 4.2 % of global deaths and 90 % of that burden is born by children under five years of age (Bartram and Cairncross, 2010). In Tanzania, 9 % of all mortality in children under five years is due to diarrhoea (World Health Organisation, 2010). This is an improvement on the health status in 2000 - 2003 when it was estimated that 17 % of all mortality in children under five was attributed to diarrhoea (World Health Organisation, 2006). For the adult population diarrhoea accounted for 6 % of mortality and attributed morbidity was estimated to be 6 % of the total disability adjusted life years (DALY) for all causes (World Health Organisation, 2006).

A review of the literature identifies the links between mortality and inadequate sanitation and hygiene in Tanzania. A study in the Illala District in Dar es Salaam looking at the causes of maternal mortality reported that lack of access to a latrine, long distances to a water point, as well as poor general living standards and associated hygiene were all significantly linked to increased rates of maternal mortality (Urassa *et al.*, 1995). Similarly a study of a larger number of households in Tanzania linked increased poverty, in part measured by latrine access and the condition of the latrine, with increased mortality both maternal and from other causes (Graham *et al.*, 2004). However, in other studies the exact affects of latrines was less clear. An analysis of census data from Rukwa, Tabora and Kigoma reported no difference in childhood mortality associated with latrine presence (Mbago, 1994). Inadequate sanitation and hygiene in Tanzania undoubtedly result in many preventable deaths although the exact contribution from each practice or behaviour is difficult to quantify.

2.2 Diarrhoea

Diarrhoea is one of the most common reported illnesses in Tanzania. In 2006 there were an estimated 454 954 cases of diarrhoea and 539 deaths (Chaggu, 2009). The 2010 National Demographic and Health Survey reported that 15 % of children under 5 had diarrhoea in the preceding two weeks (Tanzania National Bureau of Statistics, 2010). Similarly, in the National Household Budget Survey in

2007, 7.1 % of adults and 12.2 % of children under 15 years reported having diarrhoea in the preceding four weeks (Tanzania National Bureau of Statistics, 2009). However, there are large difference between regions with respect to diarrhoea; Kigoma reported 29 % while Shinyanga only 4 % frequency of diarrhoea in children under five (Tanzania National Bureau of Statistics, 2010). Some studies have reported that the frequency of diarrhoea appears to have decreased with a 30 year prevalence study of households in Tanzania finding that diarrhoea frequency had decreased from 11 % to 8 % between 1967 and 1997 (Tumwine *et al.*, 2002). The causative agent of diarrhoea is not always identified. A study conducted in the Ifakara District Hospital, Kilombero Valley of children with diarrhoea (n = 103) and those without (n = 206) found that *Shigella* spp. were significantly associated with diarrhoea and not *Escherichia coli* or *Salmonella* spp. (Gascon *et al.*, 2000). This emphasises that some faecal origin pathogens cause more diarrhoea than others.

There are a number of sanitation and hygiene factors that have been linked to diarrhoea in Tanzania. The risk factors for diarrhoea include unsafe disposal faeces and wastewater and the quantity of water used for cleaning (Tumwine *et al.*, 2002). A study of households (n = 278) in the Kilombero valley in Tanzania revealed that instances of diarrhoea in children under 5 years were significantly reduced when hands were washed before cooking, if the children were washed regularly and if the opening to the pit latrine was covered (Owuor *et al.*, 2012). Similarly, in separate studies the distance from the household to a water source was significantly linked to instances of diarrhoea (Gascon *et al.*, 2000), as well as the unsafe disposal faeces and wastewater and the quantity of water used for cleaning (Tumwine *et al.*, 2002).

2.2.1 Cholera

Chlorea is endemic in seven regions of Tanzania; Tanga, Kigoma, Mwanza, Singida, Dar es Salaam, Zanzibar and Mara (Masauni *et al.*, 2009). Lack of access to improved sanitation in informal settlements have been shown in Dar es Salaam to be significantly associated (r = 0.49, p < 0.0001) with a higher instances of cholera (Penrose *et al.*, 2010). Additional, risk factors for cholera identified in patients in Zanzibar during an outbreak included using open water containers for drinking water (p = 0.017) and protective behaviours were identified as washing hands after defecation (p < 0.001) (Masauni *et al.*, 2009).

2.2.2 Typhoid fever

The prevalence of Typhoid fever has increased significantly (p < 0.0001) in some urban areas in Tanzania (Malisa and Nyaki, 2010). In the Singida urban area the frequency of cases increased from 580 - 1400 cases per 100 000 in 2003 to 771 - 942 cases per 100 000 in 2007 (Malisa and Nyaki, 2010). The reasons for the increases were associated with poor personnel hygiene, improper drainage and unsanitary toilets (Malisa and Nyaki, 2010).

2.3 Topical infections

2.3.1 Skin infections

Skin infections are a common consequence of inadequate hygiene. A study of children (n = 1855) across Dar es Salaam and five Ujamaa villages found that the instances of scabies (infections with *sarcoptes scabiei*) were higher were there were lower hygiene standards (Masawe *et al.*, 1975). Conversely, in the same study pyoderma (bacterial skin infections) were not positively associated with hygiene conditions (Masawe *et al.*, 1975), indicating that other factors may have been associated but not recorded.

2.3.2 Eye infections

A study of 678 households in eight villages in the Kongwa District concluded that latrine use was significantly (p = 0.03) linked to reduction of trachoma cases children (Montgomery *et al.*, 2010). Inadequate hygiene is also a risk factor with high rates of trachoma infections in children in Dodoma being significantly linked to unwashed faces (McCauley *et al.*, 1990). Similarly, in Kongwa children with clean faces, on a sustainable basis, had lower odds of severe trachoma (West *et al.*, 1996). Increased distance to the water point is associated with increased risk of trachoma due to their being less water available for hygiene activities (West *et al.*, 1989; Polack *et al.*, 2005). In Central Tanzania, an additional risk factor contributing significantly to instances of trachoma in children was having a high density of flies in the household (Taylor *et al.*, 1989). Pit latrines without a roofed super-structure have significantly more (p = 0.0008) flies than those pit latrines with a roof (Knudson, 2011).

2.4 Parasitic infections

2.4.1 Malaria and filariasis

In Tanzania 11 % of mortality in children under 5 years of age is attributed to malaria (World Health Organisation, 2010). Malaria and filariasis are parasitic infections transmitted by mosquitoes and mosquitoes need stagnant water in which to breed. A survey of Dar es Salaam found that 70 % of breeding grounds for malaria and/or filariasis carrying mosquitoes were man made; drains, holes, house foundations under constructions, borrow pits and (Castro *et al.*, 2010). The majority (42 %) of breeding grounds were drains where there was a significantly higher (p < 0.001) chance of finding mosquito larvae in stagnant water rather than drains functioning correctly (Castro *et al.*, 2010). The surface of pit latrines has also been identified as a breeding ground for malaria and filariasis carrying mosquitoes in Tanzania (Curtis and Maxwell, 1997). In a study in Zanzibar it was found that if larvaecide and polystyrene beads were used to cover the surface of the pit latrines then the density of mosquitoes dropped by 98 % in households and the detection of microfilarasis in peoples blood reduced from 49 % to 10 % (Curtis and Maxwell, 1997).

2.4.2 Helminths

Hookworms are the most prevalent soil transmitted helminth in rural and urban studies (Baker, 2010; James, 2011). Pit latrines are known to be a source of transfer for soil transmitted helminths such as *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm (Baker, 2010). Although, helminths were more likely to be found associated with pit latrines in rural areas (Ifakara) than urban areas (Dar es Salaam) (James, 2011). A study of latrines (n = 72) in the village of Sululu in Tanzania found helminths in the soil of 71 % of the latrines (James, 2011). An additional significant factor (p = 0.05) for the presence of helminths was if the latrine was shaded (Baker, 2010) or had a complete superstructure that gave shade (James, 2011). Further, in rural Zanzibar there is an association between the absence of a latrine and increased helminth infections (Ericsson and Stephansson, 1996).

2.4.3 Schistomaniasis

Schistomaniasis is a chronic parasitic infection, contracted from contact with the faecaly contaminated water via a snail host. In children the infection results in anaemia, malnutrition, stunted growth, reduced physical activity and impaired cognitive function (Freudenthal *et al.*, 2006). Infection rates of schistosomiasis in Tanzanian school children surveyed (n = 350) in Kivulini, Mwanga District were reported at rates of 86.3 % for urinary schistosomiasis and 43.5 % for intestinal schistosomiasis (Poggensee *et al.*, 2005).

2.4.4 Other parasites

Infection from the pig parasite, *Taenia solium*, can cause serious illness and epileptic seizures (Ngowi *et al.*, 2007). Risk factors for contracting the infection for small scale pig farmers include not using a pit latrine and having free ranging pigs (Ngowi *et al.*, 2007).

2.5 Viral infections

Denque and yellow fever are mosquito borne infections which are present in Tanzania. Improper drainage providing mosquito breading grounds is likely to contribute to theses infections but no literature specific for Tanzania was identified. Similarly polio and hepatitis are two viruses which can be transmitted via faecal-oral route and related to more sanitation and hygiene however no literature was identified from research conducted in Tanzania.

2.6 Oral diseases

Dental gum infections such as gingivitis are present in almost all (exact figure not supplied) in school children surveyed (n = 640) in Dar es Salaam indicating a need for oral hygiene education (Kerosuo *et al.*, 1986).

3. CURRENT STATE OF SANITATION IN TANZANIA

The 2007 National Household Budget Survey reports that nationally 93 % of Tanzanians households have a latrine (Tanzania National Bureau of Statistics, 2009). However, in 2008 only 24% of Tanzanian's had access to improved sanitation by definition of United Nations Children's Fund (UNICEF) and the World Health Organisation (WHO) Joint Monitoring Program (JMP) (World Bank *et al.*, 2011). The JMP definition of improved sanitation does not included shared facilities or traditional pit latrines regardless of the floor material or super-structure (World Bank *et al.*, 2011). If pit latrines with slabs are included in the definition of improved sanitation then in 2004 that 47 % of Tanzania had access to improved sanitation (World Health Organisation and United Nations Children's Fund, 2006). The current absence of any legislated Tanzanian definition of adequate sanitation limits the ability to assess the current status of sanitation and compare and contrast sanitation coverage statistics (Chaggu, 2009; Pauschert *et al.*, 2012).

3.1 Urban areas

3.1.1 Sanitation coverage

The National Household Budget Survey in 2007 reported that 97.3 % of households have a basic latrine in urban areas (Tanzania National Bureau of Statistics, 2009; Ministry of Health and Social Welfare, 2011). However, 78.6 % of households in other urban areas and 80.5 % of households in Dar es Salaam use pit latrines (Tanzania National Bureau of Statistics, 2009). A household survey in Dar es Salaam that found 80 % of population used pit latrines, 2.5 % used septic tanks, 2 % ventilated improved pit latrines, 6.5 % with sewerage connection and only 1 % without any sanitation options (Chaggu *et al.*, 2002). The World Health Organisation (WHO) in 2008 estimated that the urban population having access to improved sanitation facilities was only 27 % (Ministry of Health and Social Welfare, 2011). Urban sanitation coverage was assessed to have increased 5 % between 1990 and 2008 (World Bank *et al.*, 2011).

Based on achieving the MDG the National Strategy for Growth and Reduction of Poverty (NSGRP), *Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania* (MKUKTA), has a target of 45 % of urban population having improved sanitation by 2015 (Ministry of Health and Social Welfare, 2011).

3.1.2 Service provision responsibilities

At present the Tanzanian's governments public service capacity is weak and despite pressure they have been unable to provide urban sanitation and solid waste services (Oosterveer, 2009). The African Minister's Council on Water report on country status overview in 2011 assessed that Tanzania was still in the establishing stages of urban sanitation service provision because they scored poorly across the required criteria; policy, planning, budget, expenditure, equity, markets, uptake and use (World Bank *et al.*, 2011). Additionally, the current Tanzanian government policy is to invest public funds in sewerage network expansion which results in the wealthy being serviced before the poor (World Bank *et al.*, 2011). In Dar es Salaam Water and Sewerage Corporation (DAWASCO) has the contract for water and sewerage provision but it has not met the contractually required service provisions for a number of years (World Bank, 2011).

3.1.3 Formal urban settlements

3.1.3.1 Sewerage coverage

Sewerage coverage in Dar es Salaam is estimated at about 4.8 % of the population (Pauschert *et al.*, 2012). In Dar es Salaam flush toilets are reported in 10.3 % of households in 2007 (Tanzania National Bureau of Statistics, 2009) with septic tanks accounting for the difference. Some smaller cities in Tanzania have greater coverage (Table 1). The coastal city of Tanga has a population of 265 549 and has only 2495 households are connected to the sewerage system (Mhina, 2013) with coverage estimated at 9.3 % of the population (Pauschert *et al.*, 2012; Mhina, 2013).

3.1.3.2 Sewage treatment

Dar es Salaam is typical of other Tanzanian cities where there is minimal treatment of sewage with direct discharge via short ocean outfall into the Indian Ocean (Yhdego, 1992; Mwalimu, 2012). There are also large discharges of sewage into the Msimbazi River in Dar es Salaam with coliform bacterial counts once it reaches the Indian Ocean of $2.5 - 4.0 \times 10^5$ cfu/100 mL (Yhdego, 1992). Even large five star hotels discharge their sewage directly into the Indian Ocean in Dar es Salaam (Mwalimu, 2012). Smaller cities also have inadequate or no sewage treatment. In Tanga there is no sewage treatment facility and 2164 m³ of raw sewage is discharged directly into the Indian Ocean each day (Mhina, 2013).

Some areas of Dar es Salaam have waste stabilisation ponds to treat sewage from 2000 - 6000 people and in 1989 there were only 9 of such ponds (Mbwele *et al.*, 2003; Weatherell *et al.*, 2003). A survey of waste stabilisation ponds across Tanzania found that the majority were not functioning properly and had become stagnant sites for mosquito breeding (Yhdego, 1992). The reasons behind the failure were: they had not been designed correctly for the specific conditions initially, they were not maintained properly, there was a lack of sludge removal, lack of funds for maintenance and lack of trained operators (Yhdego, 1992). Specifically, the waste stabilisation at the University of Dar es Salaam had not been de-sludged in 16 years (de-sludging should occur every five years) and were ineffective at removing nutrients from waste water (Mbwele *et al.*, 2003).

Clty	Sewerage
Dar es Salaam	4.8
Arusha	7.0
Moshi	5.8
Dodoma	11.6
Morogoro	1.6
Mwanza	3.1
Iringa	11.9
Mbeya	0.6
Songea	3.7
Tabora	1.3
Tanga	9.3

Table 1. Sewerage coverage in the urban areas of Tanzania (Pauschert et al., 2012).

3.1.4 Informal urban settlements

Informal urban settlements continue to grow as the government is not able to control land use and development due to the rapid increase in population and limited resources available (United Nations Human Settlements Programme *et al.*, 2010). A survey of 19 urban settlements in 2010, commissioned by GIZ, identified that 74 - 90 % of the populations lived in informal settlements (Pauschert *et al.*, 2012). In Dar es Salaam it is estimated that 70 - 80 % of people live in unplanned and un-serviced settlements (Ndezi, 2009; United Nations Human Settlements Programme *et al.*, 2010).

3.1.4.1 Service provision

Informal settlements have very limited sanitation services and the majority use on-site sanitation (Pauschert *et al.*, 2012). A survey of informal settlements in 20 urban areas of Tanzania, including Dar es Salaam, reported that only 57 % of households had on-site sanitation (pit latrines, ventilated pit latrines, composting latrines) (Pauschert *et al.*, 2012). Those households without their own sanitation reported using public or shared facilities (Pauschert *et al.*, 2012). When looking at the quality of the sanitation it was found that in Dar es Salaam that on average 92.4 % of informal settlements across 45 wards did not have access to improved sanitation (Penrose *et al.*, 2010). In 2007 it was estimated that only 7.8 % of households in Dar es Salaam and 12.9 % in other urban areas used improved sanitation such as ventilated improved pit latrine (Tanzania National Bureau of Statistics, 2009).

3.1.4.2 Latrine construction

A survey of construction of pit latrine in Dar es Salaam found that 86 % of pit latrines are built with sand cement blocks, 94 % had floor slabs and only 53 % had a roof (Chaggu *et al.*, 2002). The high proportion of pits using sand cement blocks is a means to prevent pit collapse due to the high water table (Chaggu *et al.*, 2002). Of the pits 93 % are dug to between 2.5 - 5 m (Chaggu *et al.*, 2002). Households do have a preference to dig their pit as deep as they can afford so that it lasts longer (Biran, 2010). The latrines generally cost ranged from labour and material only costs to from TZS 320 000 (Biran, 2010) to 400 000, with 88 % of latrines built by a craftsman (Chaggu *et al.*, 2002). In contrast In the coastal city of Tanga in informal settlements shallow pits are often constructed in the household back yard which are covered with a sheet after use; a form of very shallow pit latrine without a super-structure (Mhina, 2013).

Building a septic tank is aspired to for residents surveyed in informal settlements of Dar es Salaam as they last longer, have less smell and fewer flies and are easier to empty (Biran, 2010). However, due to cost septic tanks are not accessible to most people in informal settlements (Chaggu and Edmund, 2002; Biran, 2010).

3.1.4.3 Latrine de-sludging

In Dar es Salaam full pits were in 50 % of cases due to the high water table (Chaggu *et al.*, 2002). Solid waste and sand are also commonly present in the pit latrines (Biran, 2010). Reported data on the frequency of pit de-sludging varies. In

two separate studies undertaken in Dar es Salaam one reported that when pits were full that 72 % of people reported de-sludging them, 23 % planned to build a new one and 5 % did not know what to do (Chaggu et al., 2002). While a similar study reported that only 30 % of households de-sludged their pits and the remainder preferred to establish new pits due to costs (Pauschert et al., 2012). Also the methods used to de-sludge vary considerably. Again two studies undertaken in Dar es Salaam report different practices; one study undertaken in 2008 by WSP reports that only 19 % of people surveyed (n = 600) used de-sludging pumping services with the majority (58 %) using the 'vomiting' method to divert the sludge to a second pit (Biran, 2010). While a second study reported that the majority (94 %) of people surveyed reported using pit-latrine de-sludging services at a cost of TZS 25 000 - 70 000 in depending on the distance to the disposal area (Chaggu et al., 2002). A further method reported in 12 % of those survey (n = 600) in Dar es Salaam was flooding the pit to flush out the sludge to the surface and into local waterways or the drainage system (Biran, 2010; Mwalimu, 2012). Also sinking the sludge by using a chemical coaggulant was not widely reported (2 %) (Biran, 2010). There is a large variation in the data collected from informal settlements about pit latrine de-sludging which is likely indicative of large variation in practices across different settlements.

In Dar es Salaam in 2002 there were 28 privately owned de-sludging operators and 14 city council operators (Chaggu *et al.*, 2002). However, access to informal settlements latrines to de-sludge them is a continual problem as the large 5 m³ tankers can not obtain access and there is a limited number of mini-tankers available (Chaggu *et al.*, 2002). Also the majority of pit latrines are emptied during the wet season when they are full due to the raising water table. Additionally some de-sludging operators techniques are not adequate as they remove the water primarily and not the sludge (Chaggu *et al.*, 2002). An further problem is the cost and locations for safe sludge disposal. Frequently sludge is dumped onto fields or mixed with other solid waste and buried (Chaggu *et al.*, 2002).

3.1.5 Absence of sanitation

Open defecation was reported as < 1% in urban areas surveyed (Chaggu *et al.*, 2002; Pauschert *et al.*, 2012). Through community focus groups and interviews in Mbuyni sub-ward, Dar es Salaam, the problems associated with lack of access to sanitation become clear (Slum Dwellers International and Centre for Community Initiatives, 2009). The community report that 40 % of the 7489 people living in the

ward do not have a latrine and there is no public facility (Slum Dwellers International and Centre for Community Initiatives, 2009). Those that don't have a latrine either share with their neighbours or defecate in the Ng'ombe River and Mwanaanyamala reservoir (Slum Dwellers International and Centre for Community Initiatives, 2009). Environmental waters are also frequently used a site for open defecation in other cities, as observed in the coastal city of Tanga were members of the informal settlements use the adjacent Indian Ocean (Mhina, 2013).

3.1.6 Solid waste

Solid waste disposal in urban centre's is a continuing problem as the population continues to grow and public service provision cannot meet the demand. In Dar es Salaam through the National Household Budget Survey it was estimated that 36.7 % of households used rubbish pits, 32.8 % garbage bins and 25.5 % of households dump their waste (Tanzania National Bureau of Statistics, 2009) into water courses, valleys, pit latrines or other drainage areas (Chaggu et al., 2002). There has been a steady increase in the number of households using rubbish bins in Dar es Salaam over the last three household surveys (5.3 % in 1991/1992 and 20.3 % in 2000/2001) (Tanzania National Bureau of Statistics, 2009). Rubbish bins are more popular in Dar es Salaam than other urban areas where there usage was only 9 % (Tanzania National Bureau of Statistics, 2009). Likewise, focus groups with community members from 197 informal settlements in Dar es Salaam highlight that in those settlements where there is no solid waste collection services available then people will simply dump their rubbish on the ground or burn it in pits (Slum Dwellers International and Centre for Community Initiatives, 2009). In other urban areas the majority (70.1 %) of rubbish was disposed of in rubbish pits (Tanzania National Bureau of Statistics, 2009).

In Dar es Salaam the solid waste management has been successfully contracted out to commercial operators at the municipal government level (Venkatachalam, 2009). In 2009 there were 23 different solid waste operators and solid waste collection had increased to 45 % of the city area from only 2 - 4 % in 1992 (Venkatachalam, 2009). In smaller cities, such as the coastal city of Tanga, solid waste collection is equally a problem due to inconsistent city council facilitated collection or private collectors, hence rubbish is dumped on the street or in front of houses even in formal settlements (Mhina, 2013). However, there is also evidence of

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informal community based collections where-by a community member takes a wheelbarrow and collects waste for a small fee (TZS 500 - 1000) (Mhina, 2013).

3.1.7 Industrial waste

In Dar es Salaam the river that runs through the industrial area of Mabibo Viwandani appears heavily contaminated and local community members, who grow vegetables along its banks, report that it changes colour (Barozi, 2011). It is suspected that the colour changes are due to the local textile dying factories discharging wastes, directly into the rivers (Barozi, 2011). Environmental wastewater discharge also comes from other industries in Dar es Salaam including; food processing, tanneries, fertilizer and petroleum refining (International Water Association Water Wiki, 2013). Discharging industrial wastewater requires a permit from the Wami/Ruvu Basin Water Office (WRBWO), however at present in Dar es Salaam no permits have been issued (Barozi, 2011). The contamination of environmental waters with industrial waste is a continued environmental health problem that does not receive the same attention as the domestic sewage management problems does.

3.1.8 Water drainage

The rapidly increasing size of cities since the 1970's and especially informal settlements means that basic infrastructure such as storm water drainage has not been constructed (Yhdego, 1992; Castro *et al.*, 2010). Further, when drainage is present is not cleaned or maintained adequately becoming blocked with sediment, filled with rubbish or vegetation (Castro *et al.*, 2009). The lack of adequate drainage in Dar es Salaam means that after short periods of rain water pools and storm water floods the limited sewerage network (Mwalimu, 2012). The same drainage problems exist In the coastal city of Tanga despite the construction of new drainage system by the city council (Mhina, 2013). When surveyed over 75 % of the drains were not functioning properly and with most being blocked (Mhina, 2013). Due to the inadequate drainage network in Dar es Salaam drains are treated with costly insecticide as part of the lymphatic filariasis and malaria control programs (Castro *et al.*, 2010).

3.2 Rural areas

3.2.1 Sanitation coverage

The National Household Budget Survey in 2007 reported that 90.4 % of households had a latrine in rural areas (Tanzania National Bureau of Statistics, 2009). However, improved latrines were lower than urban area with only 2.2 % of households having VIP latrines and 1 % with a flush toilet (Tanzania National Bureau of Statistics, 2009). The World Health Organisation (WHO) in 2008 estimated that the rural population having access to improved sanitation (including pit latrines with slab floor) was only 23 % (Ministry of Health and Social Welfare, 2011). Tanzania was also assessed at being in the establishment stage of rural sanitation provision in the country status overview (World Bank *et al.*, 2011). It was assessed that there has actually been a 2 % decrease in sanitation coverage in rural areas between 1990 and 2008 (World Bank *et al.*, 2011). The MKUKUTA target for 2015 is 42 % access to improved sanitation (Ministry of Health and Social Welfare, 2011).

3.2.2 Absence of sanitation

Overall in rural areas it is estimated that 9.5 % of households have no toilet (Tanzania National Bureau of Statistics, 2009). The proportion of people practicing open defecation in rural areas is likely to vary between areas. For example in the Kongwa District open defecation was reported at a slightly higher rate (11.5 %) by households surveyed (n = 678) (Montgomery *et al.*, 2010).

3.2.3 Solid waste

In rural areas in 2007 with National Household Budget Survey estimated that 54.9 % of households place their rubbish in a pit and burnt it while 42.8 % threw it on the ground (Tanzania National Bureau of Statistics, 2009).

3.3 Specific institutions or groups

3.3.1 Schools

Access to adequate school sanitation is a basic need and also linked directly to attendance rates, particularly for girls. The Ministry of Education and Vocation Training (MoEVT) has latrine ratio guidelines for schools of one latrine for every 20 girls and one for every 20 boys enrolled (Stichting Nederlandse Vrijwilligers *et al.*, 2009). A study of the Bagamoyo district of 162 schools found that only 16.7 % (n =

27) met the minimum standard and 8.6 % (n = 14) of schools had no latrines at all (Stichting Nederlandse Vrijwilligers *et al.*, 2009). In this district, across all schools surveyed based on the number of pupils (69 715 children) there is a need to provide an additional 1 704 latrines to meet the minimum standards (Stichting Nederlandse Vrijwilligers *et al.*, 2009). Nationally, only 11 % of schools have sufficient latrines to meet the government required ratio (Stichting Nederlandse Vrijwilligers *et al.*, 2009).

The MKUKUTA goal for 2015 is that there is at least one latrine per 40 girls and 50 boys as schools move forward to try and meet the minimum standard (Ministry of Health and Social Welfare, 2011).

3.3.2 Health facilities

It is important to have safe and improved sanitation at health care facilities due to the risks of disease transmission between patients. Despite this it was estimated in 2006, by the Tanzania Service Provision Assessment, that only 63 % of health facilities had at least one latrine for patients (Ministry of Health and Social Welfare, 2011).

Disposal of hospital waste is also another significant problem with a survey of across Tanzania finding that 50 % of hospitals burn thier waste in an open pit and 30 % bury it (Manyele and Anicetus, 2006). Concerns about poor hygiene in Tanzanian hospitals have been found to actually be a deterrent for women seeking paediatric care (Mwangi *et al.*, 2008).

3.3.3 Women and children

Children under five years are the most at risk group for mortality following diarrhoea (Bartram and Cairncross, 2010) hence understanding the sanitation behaviours of mothers are especially important. Lack of sanitation education for mothers is a contributing factor to poor sanitation practices for young children. In the Temeke Municipality only 31 % of mothers surveyed (n = 161) understood the risk factors for childhood diarrhoea and the impacts of poor sanitation (Mwambete and Joseph, 2010). Further, children's feaces is thought of as safe by many Tanzanian's (Hooks, 2008). The defecation practices of young children is a significant sanitation issue for mothers. In a survey in Dar es Salaam it was reported for young children that 35 % defecate in the home and 37 % used the courtyard or area near the home (Chaggu *et al.*, 2002). The excreta is collected and added to solid waste or placed in the latrine (Chaggu *et al.*, 2002). The hygiene disposal of infant faeces is problem

with 6 % of urban households and 27 % of rural households disposing of faeces in an unsafe manner (disposed in the area around the dwelling or rinsed away) (Ministry of Health and Social Welfare, 2011). Having an infant in the household was found to significantly (p = 0.01) increase the quantity of faecal indicator bacteria on mothers hands in Dar es Salaam to 1 x 10³ cfu/ pair of hands (Pickering *et al.*, 2010). Contaminated hands then serve as source of contamination for household members. Hence, the disposal of children's faeces has been shown to be a reliant indicator of general sanitation and hygiene practices in Tanzania (Almedom, 1996).

3.3.4 Different tribal groups

Overall sanitation access is much lower (12 %) for nomadic communities compared to rural averages of 90 % (Ministry of Health and Social Welfare, 2011). The rural Maasai communities in northern Tanzania have a 'virtual absence of sanitation' (Nangawe, 1990).

3.3.5 Refugees

Refugee camps and refugees present a very vulnerable group of people within Tanzania. Burundi refugees mothers' living in the community have a higher instances of childhood mortality compared to Tanzanian mothers (Mbago, 1994). Additionally, lack of adequate sanitation in refugee camps in Tanzania is responsible for increased instances of diarrhoea but not associated mortality due to the availability of medical care (Cronin *et al.*, 2009).

4. CURRENT STATE OF HYGIENE IN TANZANIA

4.1 Personal hygiene behaviours

It is important to understand hygiene behaviours in Tanzania as the health benefits of provision of adequate sanitation and drinking water can be quickly eroded if poor hygiene practices are present in the household. For example, households surveyed (n = 20) in Bagamoyo, indicated that the type of latrine floor (concrete or dirt) did not make a significant difference in the concentration of faecal indicators in households but hygiene practices did (Pickering *et al.*, 2012). Types of personal hygiene behaviour will be covered initially followed by any difference in urban, rural or specific institution or group hygiene behaviours.

4.1.1 Hand washing

Hand washing at critical times in Tanzania has been shown to be a rapid and reliable indicator of general hygiene behaviour in households (Almedom, 1996). Critical times were determined to be after defaecation, after handling children's faeces, before handling food, before feeding young children and before eating (Almedom, 1996). Hand washing with soap after using the toilet was reported at 62 % in low income urban areas (Pauschert et al., 2012). Other studies in Dar es Salaam and rural districts of Mpwapwa and Rufiji report that only 4 % of mothers and 5 % of children wash their hands with soap after using the toilet (Hooks, 2008). A Ministry of Health and Social Welfare (MoHSW) study in 2004 reported that only 31.3 % of latrines had hand washing facilities (Ministry of Health and Social Welfare, 2011). Additionally, although soap is found commonly in the household it is more frequently used for bathing and laundry than hand washing (Hooks, 2008). In a study of women's hand hygiene, faecal bacteria on hands were significantly (p = 0.023) associated with the length of time since last washing hands with soap and water (Pickering et al., 2010). The MKUKUTA goal for 2015 is that at least 25 % of households have hand washing facilities with soap and water (Ministry of Health and Social Welfare, 2011).

4.1.2 Face washing

Face washing is important in reducing eye infections such as Trachoma (Montgomery *et al.*, 2010). In Dodoma region of Tanzania there was a perception

from mother's that washing children's faces regularly used a lot of water and they were therefore reticent to change their hygiene behaviour as they needed the water for other purposes (McCauley *et al.*, 1990).

4.1.3 Bathing

It is very common to bath in the same super-structure as the latrine. In Dar es Salaam a survey reported that 52 % of people bath in the latrine, while 32 % use a separate room adjacent to the latrine but the water goes into the latrine pit (Chaggu *et al.*, 2002). Bathing and clothes washing in rivers is known to increase the instances of schistosomiasis infections (Poggensee *et al.*, 2005).

4.1.4 Anal cleaning

Tanzania is a society where anal washing is the most common form of cleaning after defecation. A survey in Dar es Salaam found that 84 % of people reported using water for anal washing, 1 % used only toilet paper and 15 % used both (Chaggu *et al.*, 2002). Combined with a failure to wash hands with soap after defecation this hygiene behaviour is likely to attribute to a large portion of faecal contamination on hands and in households.

4.1.5 Menstrual hygiene

In Mwanza, a study related to the use of microbicide for prevention of HIV/AIDS contraction reported that intra-vaginal cleaning was a hygiene behaviour practiced by women regularly (Allen *et al.*, 2010). Women used their fingers alone or with soap and/or water to remove post coital excretions or menstrual blood (Allen *et al.*, 2010).

4.2 Water and food hygiene

4.2.1 Stored drinking water quality

Uncovered drinking water containers were identified as a risk factor for diarrhoea in households in Dar es Salaam (Badowski *et al.*, 2011). Also, the presence of faecal indicator bacteria on the hands of mothers and children in households in Dar es Salaam were positively related to faecal contamination of stored drinking water (Pickering *et al.*, 2010). Even those sources of water considered safe can be contaminated. A survey of purchased drinking water in bottles and plastic bags (n = 130) in Dar es Salaam found faecal coliforms in 3.6 % of

samples (Kassenga, 2007). Contamination of drinking water after it is collected is a very important hygiene issue in Tanzanian households as it reduces the health benefits gained from safe water supply provision.

4.2.2 Food preparation

Preparation of food was found to be one of the highest sources of faecal indicator bacteria (enterrococci) on women's hands in a study in Dar es Salaam; where the average was of 6310 cfu/pair of hands (Pickering *et al.*, 2010). This correlates with other research where thermotolerant coliforms were detected in 58 % of household meals (1×10^3 cfu/g) and 98 % of milk products (3×10^4 cfu/g) on Pemba Island (Vigano *et al.*, 2007). During food preparation it is likely that the faecal contamination is present both on the hands of the person preparing the food and on the food itself when it is purchased.

4.3 Urban and rural areas

Access to sufficient clean water for hygiene practices is an important factor in both urban and rural areas. The large majority of Tanzanian's water is extracted from unimproved sources such as ground water (Owuor *et al.*, 2012). It is not uncommon for improved water points to not function properly. A survey of 10 districts in Tanzania found that 43 % of improved water points were not functioning (Stichting Nederlandse Vrijwilligers, 2010). Failures in supply of safe water directly impact upon the ability for households to practice adequate hygiene.

4.3.1.1 Informal urban settlements

The high population densities (25 000 pers/km² in Dar es Salaam), poor housing, low income, inadequate sanitation and clean water lead to very poor hygiene and devastating public health in low income urban areas in Tanzania (International Food Policy Research Institute, 2002; Pauschert *et al.*, 2012). The risk of contamination with faecal indicator bacteria in drinking water wells in peri-urban areas of Dar es Salaam can be significantly linked to close proximity of a pit latrine (< 10 m) to the water point (Mushi *et al.*, 2012).

4.4 Specific institutions or groups

4.4.1 Schools

A survey of 162 schools in the Bagamoyo District found that only 14.2 % (n = 23) had hand washing facilities available and even less 3.7 % (n = 6) supplied soap (Stichting Nederlandse Vrijwilligers *et al.*, 2009). MKUKUTA goal for 2015 is that at least 15 % of schools have hand washing facilities with soap (Ministry of Health and Social Welfare, 2011).

4.4.2 Health facilities

It is informally estimated that less than 1 % of health facilities have hand washing facilities with soap for patients (Ministry of Health and Social Welfare, 2011). The hygiene aspects were also challenged by the fact that in 2006 it was estimated that only 34 % of facilities had regular access to safe water (Ministry of Health and Social Welfare, 2011). The MKUKUTA goal for 2015 is that at least 20 % of health facilities have hand washing facilities (Ministry of Health and Social Welfare, 2011).

4.4.3 Women and children

Women bare the main responsibility for maintaining hygiene in the home and educating children about good hygiene practices (Obrist, 2004). Women and girls have to the collect water for the household for all needs including hygiene purposes (Waititu, 2009). In Ilala Ilala, Dar es Salaam qualitative interviews with women (n = 100) showed that they had good knowledge of hygiene with phrases like 'cleanliness is health' (*usafi ni afya*) and 'safe water' (*maji safi*) used commonly (Obrist, 2004). However, many women are not able to provide the level of hygiene that they would want in their homes or for their children because they do not have enough money and food takes priority over soap and shoes (Obrist, 2004). Other studies have also reported that women are knowledgeable about better hygiene practices but were restricted by finances and also a perception that changing the behaviour would be impractical (Badowski *et al.*, 2011).

4.4.4 Different tribal groups

As reported for sanitation practices, tribal groups also have poorer hygiene practices. The rural Maasai communities in northern Tanzania generally have very poor hygiene practices in comparison to non-tribal groups in part due to their lack of access to water (Nangawe, 1990).

4.4.5 Refugees

Hygiene for refugees and in refugee camps are often poor compared to nonrefugees. A large cholera outbreak in a Rwandan refugee camp in Tanzania was attributed to poor hygiene and limited access to water supplies for hygiene practices (Plummer, 1995). However, through education and effective medical care the outbreaks were controlled within three months and their was no attributed mortality (Plummer, 1995)



Figure 5. A school latrine with a mural promoting hand washing.

5. COMPLETED SANITATION AND HYGIENE PROGRAMS IN TANZANIA

5.1 National programs

The socialist government of Tanzania in the 1970's implemented a very high profile sanitation campaign *Mtu ni Afya* (health is life). This campaign resulted in widespread latrine construction the results of which are still evident today as Tanzania has high sanitation coverage comparted to other African countries (World Bank *et al.*, 2011). Between the 1970s and 1980s there was a top down approach but no notable improvements in sanitation or hygiene. In 1991 the first National Water Policy was introduced which included the formation of water utilities which charged for services and meant to be self-sustaining (World Bank *et al.*, 2011).

5.2 Urban programs

A joint initiative between the Tanzanian Government and the United Nations Human Settlements Program (UN Habitat) in 2007 saw a Citywide Action Plan developed to increase services to informal settlement areas of Dar es Salaam (United Nations Human Settlements Programme *et al.*, 2010). The plan was implemented by the Citywide Slum Upgrading and Prevention Program Unit (CSUPPU) which is linked to the communities by via a technical support team in each municipality (United Nations Human Settlements Programme *et al.*, 2010). The Citywide Action Plan aimed to increase the number of people serviced with basic sanitation and waste collection from 30 to 60 % by 2020 (United Nations Human Settlements Programme *et al.*, 2010). For sanitation the objectives were to conduct assessments on user needs, constructing 159 communal latrines, constructing three demonstration latrines and establishing a regulatory framework for de-sludging (United Nations Human Settlements Programme *et al.*, 2010).

5.3 Rural programs

The Health through Sanitation and Water Program (HESAWA) was implemented by the Tanzanian Government in the Lake Zone (Mwanza, Kagera and Mara Regions) between 1985 and 2002 and funded by the Swedish International Development Cooperation Agency (SIDA) (Tufvesson *et al.*, 2005). The program
reached 5 million people in rural areas with sanitation and hygiene education using the PRA approach through schools and utilising the LGA district health and community development officers (Smet *et al.*, 1997). However, there were concerns with sustainability due to the communities reliance on donor funds (Smet *et al.*, 1997). There were sustained benefits of the program and in 2005 it was found that due to effective capacity and institution building that the at the community and LGA level that there was sustained commitment to some of the program objectives even after it had concluded (Tufvesson *et al.*, 2005).

In 2002 there was a Rural Water Supply and Sanitation Program launched by the Tanzanian Government (World Bank *et al.*, 2011).



Figure 6. Improved sanitation - ecological sanitation with a double vault to compost sludge and urine diversion.

6. COMPLETED SANITATION PROGRAMS AND PROJECTS IN TANZANIA

6.1 Urban centralised sanitation projects

Under the Dar es Salaam Water Supply and Sanitation Project (DWSSP) the technical and commercial operation of water and sewerage services in Dar es Salaam was contracted out for 10 years to a private company, City Water Services, in 2002 (Venkatachalam, 2009). The project was funded by the World Bank and had the project development objectives; of 80% of effluent collected to be treated; 95 % of effluent to be compliant with standards; construction of 26 km of new sewers, rehabilitation of 140 km of existing sewers, 15 pumping stations and 9 waste stablisation ponds and a Community Water Supply and Sanitation Program (CWSSP) (onsite sanitation facilities and hygiene promotions) (World Bank, 2011) However, the contract was cancelled in 2005 due to problems with providing adequate services and meeting other contractual requirements (Venkatachalam, 2009). Presently the public utility Dar es Salaam Water and Sewerage Corporation (DAWASCO) provides services (Venkatachalam, 2009). DAWASCO has not met its contractual requirements for consecutive years, there is inconsistent data on the number of customers served and operating costs remaining higher than revenue (World Bank, 2011). The funding body rates the overall project as 'moderately unsatisfactory' and cite problems with meeting contractual requirements by DAWASCO due to the lack of impartiality and accountability between DAWASCO, DAWASA and the Government of Tanzania (World Bank, 2011).

In smaller cities in Tanzania, improving the capacity of local water utilities has shown to be an effective approach. The Mwanza Urban Water and Sewerage Authority (MWAUWASA) participated in the Water Utility Management program where a performance improvement plan was developed by the utility (Mihayo and Njiru, 2005). Through capacity building and strategies for dealing with unaccounted for water, such as district water meters, the utility was able to develop long term plans and further develop their service capacity (Mihayo and Njiru, 2005).

6.1.1 Wastewater stabilisation ponds

If designed correctly and maintained pilot waste stabilisation ponds at Ardhi University in Dar es Salaam designed for the local conditions and operated correctly have been shown to be successful (Yhdego, 1992). However, waste stablisation ponds require a large area of land for construction and are there for not a suitable solution for rapidly urbanising cities where space is at premium (Yhdego, 1992).

6.1.2 Alternative centralised wastewater treatment systems

There are a number of alternative wastewater treatment projects that have been trialed in Tanzania on a small scale. As an alternative to individual septic tanks, up-flow anaerobic sludge blanket technology with constructed wetlands for post treatment have been found to be an effective cost effective method of treatment when trailed at the University College of Lands and Architectural Studies, located 12 km north of Dar es Salaam (Kaseva, 2004). The combination would be suitable for small communities with space available, however, further research is required to determine if the Tanzanian standards for effluent discharge can be met (chemical oxygen demand 40 mg/L and faecal coliforms < 10³ cfu/100 mL) (Kaseva, 2004). Alternatively, constructed wetlands can treat wastewater directly from septic tanks which has been shown to be successful in producing recycled water for irrigation quality in a Mbagala peri-urban settlement in Dar es Salaam (Mbuligwe, 2005; Agenda for Environment and Responsible Development, 2013).

For coastal communities the use of natural mangroves either through forestation or re-forrestation may be a cost effective treatment alternative sewerage treatment in developing countries (Crona *et al.*, 2009). Another alternative is the use of local macroalgae for waste water treatment was demonstrated effectively in Zanzibar (Haglund and Lindström, 1995). However, the treatment system is limited to coastal communities as it requires 25 % seawater and needs to be further trialed on a larger scale (Haglund and Lindström, 1995).

All constructed wetlands and marine treatment systems require maintenance and monitoring in order to remain operational and effective (Haglund and Lindström, 1995; Kaseva, 2004; Mbuligwe, 2005) and also up-scaled trials to fully evaluate their effectiveness are needed.

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6.2 Urban de-centralised sanitation projects

6.2.1 Improved pit latrines

Pit latrines can vary in quality and construction. In studies in Dar es Salaam and Ifakara it has been shown that the level of faecal contamination present is significantly linked (p < 0.0008) to the decreasing quality of the latrine design (Exley, 2011). Therefore, improving pit latrine quality is an important target in sanitation promotion. Knowledge of latrine types and construction has been reported to come almost solely (99 %) from the seeing and replicating other structures in the community (Chaggu *et al.*, 2002). Hence, construction of demonstration sanitation installations is a very effective way to promote sanitation. Resource orientated sanitation concepts for peri-urban areas of Africa conducted a pilot study in Arusha (Shewa *et al.*, 2009). The pilot started with construction of demonstration composting and urine diverting toilets which then led to subsidised construction of further toilets and ultimately it would transition to a loan scheme for the community to finance the cost of the toilets (Shewa *et al.*, 2009)

The construction of 96 ecological sanitation (eco-san) toilets in the Majumbasita peri-urban area of Dar es Salaam were found to be very suitable for Tanzanian conditions (Chaggu and Edmund, 2002). It was found that women and children were the main household members who maintained the Eco-san and that their negative social perceptions around handling waste were reduced once they began using a workable Eco-san (Chaggu and Edmund, 2002). Similarly, in Arusha a demonstration urine diversion dry toilet with a garden fertilised with the compost and urine was built as part of the Resource Orientated Sanitation concepts for peri-urban Africa (ROSA) (Tendwa and Kimaro, 2010). The demonstration was found to positively influence peoples uptake of the technology and showed potential for upscaling (Tendwa and Kimaro, 2010). T

There are continued perception issues and lack of understanding around the reuse of faecal sludge. In Dar es Salaam 49 % of people were not aware that faecal sludge is used as a fertiliser and 96 % of people believe that re-using sludge will transmit communicable disease (Chaggu *et al.*, 2002). Even after education and explanation 37 % of respondents stated that they would not use reuse faecal sludge for cultural and health reasons (Chaggu *et al.*, 2002). There are conflicting findings on the perception of the safety of sewage with 53 % of respondents in Dar es Salaam and 33 % from Zanzibar reporting that they believed there was a health risk from

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sewage (Crona *et al.*, 2009). However, the study cohort was small (Dar es Salaam n = 61; Zanzibar n = 15) and was centred around environmental discharge (Crona *et al.*, 2009).

Previous programs to assist with pit latrine emptying have not been particularly successful. In 1992 the Manual Pit Emptying Technology (MAPET) program did not up-scale well due to limitations in transportation volumes, maneuverability of the vehicle and travel times (EWAREMA Consult, 2010).

Biogas reactors with an above ground super structures using enclosed 3000 L plastic tanks seeded with 10 % septic pit sludge have potential as an alternative but more work is needed to optimise the bio-degradation conditions length incubation needed (Chaggu *et al.*, 2007).

6.3 Specific institutions or groups

6.3.1 Schools

Improved sanitation in some schools has been partly achieved through programs to reduce schistosomiasis infections that included latrine construction (Magnussen *et al.*, 2001; Poggensee *et al.*, 2005) and education (Freudenthal *et al.*, 2006). For example, 11 schools involved in a schistosomiasis reduction study commencing in 1995 (Magnussen *et al.*, 2001). Initially the schools did not have any functioning latrines, but at the conclusion of the study in 1999 all the schools had at least two functioning latrines (Magnussen *et al.*, 2001). These projects have only been completed at small scales and not consistently across different districts.

6.4 Solid waste

As urban populations grow so does the quantities of solid waste generated for which the public collection service cannot meet. The majority of solid waste is burnt creating environmental health hazards. In the Alinyanya settlement in Arusha a small team (9 people), initially formed as part of the Participatory Hygiene and Sanitation Transformation (PHAST) model, successfully created a small community run users pays waste service (Tanzania Urban Poor Federation and Center for Community Initiatives, 2011). The team charged TZS 200 per bag of waste and employed locals to collect the rubbish with carts once weekly (400 - 500 bags/week) as well as cleaning. The waste was transported to a town garbage tip using a hired truck and at the time of collection they also promoted hygiene messages (Tanzania Urban Poor

Federation and Center for Community Initiatives, 2011). This solution represents a community driven cost effective solution to waste disposal and has been replicated in other communities successfully (Tanzania Urban Poor Federation and Center for Community Initiatives, 2011).

Another example, is a group was formed in Dar es Salaam by local women called the Kisutu Women Development Trust Fund (KIWODET) (Oosterveer, 2009). The group collected solid waste and were later given a contract by the City Council to sweep streets and collect household waste which is then centralised at a transfer centre, where it is sorted for recycling and collected by the council (Oosterveer, 2009). Research was conducted by The Bremen Overseas Research and Development Association (BORDA) on the markets for recycled material in Dar es Salaam. However, they found that at present their was not sufficient demand from industry for recycled plastic, aluminum or glass (Bremen Overseas Research and Development Association, 2013).

A government led approach is present in Tanga City Council which has a weekly campaign since 2010 called 'Kalembo Day' where households and businesses were required to clean their street front and household area of rubbish (Mhina, 2013). Between the hours of 6 - 10 am on a Saturday morning businesses are closed to facilitate the cleaning which can result in some problems in the community, but is generally accepted (Mhina, 2013).

6.5 Drainage

As part of Community Managed Upgrading project in the informal settlement of Hanna Nassif in Dar es Salaam community labour was used to construct drainage as well as other infrastructure between 2004 and 2007 (United Nations Human Settlements Programme, 2010). The project was a collaborative partnership of a local community based organisation (CBO), the Hanna Nassif Community Development Association (HNCDA), Dar es Salaam City Council, UN Habitat, Ardhi University and the Ford Foundation (United Nations Human Settlements Programme, 2010). The project successfully managed to generate employment for the local residents through the construction of storm water drainage however the ongoing maintenance schedules were not implemented (United Nations Human Settlements Programme, 2010). Cleaning and correct maintenance of the drains is of particular importance as it has been shown to significantly (p < 0.001) reduce the chances of malaria infection (Castro *et al.*, 2009). The Hanna Nassif project, nonetheless, is an example of how partnership programs can use the community to improve their sanitation in informal settlements (United Nations Human Settlements Programme, 2010).



Figure 7. Discharge of untreated wastewater into a stream.

7. COMPLETED HYGIENE PROGRAMS AND PROJECTS IN TANZANIA

7.1 Personal hygiene

7.1.1 Hand washing

Hand washing campaigns can be successful when delivered correctly in Tanzania. It has been shown that information individually given to 334 households in Dar es Salaam about hand washing and water treatment significantly (p < 0.05) increased the occurrences of the behaviour (Davis *et al.*, 2011).

As shortage of available water for hygiene practices has been identified as a constraint to adoption of improved behaviours, non-water based hygiene projects could help improve sanitation. Hand cleaning with alcohol based hand sanitiser was found to be more effective at removing faecal origin bacteria than soap and water in a trail in Dar es Salaam (Pickering *et al.*, 2010). Hand sanitiser presents a feasible alternative when water is not readily available although the product is more expensive than soap and water and there would have to have to be a supply chain developed as it is not as readily available as soap. In a study of women hand hygiene practices faecal bacteria on hands were significantly (p = 0.023) associated with the length of time since last washing hands with soap and water (Pickering *et al.*, 2010).

7.2 Food hygiene

Behavioural and environmental assessments around the transmission of zoonotic parasites from pigs have been demonstrated to be an effective tool in identifying the risk factors for small scale pig farmers in the Mbulu District and what behaviour change interventions were needed (Ngowi *et al.*, 2007).

7.3 Specific locations or groups

7.3.1 Schools

Schools have formed the basis for a number of successful hygiene promotion projects in Tanzania. The Lushoto Enhanced Health Education program which taught personal hygiene to primary school children to control schistosomiasis and helminth infection found that after one year children had evidence of retained knowledge and behaviours (Lansdown *et al.*, 2002). Through primary schools education programs in central Tanzania focusing on face-washing hygiene the instances of dirty faces and nasal discharge were significantly reduced (Lewallen *et al.*, 2008). This was despite a lack of access to water at school inhibiting the application of the education program (Lewallen *et al.*, 2008). Further, a study of primary school children in the Kilombero District found that supplying them with a bar of soap for bathing over a two month period significantly reduced their instances of skin infections (Dinkela *et al.*, 2007).



Figure 8. Wastewater treatment pond with de-sludging tanker in the background.

8. CURRENT SANITATION AND HYGIENE PROGRAMS AND PROJECTS IN TANZANIA

8.1 Sanitation and hygiene programs

Government hygiene promotion campaigns are part of the National Environmental Health, Hygiene and Sanitation Strategy (NEHHASS). Developed by the MoHSW the strategy includes community sensitisation of hygiene and health problems (Hooks, 2008). Further the Ministry of Water and Irrigation coordinates the Water Sector Development Program (WSDP) 2006 - 2025 which includes hygiene promotion encompassing schools and health clinics (Hooks, 2008). The WSDP is primarily for water provision and a much smaller portion of the US\$ 2.85 billion budget is for sanitation and hygiene activities (Ministry of Health and Social Welfare, 2011). The program is funded by World Bank, African Development Organisation (SNV) and French Development Agency (AFD) (Ministry of Health and Social Welfare, 2011). One of the objectives of the WSDP is to upgrade 2 million latrines across Tanzania (African Development Bank, 2011).

The World Bank, Water Sanitation Program, is employing Community-Led Total Sanitation (CLTS) to increase sanitation (World Bank *et al.*, 2011). Tanzania is one of the trial countries for the Global Scaling Up Sanitation Project which is funded by the Gates Foundation (World Bank, 2008). The intervention is being evaluated in 10 districts to access which campaigns were more effective; sanitation activities, hand washing activities or a combination of both (World Bank *et al.*, 2011). The program aimed to complement the existing Tanzanian Government WSDP and NEHHASS programs (Hooks, 2008). The project was funded by the Gates Foundation for 4 years commencing in 2006 (Hooks, 2008). The program successfully reached 14.5 million people through mass media campaigns and hundreds of thousands through direct consumer contact and interpersonal contact (Coombes and Paynter, 2011). These campaigns were designed and targeted to convey both emotive and pragmatic messages about hand washing.

Initial findings have reported that the use of registers at local government level as means of recording any changes in sanitation behaviour were not reliable (Coombes *et al.*, 2011). This is due to the variation in record keeping, in some

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districts only 13 % of sub-villages had a register present while in other is was a high as 100 % (Coombes *et al.*, 2011). However, even if a register was present the accuracy and frequency of the information collected was not sufficient (Coombes *et al.*, 2011). If government registers are to be used to evaluate the effectiveness of CLTS then training and incentives for accurate record keeping will need to be made (Coombes *et al.*, 2011). Additionally, the program used community volunteers coordinated through the local government to deliver the interpersonal contact message. The return of forms from these volunteers was low (67 %) and there was volunteer lag as they were not being reimbursed for their time nor expenses (Coombes and Paynter, 2011). There was also message creep identified in the direct consumer contact promotions which is one of the challenges of communicating a consistent hygiene message (Coombes and Paynter, 2011). There was also difficulty actually quantifying the level of behaviour change due to data collection inconsistencies at the local government levels (Coombes *et al.*, 2011).

8.1.1 Urban areas

8.1.1.1 Dar es Salaam

The Dar es Salaam Water Supply and Sanitation Project (DWSSP) aims to supply affordable and sustainable sanitation to all areas designated by the Dar es Salaam Water and Sanitation Authority (DAWASA) (United Nations Human Settlements Programme et al., 2010). The DWSSP is implemented in partnership with Care International, Plan International and WaterAid (United Nations Human Settlements Programme et al., 2010). DWSSP aims to provide sanitation to 200 000 people by designing and installing sanitation facilities (United Nations Human Settlements Programme *et al.*, 2010). The Citywide action plan developed for Dar es Salaam aims to upgrade 50 % of informal settlements with adequate sanitation and waste disposal by 2020 and prevent the creation of new informal settlements (United Nations Human Settlements Programme et al., 2010). However, this only goes part way to service the remaining estimated 3 million people in Dar es Salaam who do not have access to improved sanitation. In addition to DWSSP the DAWASA has funding to improve its efficiency as part of the US\$ 64 million provided under a Tanzania Compact by the United States Millennium Challenge Corporation (MCC) to improve the water sector in Tanzania (Millennium Challenge Corporation, 2013).

Gulper pit latrine technology is an action pump is a human powered and capable of removing 500 - 700 L of sludge at a height of 2.3 m and has been used in

Dar es Salaam by local sludge removalist contractors since 2008 (EWAREMA Consult, 2010; Mgana, 2012). The technology was successfully trialed between 2008 - 2011 in a ward in each of the Temeke and Illala Municipalities (Mgana, 2012). WaterAid Tanzania is in the process of up-scaling the Gulper pit latrine emptying business model in Dar es Salaam to reach 123 000 people by 2015/16 (Cox, 2011). The Gulper pit latrine emptying program plans to give access to affordable sludge removal where other programs have not been as successful (EWAREMA Consult, 2010). Increasing sludge dumping prices, however, can negatively impact on any sustainable sludge removal business (EWAREMA Consult, 2010)

8.1.1.2 Other urban areas

The Zanzibar urban water supply and sanitation project is due to commence in December 2013 (African Development Bank, 2013). The project is to be implemented by the Zanizbar Water Authority and is partly funded by the African Development Bank (African Development Bank, 2013). To improve sanitation in Zanzibar town awareness campaigns will be run and latrines and hand washing facilities will be built in schools and in public areas (African Development Bank, 2013).

8.1.2 Rural areas

8.1.2.1 National programs

In 2012 the MoHSW commenced a National Water Government Sanitation promotion as part of the WSDP (Hooks, 2008; World Bank *et al.*, 2011). In January 2013 the sanitation marketing component of this promotion was commenced in 42 rural LGAs (Mwakitalima, 2013). The sanitation marketing campaign focuses on marketing improved sanitation using the district health officers and community development officers as well as radio campaigns (Mwakitalima, 2013). The MoHSW definition of improved sanitation is a flush toilet, VIP, Eco-san, enclosed septic or pit latrine with a washable floor and complete super-structure (Mwakitalima, 2013). The program is aiming for 1.52 million people adopting improved sanitation after 4 years and plans to up-scale to urban areas (Mwakitalima, 2013). The program is financed by a local from the African Development (DFID) (Mwakitalima, 2013). Additionally, the National Environmental Health, Hygiene and Sanitation Strategy (NEHHASS) developed a guidelines on sanitation and waste management (Hooks, 2008).

As mentioned previously *Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania* (MKUKUTA) is kiSwahil for the National Strategy for Growth and Poverty Reduction (Ministry of Health and Social Welfare, 2011). The program is supported by the African Medical Research Foundation (AMREF) and includes projects in the rural areas of Tanzania (African Medical Research Foundation, 2013). Specifically, AMREF is supporting the *Maji ni Uhai* (Water is Life) project in the Serengti District which has trained people in PHAST (African Medical Research Foundation, 2013). The program has also delivered hygiene and sanitation education, trained local ward officials, and local labourers to construct and repair latrines (African Medical Research Foundation, 2013). Additionally since 2001, AMREF has been working in the Mkuranga District, 50 km south of Dar es Salaam (African Medical Research Foundation, 2013). The project outcomes include an increase from 40 % to 85 % access to sanitation facilities using the PHAST approach (African Medical Research Foundation, 2013).

8.1.2.2 Regional programs

There are a number of regional programs focusing on rural sanitation and hygiene. The programs involved a combination of local and international NGOs and local government. In the Wami-Ruvu and Great Ruaha river basins Care International implemented the Integrated Water Sanitation and Hygiene Program (iWASH) between 2010 to 2012 (Care International, 2013). The program was funded with US\$ 3 million and reached 140 000 people using a combination of market driven sanitation and integrated water service provision with sanitation and hygiene (Care International, 2013) although this work was implemented by a local NGO, MSABI.

Plan International has an ongoing program on improving sanitation and hygiene as a means to improve the health of children and youth (Plan International, 2013). The program commenced in 1991 and is now operating in five regions in Tanzania: Dar es Salaam, Coast, Ifakara, Geita and Mwanza (Plan International, 2013).

In the Dodoma and Morogoro Regions, LVIA (an Italian NGO) has been implementing rural development programs since 1986 (LVIA, 2013). Their program's objectives are to build latrines and educate and they have been funded by the AFD and the Italian Government (LVIA, 2013).

WaterAid are currently up-scaling the Mtumba sanitation marketing approach in six rural districts to reach 229 000 people by 2015/16 (Cox, 2011). The Mtumba

sanitation approach is a hybrid concept developed by WaterAid Tanzania combining Community Led Total Sanitation (CLTS), PHAST and Participatory Rural Appraisal (PRA) (Cox, 2011).

In the Ngara, Biharamulo and Kibondo districts the International NGO Concern, commenced in 2011 a Water, Sanitation and Hygiene Program which will run until 2014 (Concern, 2012). The objectives of the program are to construct 9000 household sanitation facilities and hygiene promotion to 400 000 using community mobilisation and school education (Concern, 2012).

To protect Lake Victoria the Lake Victoria Basin Commission is currently implementing the Lake Victoria Basin Water and Sanitation Program which commenced in 2011 and is partly funded by the African Development Bank (African Development Bank, 2013). The program covers the regions that border Lake Victoria which in Tanzania are; Mwanza, Kagera, Geita, Simiyu and Mara Regions (African Development Bank, 2013). The program includes improving communal sanitation facilities, faecal sludge management, solid waste management and storm water drainage (African Development Bank, 2013).

Maji Safi kwa Afya Bora Ifakara (MSABI) is a local NGO located in the Kilombero District, Morogoro Region. MSABI has an integrated approach to sanitation and hygiene with latrine construction for schools and the community and an education program that includes community drama and direct consumer contact (MSABI, 2011). MSABI donors included United States Aid (USAID) who fund installation of water points and latrine as well as community education as part the of the East African Community Regional Development Program (United States Aid, 2013).

Also working in the Morogoro Region but in the Ulanga District is the Community Environmental Management and Development Organisation (CEMDO) (Community Environmental Management and Development Organisation, 2010). Their program of community development includes sanitation projects which is funded by the organisation (Community Environmental Management and Development Organisation, 2010).

To the south west in the Njombe Region the Southern Highlands Participatory Organisation (SHIPO) has a program that includes sanitation and hygiene education in the villages (Southern Highlands Participatory Organisation, 2013). Their programs also include using micro-finance facilities available for community members to take loans to finance their sanitation facilities (Southern Highlands Participatory Organisation, 2013).

The Health Actions Promotions Association (HAPA) is a local NGO based in the Singida Region the who is in part funded in part by the Body Shop Foundation (Body Shop Foundation, 2013). HAPA provides sanitation and uses participatory approaches in schools to promote sanitation and hygiene in the community (Health Actions Promotion Association, 2013).

Community Based Health Care Council (CBHCC) is another local NGO in Tanzania which works in the Arusha Region (Community Based Health Care Council, 2013). Their program is funded by Oxfam and focuses on improving the living conditions for women and children health and includes sanitation facility construction (Community Based Health Care Council, 2013).

8.1.2.3 Specific institutions and groups

Tanzania has hosted more refugees than any other sub-Sahara African country, refugees come from Burundi, Democratic Republic of Congo, Kenya, Rwanda, Somalia, Sudan and Uganda (Tanganyika Christian Refugee Service, 2013). Oxfam and the Tanganyika Christian Refugee Service is working with the UN Refugee Agency (UN HCR) and the Tanzanian Government to provide water and sanitation facilities in refugee camps (Oxfam, 2012; Tanganyika Christian Refugee Service, 2013).

Oxfam's and World Vision have programs that work with Maasai pastoralists in the Ngorongoro Region to assist then access to water required for drinking and hygiene purposes (Oxfam, 2012; Tanganyika Christian Refugee Service, 2013).

Schools are an important focus for a number of NGO. BORDA conducts school based sanitation as part of the national government MKUKUTA program (Bremen Overseas Research and Development Association, 2013). BORDA use decentralised wastewater treatment solutions employing low cost technology that low maintenance requirements (Bremen Overseas Research and Development Association, 2013). Local NGOs also work extensively with school. As an examples include The Desk and Chair Foundation, MSABI and HAPA construct latrine facilities and provide sanitation and hygiene education (MSABI, 2011; Health Actions Promotion Association, 2013; The Desk and Chair Foundation, 2013).

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9. CURRENT SANITATION AND HYGIENE KNOWLEDGE GAPS IN TANZANIA

9.1 Health impacts of hygiene and sanitation

Despite infections like Dengue Fever, Yellow Fever, polio and hepatitis being present in Tanzania there was no literature identified within a Tanzanian context that linked these infections environmental conditions. The literature search terms (Annex 2) specifically covered these viral pathogens and therefore this review reveals a knowledge gap that needs to be address. Knowledge of the links between enteric and mosquito borne viruses are important in order to tailor sanitation and hygiene programs and projects to help prevent them.

9.2 Sanitation

Nationally there is a lack of accurate data on latrine coverage (World Bank et al., 2011). The large variation in the data available on the methods and frequency of pit latrine emptying indicates that the practices are varied and more research is needed to gain an accurate understanding of pit latrine practices especially in informal urban settlements. Accurate data on pit latrine practices will facilitate further research on how to get households to invest in and up-take improved sanitation is lacking in Tanzania (World Bank et al., 2011). Particularly in informal urban settlements there needs to be a greater understanding of what the demands are and the capacity for people to pay for services both public and private (Pauschert et al., 2012). Specifically to facilitate the up-scaling of sustainable sludge removal research is needed on the market demand for sludge removal and the ability and willingness of people to pay for it (EWAREMA Consult, 2010). More work is also needed on appropriate technologies for affordable and sustainable removal of sludge in areas with high water tables and large quantities of sand in the pits needs to be applied in informal settlements (EWAREMA Consult, 2010). Finally, mechanisms to get the urban population to invest in and finance their own sanitation are required (World Bank et al., 2011). The Sanitation and Hygiene Applied Research for Equity (SHARE) consortium is presently undertaking research on market sanitation that will partly address some of these knowledge gaps (Sanitation and Hygiene Applied Research for Equity, 2012).

In rural areas more work is needed on capacity building for the construction of affordable improved sanitation. As the rural population is expected to finance their sanitation improvements to a greater degree than urban populations (World Bank *et al.*, 2011), affordability is a critical factor in adoption. Further, more work is needed to evaluate the effectiveness of the different approaches (CLTS, PHAST and RPA) and determining which ones are most effective in what contexts in Tanzania. It is likely that a hybrid approach as adopted by WaterAid Tanzania (Cox, 2011) is the answer, however, effective and standarised evaluation tools are needed in order to measure any impact.

9.3 Hygiene

Overall there was less literature available about the current hygiene status compared to sanitation. In part this could be due to the fact that is easier to collect data on hardware (number of toilets) rather than reported behaviour (frequency of hand washing). More research is needed on hygiene practices at a national level in both urban and rural areas in order to be able to design and evaluate effective hygiene promotion programs.

There is also less literature evaluating the effectiveness of hygiene programs and projects. This is likely because there have been less hygiene specific programs and projects implemented. Alternatively as demonstrated with the WSP CLTS program (Coombes *et al.*, 2011) that the data collection around hygiene behaviour change is challenging and needs to be monitored closely in order to get accurate and representative information.

9.3.1 Anal washing

There is very little information on the contribution of anal washing to faecal contamination in the household and associated illness. Considering that anal washing is the most common form (84 %) of cleaning post defecation in Tanzania (Chaggu *et al.*, 2002) it is important that more research is done on both the impacts of the behaviour and how to improve associated hygiene.

9.3.2 Menstrual hygiene

Only one study covering menstrual hygiene behaviour in Tanzania was identified in the literature. Information about menstrual hygiene behaviour, especially for girls while attending school, is needed in order to design effective hygiene education strategies and also to provide the necessary facilities for girls while attending school to enable attendance.

9.3.3 Oral hygiene

In the literature reviewed there was no information identified which described the oral hygiene practices for Tanzanian's. Due to the high reported rates of gingivitis in children (Kerosuo *et al.*, 1986) more research is needed in this area.



Figure 9. Using drama to educate school children about sanitation and hygiene.

10. PERSPECTIVES ON SANITATION AND HYGIENE FROM PRACTITIONERS WORKING IN TANZANIA

10.1 Practitioners interviewed

A selection of practitioners working with government, donors and NGOs were interviewed (Table 2). The interviews were semi-structured and the questions listed in Annex 3. Perspectives given are not linked to individuals but grouped based on theme and intent.

Name	Organisation type	Organisation	Position	Tanzanian WASH experience
Mr Anyitike Mwakitalima	Government	MoHSW	Acting head of Environmental Health and Sanitation Unit	10 years
Mr Akley Galawika	Local Government	Kilombero District Water Engineers Office	Environmental Engineer	16 years
Mr Kristoffer Welsien	Donor	World Bank	Country Officer	0.5 years
Ms Gertrude Mapunda Kihunrwa	Donor	UK DFID	Policy Advisor for WASH	5 years
Mr Herbert Kashililah	International NGO	WaterAid	Sanitation Officer	15 years
Ms Dhahia Mbaga	International NGO	CARE International	WASH Program	1.5 years
Mr Morten van Donk	Local NGO	SHIPO	Program Manager	1.5 years
Ms Naomi Ng'endo	Local NGO	MSABI	Sanitation Program	2 years

Table 2. Practitioners working in sanitation and hygiene in Tanzania

10.2 Practitioners perspectives

10.2.1 Experiences in improving sanitation

All stakeholders interviewed stated that in their experience some form of community motivation to improve their own sanitation (independent of the approach) was the most effective in triggering the community to change. However, this model was more easily implemented in rural areas due to the existing local government structures compared to the informal urban settlements which lacks formal governance structures. Timing was a critical factor for success. The ideal time for implementation of community motivation in rural areas was between June to August (the start of the dry season) when people were not busy on their farms and they have money from the sale of their crops. Equally important to timing is involving the right people from local government. The involvement of community health care workers and community development workers was a positive association that helped ensure the success of the sanitation marketing program. In one particular instance cited, the local health officer had informed the community that they could no longer build pit latrines because of health reasons and this assisted in triggering demand for improved sanitation. Further, the selection of the right people within the community, effective training and on going support was also essential. A respected senior person, such as a religious leader, who mobilises the community is a very powerful factor that should be sort. Also, the use of demonstration latrines and gardens in the markets was one approach that was found to be effective in aiding community motivation.

A common problem counted was that when the programs were implemented that there needed to be sufficient resources to meet the demand that the market driven sanitation program was going to create. Resources both in terms of local labours trained to be able to construct improved latrines and also in subsidises or loan schemes to assist households reach their sanitation goals. There were examples of government triggering community demand for improved sanitation which a local NGO was able to meet by training local labours. However, this was a rather ad-hoc arrangement. There were other examples where their was not sufficient follow up, due to lack of funds and trained labours, and the triggering of the community demand was in part wasted effort.

It was even stated by some that a community motivation based approach should be adopted more widely as they are more successful than a health based approach. Although there was acknowledgement that the community motivation approach does not reach the "poorest of the poor" but only further marginalises them, as they do not have the resources to improve their own sanitation status. It was recommended that subsidy schemes for the poorest were needed within the scope of a community motivated market based approach.

With respect to financing there were successes cited using local micro-finance institutions to offer sanitation products to the community. Market research was

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needed to find the right sanitation product demanded by the community. Interestingly, there was more demand for complete new improved latrines of a higher sanitation standard than simply improving existing pit latrines with precast slabs or improved super structures. Another example of local financing for sanitation improvement that was found to be successful was the engagement of local lending groups.

10.2.2 Experiences in improving hygiene

Improving hygiene was generally seen as a more complex and difficult area compared to sanitation as it required sustained behaviour change whereas hardware provision can improve sanitation. Promoting hygiene messages along with sanitation improvement through community motivated based programs was seen as the best method. Especially, when coupled with resources for radio or television advertising campaigns. However, the way in which the hygiene messages are promoted needed to be tailored to the specific community. Some approaches such as using drama, poems and dancing were found to be effective in some villages but not in others.

Overall the use of hygiene education through schools was reported to be very effective and widely utilised. Ownership of the school hygiene program was also cited as an important factor for success. The creation of school hygiene committee which had responsibility for ensuring latrines were cleaned and that other students practice good hygiene ensured empowerment and engagement of the student body. However, there was mixed feedback on specific programs such as the 'child to child' approach for hygiene education was not found to be very effective at communicating messages in some contexts but not in others. Other successful avenues of hygiene education have been through using the local health dispensaries and the local health workers.

A number of interviews made mention of the successful hygiene promotion program of the Nyerere government in the 1970s. This national program was in part so successful because it was driven by the government and conducted at a national level with sufficient resources. It was stated that programs of this scale are needed to have significant impacts on hygiene behaviour change in Tanzania.

10.2.3 Roles of stakeholders in improving sanitation and hygiene

All stakeholders spoken with were in consensus that the government needed to play the central role in improving sanitation and hygiene. One respondent commented that "without political will there will be no change" and that presently

"politicians do not believe that there is a problem" with sanitation and hygiene and there for there is "no political will". The government needs to provide the policy direction, regulation, enforcement, funding and implementation while working in conjunction with the community, commercial sector, donors and NGO. A common problem observed within government is the disjointed approach to water, sanitation and hygiene across the different departments. Water is the responsibility of the Department of Water and Environment, sanitation the Department of Health and schools and hygiene education the Department of Education. This division results in a lack of information sharing and co-ordination to improve sanitation and hygiene. In addition the different departments have competing demands on their budgets which often means that resources are not allocated to sanitation and hygiene programs. Further, the different departments have distinctive focuses which impacts on their programs. The Department of Water and Environment have a very technical approach to service provision and this can results in a lack of evaluation of the social and other soft influences on the success of the programs. The Department of Health generally has a more holistic community perspective which can be very effective for implementation of sanitation and hygiene programs.

To improve hygiene and sanitation "water and sanitation need to go together". A successful example of co-ordination was the formation of a water and sanitation committees at local and district government level with representatives from all the involved departments, including the Departments of Planning and Community Development. Water and sanitation committees facilitate information sharing, co-ordination of plans and pooling of resources which will ultimately enable effective program implementation. There also needs to be appropriate people selected for these roles in committees - "the right people at the right time with the right motivation and resources can make big changes".

Securing sufficient funding for the sector was in part seen as the responsibility of the donor stakeholders. It was stated that at present there is not sufficient funding for sanitation and hygiene in part because other programs were given greater priority with the donor programs. Donors could not only ensure that more funds were available for sanitation and hygiene but also place pressure on the government to allocated more funding and resources to the area.

The role of NGOs was seen as important and multifaceted. NGO roles included: being able advocate for the sanitation and hygiene agenda; to mobilise the community and other groups; to conduct research; to supplement funding sources;

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provide technical knowledge for programs; and work with the government in implementation. However, NGOs need to take the initiative to from good working relationships with the government and ensure that their programs complement the local government work. This relationship takes time to forge, protocol needs to be followed and can they can frequently need to be re-established when there is a change of position or responsibility.

Involving the commercial sector (both entrepreneurs and established businesses) in sanitation and hygiene service provision and promotion are "key to solving the problems". Given the right conditions the commercial sector has the capacity to fill the demand created by a market based approach for improved latrine construction and sludge removal. Further, those businesses which sell sanitation and hygiene products, such as soap, need to play a role in actively marketing their products.

The responsibility of the individual was also mentioned. The individual citizen should be "responsible for and take an interest in their own sanitation and hygiene". They should form community based organizations to demand services both from the government and private sector. However, it was also acknowledged that many communities were "lost" with respect to what sanitation products they should use. Identification and promoting of "champions" within the community who had adopted improved sanitation and hygiene practices was given as one solution. Another option was to guide the community through demonstration of effective solutions by NGO.

10.2.4 Knowledge gaps in sanitation and hygiene

There are a number of knowledge gaps identified in sanitation and hygiene by the interviewees. In particular what are the exact triggers for a household to change their behaviour and what are the cost associated with that change. Costs in terms of both finances to buy sanitation and hygiene products and also time taken to implement the changed behaviour. What are the restricting factors that prevent people form "moving up the sanitation ladder"?

Informal settlements in urban areas deserve special attention because of the rapid urbanization. Specifically, there needs to be more information on the state of sanitation and hygiene in informal urban settlements. Additional research is needed to determine how to work effectively within existing informal community structures or how to form new local governance structures to enable implementation of sanitation and hygiene programs. Importantly for urban areas more research is needed as to

how to get the commercial sector involved in service provision and how to make effective businesses in this area.

Women's hygiene issues remain an area that needs more attention. The knowledge gaps relating to women's menstrual hygiene need to be addressed. In particular how to assist retention of girls at school through the provision of facilities for menstrual hygiene.

The is a need for more publically available statistics on sanitation coverage and population growth. The national census and surveys currently report to broad geographic regions only. There is demand for more detailed statistics at the level of individual wards and streets. That information might be available to government but would be a useful tool for NGO and donors to design programs and respective funding. Overall, the tracking of achievements and plans of all the stakeholders in sanitation and hygiene is not being co-ordinated in Tanzania. There needs to be monitoring of the sector so that progress can be measured and attainment of targets and goals determined.

Finally, to assist in motivating both the community and the government there needs to be more research conducted on the cost-benefit of investing in sanitation and hygiene. Specifically, the exact impact of sanitation and hygiene investment on improving the countries economy prosperity through reductions in mortality and morbidity. But also the potential business earnings from creating sanitation markets for both product demand but also for re-use of faecal waste products. Investing in sanitation and hygiene should be viewed as a "tool to increase economic growth" not another drain on limited funds.

11. RECOMMENDATIONS ON HOW TO IMPROVE SANITATION AND HYGIENE IN TANZANIA

11.1 Coordinated response

It is proposed that the Tanzanian Government adopt a network approach to provision of services, where by government at all levels collaborates with private partners, businesses, NGOs and communities, to provide services (Oosterveer, 2009). Alternative terminology to describe the same interaction is tripartite partnerships between government, private sector and civil society (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007). There are risks to this approach which include a lack of legitimacy and the constant need for negotiation (Oosterveer, 2009). The government needs to provide regulation and capacity for law enforcement for the private sector (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007). However, the benefits of bottom up participation and actual service provision make it a more acceptable model for Tanzania (Oosterveer, 2009). Examples of this in action are the collaboration with private pit latrine emptying businesses and community waste collection businesses to provide services to informal settlements and the Community Managed Upgrading project in Hanna Nassif in Dar es Salaam (United Nations Human Settlements Programme, 2010).

11.1.1 Government

11.1.1.1 Responsibilities

At present the Tanzanian government public service capacity is weak and despite pressure they have been unable to provide urban sanitation and solid waste services (Oosterveer, 2009). There is also a consistence transfer of responsibility from central to local and municipal level (Montgomery, 2008) which can result in disjointed policy implementation and action as local government might not have the fulfill responsibilities (Gesellschaft für capacity to their Internationale Zusammenarbeit et al., 2007). There needs to be clear roles and responsibilities for ministries along with a national monitoring and evaluation framework (including national definitions) and database (Ministry of Health and Social Welfare, 2011).

11.1.1.2 Policy and regulation

The current draft National Sanitation and Hygiene Policy needs to be finalised and operationalised (World Bank *et al.*, 2011). This national sanitation policy will need clear regulations, definitions of adequate sanitation and frameworks to be effective (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007; Chaggu, 2009; World Bank *et al.*, 2011). The allocation of funds from the RMO - RALG to the Local Government Areas (LGA) to implement of sanitation programs and systems is more likely to ensure that the sanitation budget is actually spent in the communities (Ndgendo, 2012). However, research has shown that if LGA are not regulated and monitored then services will not been adequately provided (WaterAid, 2011).

Policy objectives need to priortise the poorest Tanzanians with the most inadequate sanitation. Specifically that sanitation services for informal urban settlements are prioritised over sewerage network expansion in formal areas of the city (World Bank *et al.*, 2011). Further that promotion of hygiene activities that will reach the poorest who do not have regular access to mass media (Ministry of Health and Social Welfare, 2011).

11.1.1.3 Monitoring and surveillance

There is a need to improve monitoring and surveillance systems inline with international best practice so that outcome of sanitation improvements can be monitored and evaluated effectively (World Bank *et al.*, 2011). Mapping of informal communities is also necessary in order to be able to understand that scale of the problem. In Dar es Salaam informal community mapping for water and sanitation was successfully carried out by selected and trained community members in five 'streets' (Glöckner *et al.*, 2004). The data collected about housing density and sanitation are very useful tools for future planning of appropriate sanitation systems (Glöckner *et al.*, 2004). Additionally with allocated housing lots and addresses surveys and enforcements of sanitation policy and regulations are more feasible (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

11.1.1.4 Financing

It is recognized that investment in sanitation by the government has been well below what is required to provide adequate sanitation services (Cox, 2011). There is a need for increased funding for sanitation and hygiene infrastructure but also operation and maintenance (Ministry of Health and Social Welfare, 2011). It is recommended by the African Ministers of Water Commission that a minimum of 5 % of government revenue is needed to be invested in water and sanitation in order to meet coverage targets (World Bank *et al.*, 2011). Additionally, the economic benefits of investing in sanitation and hygiene need to be quantified and leveraged upon to secure funding for the sector.

11.1.2 Donors and multi-lateral agencies

Interventions need to complement and work with existing national policies in order to facilitate scaling up (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007). Capacity building at all levels needs to involve people in all levels of planning, operation and management of systems (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

Improvements in the monitoring indicators for the Joint Monitoring Programme is needed (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007). Clear consensus on the definitions of improved sanitation is needed from multi-lateral agencies. Shared latrines should be promoted as a means to gain access to sanitation for the poor as work surveys in Dar es Salaam and Ifakara revealed no difference in the hygiene of private or shared facilities (Exley, 2011). The WHO/UNICEF JMP does not classify shared facilities as improved, however, research findings suggest this should be reviewed as a means for the poor to gain access to sanitation (Exley, 2011).

11.1.3 Non-government organisations

The role of the NGO, both local and international, should be in capacity building for the public sector and also the fulfillment of service provision (Chaggu, 2009). Also, NGO should continue to play an important role in raising sanitation on the agenda both through national politics and internationally (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007; WaterAid, 2011). Further, they can assist in monitoring, evaluating and ensuring the accountability of government and multi-lateral programs (WaterAid, 2011). The continued expansion and strengthening of multi-stakeholder alliances and networks is needed (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007) such as the TaWaSa and the National WASH Coalition. Finally, NGO are well placed to further develop and implement social marketing strategies for sanitation and hygiene (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

11.1.4 Community based organisations

Community based organizations (CBO) have an important role in voicing the concerns of the people regarding sanitation and hygiene and demanding more from the government (WaterAid, 2011). CBO can play a role in service provision but will not start without adequate support or the right conditions are present with respect to Government, NGO assistance and financial support and incentives (Dill, 2010). CBO, along with NGO, are also well placed to further develop and implement social marketing strategies for sanitation and hygiene (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

11.1.5 Private sector

Through developing business opportunities such as latrine construction, solid waste removal and pit latrine de-sludging the commercial sector can developed to provide sanitation services needed (Ministry of Health and Social Welfare, 2011). However, local micro-finance institutions need to be developed to assist the local business establish in sanitation and hygiene (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

11.2 Recommendations to improve sanitation

For a sanitation program to be sustainable in East Africa it needs to have three things; effective community demand, local financing and cost recovery and dynamic operation and maintenance (Montgomery *et al.*, 2009). It is recommended that all actors involved in designing sanitation programs or services include these three criteria to ensure that it actually results in health gains and development (Montgomery *et al.*, 2009). Capacity building is particularly important for the maintenance and on going sustainability of sanitation systems (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

As people's knowledge of latrines is generally gathered from observation of what is presently in use then the construction of demonstration improved latrines such as anaerobic digesters and ecological sanitation toilets would be a good awareness tool (Chaggu *et al.*, 2002). Further, the marketing of sanitation is an effective tool when the messages are clear and the means of delivery accepted and should be employed further (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

11.2.1 Latrine construction

Masons and providers need to be trained on the construction of non-leaching pit latrines (Mgana, 2012). Latrines should be constructed for faecal waste only (not water from bathing and other solid waste) and emptied regularly (Mgana, 2012). Pit latrines should be built with concrete floors and position in the sun to limit helminth transmission (Baker, 2010). Further, having a latrine super-structure with a roof is recommended to reduce the number of flies breeding in the latrine and associated risks of disease transmission (Knudson, 2011). Further these types of latrines should be regulated for (Mgana, 2012).

Focus groups with community members from 197 informal settlements in Dar es Salaam reveal that there is large community demand for public latrines (Slum Dwellers International and Centre for Community Initiatives, 2009). The public latrines were seen by the community as a good option for those households without a latrine and also in those areas where the high water table meant that the construction of pit latrines was not feasible as they filled too quickly (Slum Dwellers International and Centre for Community Initiatives, 2009). In high density informal settlements then shared sanitation facilities should be promoted (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

11.2.2 Latrine de-sludging

Pit latrines are a reality within urban areas and there needs to be clear policies on their construction, emptying and places to safely dispose of sludge. Effective management of faecal sludge is problem that requires significant resources. It is estimated that each pit latrine receives 0.48 m³ per year of faecal waste (Chaggu *et al.*, 2002). In a city the size of Dar es Salaam that lends to 254 000 m³ of sludge that needs to be disposed of per year (Chaggu *et al.*, 2002). Effective disposal sites and education about when and how to de-sludge.

Locations for dumpling sludge that are environmentally safe, affordable and accessible need to be maintained and expanded in order to facilitate sustainable sludge management practices (EWAREMA Consult, 2010). At community or Ward level there needs to be decentralised faecal sludge treatment systems (Mgana, 2012). Then decentralised collection points for faecal sludge and mobile transfer stations need to established within communities to facilitate sludge removal using manual techniques and motorbike tricycles from informal settlements (EWAREMA Consult, 2010). The Municipal Councils and Street Government need to assist in

regulating private pit emptying businesses and enforcing penalties for illegal dumping (EWAREMA Consult, 2010).

11.2.3 Financing

Current financing for sanitation in urban areas is insufficient with an estimated 40 % of the per capita cost of sanitation (US\$ 52) not met by investment (household, domestic or international) (World Bank *et al.*, 2011). However, due to capacity restrictions, resulting in budget under spending, increasing funding without first increasing the ability the supply sanitation services is futile (World Bank *et al.*, 2011). There needs to be targeted development and public funding towards the low income areas of urban settlements (Chaggu, 2009; Pauschert *et al.*, 2012). Further, raising the tariffs for public sewerage provision to make it cost effective to service the poor (Pauschert *et al.*, 2012). The urban poor have the capacity to be a profitable customer base for public service provider as they are presently paying up to 13 times more than middle or high income households for service provision via informal providers (Pauschert *et al.*, 2012).

Loans and latrine construction funds should be available for the community (Chaggu *et al.*, 2002). Also micro-finance for the commencement of pit empyting businesses, including training of operators, is needed to foster business creation (EWAREMA Consult, 2010). Public-private partnership where the costs of services is partly regulated by the government could improve and enhance sustainable sludge removal businesses (EWAREMA Consult, 2010).

To increase rural sanitation coverage it is assumed that the community and external funding will contribute 100 % to the costs of low cost sanitation technology which means that sufficient finance is present for rural sanitation (World Bank *et al.*, 2011; World Bank *et al.*, 2011). This needs to be led by a national effective approach to promote sanitation in rural areas (World Bank *et al.*, 2011).

11.2.4 Specific institutions or groups

11.2.4.1 Schools

There is insufficient government funding for school sanitation and hygiene infrastructure and no funding for on-going operation or maintenance (Stichting Nederlandse Vrijwilligers *et al.*, 2011). The schools have to rely on raising capital from the communities with mixed results and there is little support or understanding of maintaining sanitation and hygiene within the schools (Stichting Nederlandse

Vrijwilligers *et al.*, 2011). Sanitation and hygiene within school needs to be a government priority. School children learn quickly and should be the focus for marketing of sanitation messages (Gesellschaft für Internationale Zusammenarbeit *et al.*, 2007).

11.2.5 Drainage

Drains need to maintained and better designed in urban areas in order to reduce the mosquito breeding sites and reduce flooding. Training of local government and resources made available to construct and maintain drains. There also needs to be greater synergy between the National Malaria Control Program and the National Lymphatic Filariasis Elimination Program (Castro *et al.*, 2010). Government commitment, community education, resources for drain maintenance and collaboration between involved sectors (Castro *et al.*, 2009).

11.3 Recommendations to improve hygiene

Providing sufficient quantities of safe water combined with Tanzanian tailored effective hygiene promotion will facilitate adequate hygiene adoption. One possible option for effective hygiene promotion with a potential revenue source for the people tasked with community engagement could be through the sale of soap or water treatment tablets as a means to make an income from the process (Coombes and Paynter, 2011).

Effective public service of drinking water in low income areas would mean that people had sufficient clean water for hygiene. If the public service traffics for drinking water were raised from 500 TZS/m³ to 1500 TZS/m³ on average this would only be 23 % of the price being charged by informal private water vendors (Pauschert *et al.*, 2012). For low income families the cost of public service connection is often prohibitive and hence loans, installment payments or subsidies for these fees need to be put in place (Pauschert *et al.*, 2012). Also it is recommended that people use a separate room for bathing as a good hygiene practice (Chaggu *et al.*, 2002).

11.4 Impacts of climate change

Climate chance impacts need to be kept in mind when looking at solutions in the sector. Precipitation changes may see a larger number of droughts in the country and changed precipitation patterns place a larger burden on women who have to travel further or wait longer to collect water (Waititu, 2009). Also increases in temperature will result in changed infection patterns. It is estimated that risk ratio of cholera infection will increase in Tanzania from between 23 - 51 % for each 1 °C increase in annual mean temperatures (Trærup *et al.*, 2010).



Figure 10. Latrine provided at a rural health care clinic with a bucket for hand washing.

12. CONCLUSIONS

Improvements in Tanzania in sanitation and hygiene are needed to meet the MDG and the interim Tanzanian Government targets. Providing adequate sanitation and hygiene will be effective in reducing the current associated morbidity and mortality. There have been a number of projects and programs implemented or currently being implemented in Tanzania. In large these programs have failed to achieve scale and impact in both rural and urban areas. It is important to learn from the finding of past projects and programs and adopt that knowledge into effective programs for the future. A participatory approach is needed between all the stakeholders; government, NGO, donors and multilateral organisations, CBO and the commercial sector. The Tanzanian government needs to be central in a participatory providing suitable policy and regulation. With a coordinated response and a change in direction then Tanzania can adapt to the challenges of population growth, urbanisation and climate change to improve the populations health through adequate sanitation and hygiene provision.

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ANNEXES

Annex 1. Main actors in sanitation and hygiene in Tanzania

Туре	Department/ Organisation	Specific programs/responsibilities^	Location of head office in Tanzania	Reference
Government	Local Government Authorities (LGA)	 Water Sector Development Program (WSDP) Implementation of policies and programs 	All regions	
	Ministry of Education and Vocational Training (MoEVT)	- School WASH	Dar es Salaam	
	Ministry of Health and Social Welfare (MoHSW)	 National Environmental Health, Hygiene and Sanitation Strategy (NEHHASS) Monitoring LGA 	Dar es Salaam	(Ministry of Health and Social Welfare, 2011)
	Ministry of Water and Irrigation	- WSDP - Monitoring LGA	Dar es Salaam	
	Prime Ministers Office - Regional Administration and Local Governments (PMO - RALG)	- WSDP - Supervise and monitor LGA and private sector	Dar es Salaam	
Donors and multi-lateral agencies	African Development Bank (ADB)	 WSDP Zanzibar Urban Water Supply and Sanitation Project Lake Victoria Water Supply and Sanitation Program 	Dar es Salaam	(African Development Bank, 2011)
	Agence Française de Développement (French	- WSDP	-	(French Embassy Tanzania, 2013)

World Health Organisation (WHO)	- Joint Monitoring Program (JMP)	Dar es Salaam	(World Health Organisation and United Nations Children's Fund, 2006)
World Bank (WB)	Sanitation Program (DWSSP) - Water and Sanitation Program (WSP) - WSDP	Dar es Salaam	(World Bank, 2011) (Hooks, 2008)
United States Aid (USAID)	 East African Community Regional Development - water and sanitation Daries Salaam Water Supply and 	Dar es Salaam	(United States Aid, 2013)
United Nations Children's Fund (UNICEF)	- School WASH - Joint Monitoring Program (JMP)	Dar es Salaam	(Stichting Nederlandse Vrijwilligers <i>et al.</i> , 2011)
United Nations (UN HABITAT)	- Dar es Salaam informal settlement upgrading	-	(United Nations Human Settlements Programme <i>et</i> <i>al.</i> , 2010)
United Kingdom Department for International Development (DFID)	- WSDP - Sanitation and Hygiene Applied Research for Equity (SHARE)	-	(Sanitation and Hygiene Applied Research for Equity, 2012)
Millennium Challenge Corporation (MCC)	- Tanzania Compact - DAWASA efficiency	-	(Millennium Challenge Corporation, 2013)
Kreditanstalt fur Wiederaufbau (Germany Bank for Reconstruction) (KfW)	- WSDP	-	(Ministry of Health and Social Welfare, 2011)
Danish International Development Agency (DANIDA)	 vvastewater treatment research Informal settlement upgrading Agenda for Environment and Responsible Development (AGENDA) 	-	(Yhdego, 1992) (United Nations Human Settlements Programme <i>et</i> <i>al.</i> , 2010)
Belgian Directorate-Generale for Development Co-Operation (DGDC)	- Local Government Development Grant Scheme (water and sanitation)	-	(Belgian Directorate- Generale for Development Cooperation, 2010)

Development Agency) (AFD)

	ACRA cooperiamp lo sviluppo	- Water supply protection and capacity building	Njombe and Dar es Salaam	(ACRA, 2013)
	African Medical Research Foundation (AMREF)	 National Strategy for Growth and Poverty Reduction (MKUKUTA) 	Dar es Salaam	(African Medical Research Foundation, 2013)
	Bremen Overseas Research and Development Association (BORDA)	- School WASH	Dar es Salaam	(Bremen Overseas Research and Development Association, 2013)
	Care International	- Tanzania Integrated Water, Sanitation and Hygiene Program (iWASH)	Dar es Salaam	(Care International, 2013)
	Concern	- Water, Sanitation and Hygiene Program	Dar es Salaam	(Concern, 2012)
International NGOs	Gesellschaft für Internationale Zusammenarbeit (German Development Organisation) (GIZ)	- Urban sanitation	Dar es Salaam	(Pauschert <i>et al.</i> , 2012)
	LVIA solidarietà e cooperazione	 Water, Sanitation and Hygiene program 	Kongwa	(LVIA, 2013)
	Oxfam	- Refugees - Water supply for Maasai	Dar es Salaam	(Oxfam, 2012)
	Plan International	- Child focused sanitation program	Dar es Salaam	(Plan International, 2013)
	Stichting Nederlandse Vrijwilligers (SNV) (Netherlands Development Agency)	- School WASH	Morogoro	(Stichting Nederlandse Vrijwilligers <i>et al.</i> , 2009)
	Swedish International Development Corporation Agency (SIDA)	- Health through Sanitation and Water Program (HESAWA)	-	(Tufvesson <i>et al.</i> , 2005)
	WaterAid	 Samation to Scale (Guper and Mtumba approaches) Tawasanet Sanitation and Hygiene Applied Research for Equity (SHARE) 	Dar es Salaam	(WaterAid, 2011)

	Aga Khan Foundation	- Raha Leo community health program, Zanzibar	Dar es Salaam	(Aga Khan Foundation, 2007)
Foundations	Ford Foundation	- Dar es Salaam informal settlement up-grading	-	(United Nations Human Settlements Programme, 2010)
	Gates Foundation	- Community-Led Total Sanitation, Water Sanitation Program	-	(Hooks, 2008)
	The Body Shop Foundation	 Health Actions Promotions Association (HAPA) Maji na Maendeleo Dodoma (MAMADO) 	-	(Body Shop Foundation, 2013)
	The Stone Family Foundation	- Gulper pit latrine emptying business model	-	(Cox, 2011)
Networks	Tanzania Water and Sanitation Network (TaWaSa)	- Coordination and policy making	Morogoro	(WaterAid, 2011)
	National WASH coalition	- Sanitation and hygiene promotion	Dar es Salaam	(Water Supply and Sanitation Collaborative Council, 2013)
	Ardhi University (ARU)	- Sanitation research	Dar es Salaam	(Chaggu, 2009)
Research institutions	London School of Hygiene and Tropical Medicine (LSHTM)	 Gulper pit latrine emptying- Helminths association with pit latrines 	-	(Mgana, 2012)
	Sanitation and Hygiene Applied Research for Equity (SHARE)	 Sanitation markets Latrine hygiene 	-	(Sanitation and Hygiene Applied Research for Equity, 2012)
	Swiss Tropical and Public Health Institute	- MSABI	-	(MSABI, 2011)
	University of Dar es Salaam	 Wastewater treatment research Joint Environment Management Action (JEMA) 	Dar es Salaam	(Yhdego, 1992)

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	Organisation (SHIPO)			Participatory Organisation, 2013)
	TAKA NGUMU Group	*	-	(Chaggu, 2009)
	Tanzania Environment and Sanitation Conservators (TESCO)	- Environmental sanitation	Morogoro	(Chaggu, 2009)
	Tanzania Water & Environmental Sanitation (TWESA) Victoria Environmental and Fishery Development Association (VEFDA) Water and Sanitation for Community Development (WASACODE)	 Concern Water, Sanitation and Hygiene Program 	Dar es Salaam	(Concern, 2012)
		- Environmental sanitation	Mwanza	(Chaggu, 2009)
		- Environmental sanitation	Morogoro	(Tanzania Water and Sanitation Network, 2012)
Faith Based Organisatio ns	Tanganyika Christian Refugee Service (TCRS)	 Concern Water, Sanitation and Hygiene Program Sanitation for refugees 	Dar es Salaam	(Tanganyika Christian Refugee Service, 2013)
	World Vision (WV)	- Water Supply for Maasai		(World Vision, 2013)

* Programs undertaken could not be identified in the literature and more research is needed to locate this information

^ Examples of current programs and not an exhaustive list

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Торіс	Search terms
Sanitation	sanit\$, latrine\$, toilet\$, ecosan, bathroom\$, f?ece\$, f?ecal,
	excreta, waste, refuse, disposal, management, collection,
	contamination, treatment, sewage, sewer\$, sewerage,
	drainage
Hygiene	hygien\$, food, domestic, personal, education, promotion,
	behaviour, soap, handwashing, hand washing, water,
	storage, treatment, filter, contamination
Diseases	f?ecal, coliform\$, bacteria;, microbiological, viral, diarrh?ea?,
	intestinal, enteric, gastro-enteric, protozoa\$, diarrhea,
	dysentery, parasitic diseases, campylobacter, helicobacter,
	legionellos\$, vibrio, cholera, Escherichia, salmonell\$, shigell\$
	campylobacter infections, enterobacteriaceae infections,
	helicobacter infections, legionellosis, vibrio infections,
	Escherichia coli infections, salmonella infections, enterovirus,
	enteric virus, poliovirus, rotavirus, norovirus, norwolk-like
	virus, hepatitis, virus diseases, ascaris, trichuris, hookworm,
	roundworm, whipworm, nematode\$, protozoa\$, giardia,
	geohelminth\$, soil-transmitted helminth\$, worm\$,
	cryptosporid\$, helminth\$, entamoeba, am?ebiasis, isospora,
	cyclospora, microspora, blastocystis, balantidium,
	dientamoeba, helminthiasis, intestinal diseases, parasitic,
	protozoan infections, Arsenic Poisoning, arsenic or
	arsenicosis, Schistosomiasis, schistosoma, schistosomiasis,
	schistosome, trachom*, Trachoma
Geography	Tanzania

Annex 2. Literature review search terms

Annex 3. Semi-structured interview questions

- 1. What is your current position and role?
- 2. How long have you worked in the WASH sector in Tanzania for?
- 3. What programs is your organisation currently implementing in Tanzania?
- 4. In your experience what do we need to do to improve sanitation in:
 - a. Urban areas;
 - b. Rural areas; and
 - c. Specific groups (schools, hospitals, refugee camps, tribal groups)?
- 5. In your experience what do we need to do to improve hygiene in:
 - a. Urban areas;
 - b. Rural areas; and
 - c. Specific groups (schools, hospitals, refugee camps, tribal groups)?
- 6. What do you view as the roles and responsibilities of the following groups in implementation of suggested solutions:
 - a. Government;
 - b. International NGOs;
 - c. Local NGOs; and
 - d. Communities?
- 7. With regards to sanitation, from your own experience, what information/ research is need to find better solutions?
- 8. With regards to hygiene, from your own experience, what information/research is need to find better solutions?