Assessing knowledge transfer in sanitation projects to promote sustainable VIP latrine provision

Dissertation in complete fulfilment of the requirements for the degree of Master in Commerce (Information Systems)

Prepared by:

Lulama Ntombana Ngobeni

(NGBLUL001)

Supervisor:

Professor Ulrike Rivett

iCOMMS

Department of Information Systems

Commerce Faculty

University of Cape Town

May 2016

Plagiarism Declaration

1. I know that plagiarism is to use another's work and pretend that it is one's own.
2. I have used the Harvard convention for citation and referencing. Each contribution and quotation in this Thesis Proposal from the work (s) of other people has been attributed, and has been cited and referenced.
3. This Thesis is my own work.
4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.
5. I acknowledge that copying someone else's assignment or essay, or part of it, is wrong, and I declare that this is my own work.

Ms Lulama Ngobeni

Abstract

The aim of this study was to assess how knowledge transfer through community engagement and public participation can be used to support the sustainability of VIP latrines, and hence address the negative perceptions that people have of the VIP latrine. In South Africa, the basic minimum acceptable level of sanitation is a lined Ventilated Improved Pit (VIP) latrine. Some sanitation projects utilising VIP latrines have, however, been unsuccessful as a result of the poor construction and design practices, and insufficient buy-in from latrine users. Successful VIP latrine sanitation projects have shown to use effective knowledge transfer through community engagement. The study comprises of a review of literature on community engagement, public participation, sustainable sanitation, VIP latrines and the transfer of knowledge in sanitation projects.

The fieldwork study was a comparative assessment of two VIP sanitation projects implemented in the Bushbuckridge Local Municipality: a project coordinated by an NGO appointed by the Department of Human Settlements as part of the Rural Household Infrastructure Programme; and another where the project was run by a project management firm appointed by the local municipality which used funding from the municipal infrastructure grant. For the NGO co-ordinated project, a community engagement approach was adopted, whilst the Project Management Firm co-ordinated project used a public participation approach. The projects were implemented in two villages both situated 10km North East of the town of Bushbuckridge.

The comparative assessment was two-fold: an assessment of the sustainability of the VIP latrines, using the Integrated Assessment of Sustainable Development which was developed by Krajnc and Glavic (2004), and a Critical Systems Heuristics (CSH-developed by Ulrich in 1983) (Reynolds, 2007) analysis of the public participation and community engagement methods used in both projects.

The findings of the study show that community engagement methods result in VIP latrine sanitation projects that are more sustainable as such methods create a sense of ownership of the latrines (amongst users), improve health and hygiene, result in user education on the

operation and maintenance of the latrine, and promote community governance throughout the project. The involvement of community members in sanitation project must therefore not be limited to the legislated public participation methods, but should be extended to community engagement through encouraging communities to be fully involved in the project, including involvement in some decision-making processes. Additionally, all stakeholders in sanitation projects should be engaged in a manner that is beneficial to them. The CSH analysis can serve as a guideline for the engagement of stakeholders in sanitation projects and hence contribute to the provision of sustainable sanitation systems.

Acknowledgements

Achieving a God dream is not easy, but it is worth it. This is one of the quotes that kept me going throughout the process of this research project, and the God it speaks of, carried me through. So I would first and foremost like to thank the Almighty Father for making the successful completion of this research possible. It wasn't easy, but by His Grace, it has been done.

I gratefully acknowledge the funding received towards my Masters research from the Water Research Commission (WRC) and the National Research Foundation (NRF).

I am especially grateful to the members of the iCOMMS team, for their contributions and encouragement. The countless discussions and debates we had were both insightful and added value to my research. In particular, I would like to express my sincerest gratitude to the leader of the iCOMMS team and my supervisor, A/Prof Ulrike Rivett, for her support and guidance throughout my Honours and Masters Programs. Her passion and enthusiasm for her work was truly inspirational. It has truly been an honour to be a member of her team. The fieldwork in Rolle and MP Stream was an integral part of this research. It could not have been completed without the help of my fieldwork assistants and the goodwill of all the villagers who willingly took part in the household survey. To the Malomane family, thank you. May God richly bless you.

Lastly would also like to thank my friends and family for their continuous love, prayers and support. Special thanks to my parents, Dorcas Makhubela and Patrick Ngobeni, who played a very crucial role in the fieldwork study. Thank you for your constant love, advice and willingness to help, you are undoubtedly one of God's greatest gifts to me. To "dad," Pastor Sam Masigo and Mpho Sequence Sikwe, you gentlemen are awesome. Thank you for being there to laugh and pray with me in good and bad times, I thank God for both of you. To two of my biggest cheerleaders, Hlulani Mathebula and Mahlatse Tloubatla, thank you, thank you, thank you; you make me brave.

"...Being confident of this: that He who began a good work in you will carry it on to completion until the day of Christ Jesus." (Philippians 1:6; NIV)

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AHP Analytical Hierarchy Process

BLM Bushbuckridge Local Municipality

CBO Community Based Organization

CDF Community Development Forum

CDW Community Development Worker(s)

CLTS Community-Led Total Sanitation

CSH Critical Systems Heuristics

CSIR Council for Scientific and Industrial Research

DHS Department of Human Settlements

DLG Department of Local Government

DPLG Department of Provincial and Local Government

DWAF Department of Water Affairs and Forestry

$I_{A,i,j,t}$ Measured value of a given indicator

I_{CSD} Composite Sustainable Development Index

$I_{N,i,j,t}$ Normalized Indicator

I_S Sustainability Sub-index for each sustainability sub-group

MDG Millenium Development Goals

MIG Municipal Infrastructure Grant

NGO Non-Government Organization

OD Open Defecation

ODF Open Defecation-Free

O/M Operation and Maintenance

PHAST Participatory Hygiene and Sanitation Transformation

Rc Consistency Ratio

RHIP Rural Household Infrastructure Programme

RSA Republic of South Africa

SAHRC South African Human Rights Commission

SAICE South African Institute of Civil Engineers

StatsSA Statistics South Africa

SuSanA Sustainable Sanitation Alliance

UNDP United Nations Development Programme

UNICEF United Nations Children's Fund

WHO World Health Organization

W_j Weight of each sustainability sub-group

WSA Water Services Authority

VHW Village Health Worker(s)

VIP Ventilated Improved Pit Latrine

1. Introduction

1.1 Background to Study

Adequate sanitation is considered key to human development, poverty alleviation and an overall healthy wellbeing. Access to adequate sanitation is regarded as one of the criterion for the realization of several human rights such as the rights to food, an adequate standard of living, education and exercising personal socio-cultural behavioural patterns (SAHRC, 2014). Adequate sanitation is defined as

> "*The provision and ongoing operation and maintenance of a system of disposing waste water, household refuse, human excreta (toilet facilities and the associated tanks, pipes and treatment works etc.), which is acceptable and affordable to users"* (DWAF, 1996:3).

Worldwide, the provision of basic sanitation has proven to be a challenge that governments have failed to overcome (Lagardien et al., 2013) and as a result, about 2.6 billion people in the world do not have access to basic sanitation (WHO, 2011). South Africa is one of the many African countries experiencing sanitation backlogs. The legacy of apartheid resulted in an estimated 21 million people (52% of the population) lacking access to adequate sanitation in 1994, with majority of these people residing in rural areas (Rall, 2001). Although the number of people without access to adequate sanitation has been reduced over the years only 77.9% of South African households have access to adequate sanitation (StatsSA, 2014). South Africa's sanitation problem is characterized by service delivery backlogs, upgrade needs and operation and maintenance (O/M) backlogs (DWAF, 2012).

The lack of access to adequate sanitation has a negative impact on the realization of basic human rights, the environment, human health and safety. Some of the many diseases caused by the lack of adequate sanitation or access to adequate sanitation include typhoid, dysentery, cholera and diarrhoea.

Access to basic services such as water and sanitation is a right of all residents. According to the White Paper on Basic Household Sanitation, the provision of access to sanitation is

the responsibility of the local government (DWAF, 2001). The municipalities that have been designated as Water Services Authorities (WSAs) are required to use their own revenue for basic water and service provision, the Municipal Infrastructure Grant (MIG) for capital costs, and pay for O/M costs using the Equitable Share Allocation (DWAF, 2012:8). Water Service Authorities are municipalities that have the responsibility of ensuring access to water and sanitation services for everyone within its area of jurisdiction (Tissington, 2011). Due to the democratic nature of South African governance, local municipalities not only have to effectively provide basic services, they have to do so in a manner that will "encourage, and create conditions for, the local communities to participate in the affairs of the local municipality including in the strategic decisions relating to the provision of municipal services" (DLG, 2000:15).

Public participation is therefore a legislative requirement in South Africa (DLG, 2000). It is a legislative requirement that has become a priority both locally and internationally. Public participation is expected to enhance development and service delivery (Eales, 2004). In the Draft National Policy framework on Public Participation (2005), public participation is defined as:

> *"An open, accountable process or channel through which individuals and groups within selected communities can exchange views and influence decision-making. It is further defined as a democratic process of engaging people, deciding, planning, and playing an active part in the development and operation of services that affect their lives."* (DPLG, 2005:1).

The tools used for public participation include public meetings, ward committees, surveys, newsletters, posters, loudhailers, email notifications, and media advertisements (DPLG, 2007). The promotion of community action in encouraging community members to be responsible for the services provided to them, the implementation of development plans and services that are context-relevant, and the legislative requirement for public participation; are among the reasons why public participation should be promoted (DLPG, 2007). Public participation also enables community members to understand the resource constraints within which services are provided. In addition to the concept of public

participation, there is the concept of community engagement. Community engagement moves beyond the mere information and consultation of community members that is implied by the term public participation. The working definition for community engagement given by the Center for Disease Control and Prevention (CDC) is:

> *"The process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people. It is a powerful vehicle for bringing about environmental and behavioural changes that will improve the health of the community and its members. It often involves partnerships and coalitions that help mobilize resources and influence systems, change relationships among partners, and serve as catalysts for changing policies, programs and practices" (CDC, 1997 in CDC 2011:7).*

Although the above definition refers to health improvement as a result of community engagement, the concept of community engagement can be applied to projects other than those with health improvement as a main objective. Community engagement speaks to knowledge transfer, education and appreciation and acknowledgement of the local context within which projects will be implemented. Community engagement has proven to result in community development, overall health and hygiene improvement, and an increased sense of ownership, which has resulted in the sustainability of sanitation systems (Eales, 2004).

South Africa is a water scarce country thus the provision of waterborne sanitation facilities as the solution to the sanitation backlog to everyone is not a viable option. It is therefore important to obtain user buy-in for dry sanitation options and educate sanitation facility users on the O/M of the sanitation facility as this can contribute to the sustainability of the latrine, and hence the possibility to the reduce the O/M costs that the government has to incur particularly with regards to dry sanitation. The shortage of water resources is one of the constraints that community members need to understand in relation to sanitation projects. There is a need for the promotion of effective and efficient sanitation technologies

to address the sanitation backlog (Mokonyane, 2015a). The Department of Water and Sanitation has adopted the motto "A dignified toilet is not all about flushing" (Mokonyane, 2015a) in their attempt to eradicate the sanitation backlog. Dry sanitation facilities (e.g. the Ventilated Improved Pit latrine) are considered as viable options for the provision of dignified, adequate sanitation. The Department of Water Affairs seeks to ensure the sustainability of sanitation programmes through setting aside budgets for the operation and maintenance of infrastructure (Mokonyane, 2015b).

In South Africa, the basic minimum acceptable level of sanitation is a lined Ventilated Improved Pit (VIP) latrine (Tissington, 2011). According to the White Paper on Basic Household Sanitation (2001), a basic minimum acceptable level of sanitation is one which is "appropriate to health and hygiene awareness and behaviour; a system for disposing of human excreta, household waste water and refuse, which is acceptable and affordable to the users. Safe, hygienic and easily accessible and which does not have an unacceptable impact on the environment." Also, each household should have a toilet facility (DWAF, 2001: 5-6). When constructed and maintained properly, the VIP toilet meets the requirements of a basic minimum acceptable level of sanitation, as stated by the White Paper on Basic Household Sanitation (2001). The VIP latrine consists of a top structure with one or two lined pits beneath the top structure. The top structure is ventilated with a fly screen and a ventilation pipe (CSIR, 2000).

1.2 Problem Statement

The VIP latrine is ideal in water-scarce areas and has been found to be generally robust (DWAF, n.d). Although the VIP latrine can be an ideal sanitation technology, it has also acquired the stigma of being a "poor man's solution to the sanitation problem" (Austin and Van Vuuren 2001 in Austin et. al 2005: 1-2). In addition to the stigma that the VIP latrine has acquired, there are various issues, which contribute to the resistance towards on-site sanitation, and hence VIP latrines. These include (Fourie and van Ryneveld, 1993:1):

- A perception that the use of on-site sanitation implies "second class"
- A perception that there is plenty of money in the country for a high level of service

- Perception that waterborne sewerage is a robust system, whereas it is in fact a fragile system that is sensitive to misuse and the use of inappropriate cleansing materials. Furthermore there is a lack of appreciation of the failure of such systems;
- A perception that on-site sanitation is unhealthy, that it does not work as well as full waterborne sewerage and will cause disease; and
- Concern that on-site sanitation will pollute the country's scarce water sources.

Despite the resistance that exists towards on-site sanitation and the unsuccessful projects, there are also successful sanitation projects that have been implemented in South Africa, through the use of the VIP latrine. According to Kathy Eales (2004), "dry sanitation can become an acceptable option for community members when the benefits of affordability and sustainability are explained to them" (Eales, 2004: 7). The success of sanitation projects utilizing on-site/dry sanitation can be attributed to the use of effective knowledge transfer through community engagement. Communities are involved in some of the planning and decision-making processes of the project, there is emphasis on health and hygiene, and O/M practices related to the latrines; and an acknowledgement of the local context through constant engagement with community representatives. Such projects are usually coordinated by NGOs which have the time and resources to adequately engage the community throughout the project.

Some sanitation projects implemented utilising VIP latrines have unfortunately been unsuccessful in some areas. The failure of such projects is a result of "poor design and construction practices or social factors such as a lack of community buy-in, or a combination of these. Sufficient attention is not always given to factors such as environmental impact, social issues, water-supply levels, reliability or institutional capacity" (Austin and Van Vuuren, 2001 in Austin et. al, 2005: 1-2). The lack of/poor knowledge transfer through community engagement in some sanitation projects is arguably one of the reasons for the failure of some sanitation projects. Pressure on local municipalities to address sanitation service delivery backlogs as a matter of urgency has led to an emphasis, by local municipalities, on conventional/supply-driven sanitation projects. Supply-driven sanitation projects are only focused on the delivery and servicing

of sanitation infrastructure. The consultation of community members, by the project leaders, throughout the project is either non-existent or limited to public participation methods wherein the role played by the community in the planning of services and the decision-making on the type of sanitation infrastructure to be implemented or various aspects of the sanitation project, is minimal. The involvement of community members is sometimes limited to the mere information of community members about the project. There is also no health and hygiene; or O/M education (Eales, 2004).

From the foregoing information, it is evident that in order for knowledge transfer to be used effectively to support the provision of sustainable dry sanitation systems, public participation and community engagement principles and mechanisms need to be effectively implemented. It is thus important to assess the manner in which community engagement and public participation methods are and can be effectively used in VIP latrine sanitation projects.

1.3 Research Aim

The aim of this study is to assess how knowledge transfer through community engagement and/or public participation can be used to support the sustainability of VIP latrines, and address the negative perceptions that people have of the VIP latrine.

1.4 Research Questions

This research will therefore focus on answering the following questions:

1. What are the differences in the effectiveness of knowledge transfer between the use of public participation and community engagement methods and mechanisms in VIP sanitation projects?
2. What are the general user perceptions on the VIP latrines after engagement through public participation and community engagement?
3. How has public participation and/or community engagement been used to improve the sustainability of the VIP latrine?

To achieve the set aim and answer the research questions, the following methodological approach will be adopted:

a) Investigate the sustainability of the VIP latrine with regards to the health and hygiene, technical, socio-cultural and economic aspects of the latrine.
b) An assessment of a case study where a sanitation project was implemented through the use of public participation methods
c) An assessment of a case study where a sanitation project was implemented through the use of community engagement methods
d) A comparison of the two case studies to determine the sustainability of the VIP latrine; and public participation, and community engagement methods vary
e) Determine the extent to which effective public participation and/or community engagement can be used to address the user perceptions of the VIP latrine and hence aids in the provision of sustainable VIP latrines.

1.5 Ethical Considerations

In research, ethical issues are always significant. The ethical issue that was of importance in this research was the protection of the research participants. This was done through the assignment of a specific letter of the alphabet for each of the two villages (i.e. Village A and Village B). Written consent (Refer to Appendix A) was obtained from all participants prior to the recording of all data and information in writing and audio notes. In the written consent form, participants were provided with an explanation of the research objectives, and reassured that their responses to questions would remain confidential and used solely for research purposes. The above mentioned ethical considerations were in compliance to the UCT Commerce Faculty Ethics in Research Committee; the ethical considerations were adhered to whilst also providing research results and analysis that was an accurate reflection of the data collected during the fieldwork study.

1.6 Outline of the Study

The study is sub-divided into seven chapters:

Chapter one describes the introduction of the study, which includes the background to the study, the problem statement, the research aims and objectives and the ethical considerations of the study.

The literature review in Chapter Two provides an overview of public participation and community engagement. It discusses the South African public participation legislative and policy framework, and the challenges in public participation. The chapter also provides an assessment of community engagement practices in sanitation projects. Furthermore, the literature review provides an overview of sanitation, the state of sanitation in South Africa, and the design; and operation and maintenance of VIP latrines. The chapter is concluded by a brief discussion on knowledge transfer in sanitation projects.

Chapter three describes the methodology used in the study, namely the Integrated Assessment of Sustainable Development developed by Krajnc and Glavic (2005), and the Critical Systems Heuristics Developed by Ulrich in 1983.

Chapter four provides a background to the study area, including details on the demographics and the state of sanitation in the Bushbuckridge Local Municipality. Furthermore, it provides an overview of the sanitation projects implemented in each village.

Chapter five presents the findings from the fieldwork study and a discussion thereof. This includes the sustainability assessment of the latrines, the CSH evaluation of the methods used to involve community members in each project, and a discussion of how the methods affected the sustainability of latrines in each project.

Chapter six presents the conclusions of the study; and Chapter seven provides recommendations for policy, practice and further study.

2. Literature Review

The purpose of this section is to review various literature relating to the study. In particular, it seeks to investigate the practices and policies pertaining to methods of involving the community, and transferring knowledge in sanitation service delivery projects with particular focus on community engagement and public participation. Additionally, the literature review seeks to explore the concept of sustainable sanitation, and the technical requirements of the VIP latrine. The literature review seeks to further explore the state of sanitation globally and in South Africa in order to provide a better understanding of the sanitation demand and the context within which sanitation service delivery projects are implemented. Literature on the Sustainability Assessment and Critical Systems Heuristics analysis methods is not included in the chapter, however, can be found in Chapter 3 (Methodology).

The literature review begins with the definition and overview of public participation. It explores the South African public participation legislature and policy framework particularly with reference to sanitation service delivery, and the challenges experienced in the attempts to incorporate public participation into sanitation service delivery projects. The review then highlights the use of community engagement methods in sanitation projects and then explains the concept of knowledge-transfer. Methods through which knowledge can be transferred and the identification of key knowledge sources which should be considered in sanitation projects are reviewed. A section on sustainable sanitation and sanitation technology options, with particular focus on the VIP latrine and the design, provides insight to operation and maintenance requirements of the VIP latrine. In the final section of the chapter, the status-quo of sanitation internationally and in South Africa is discussed.

The section is concluded by a summary of the important issues identified particularly with reference to the research objectives.

2.1 Public Participation

As mentioned previously, public participation is defined as "an open, accountable process or channel through which individuals and groups within selected communities can exchange views and influence decision-making" (DPLG, 2005:1). Scott (2009) writes "the uptake of participation is based on a conviction that representation requires participation to work well" (2009:30) Public participation therefore allows citizens the opportunity to be involved in governance through representation, which is vital in a democratic country like South Africa.

2.1.1 Definition and Overview of Public Participation

Figure 1 shows the spectrum for public participation developed by the International Association for Public Participation (IAP2), which illustrates the different levels of participation. According to Creighton (2005) as quoted by Smith (2009), capturing the essence of public participation is an exercise that is very difficult as there are many definitions for public participation. The spectrum shows is further evidence that there is no definite definition and guidelines for public participation.

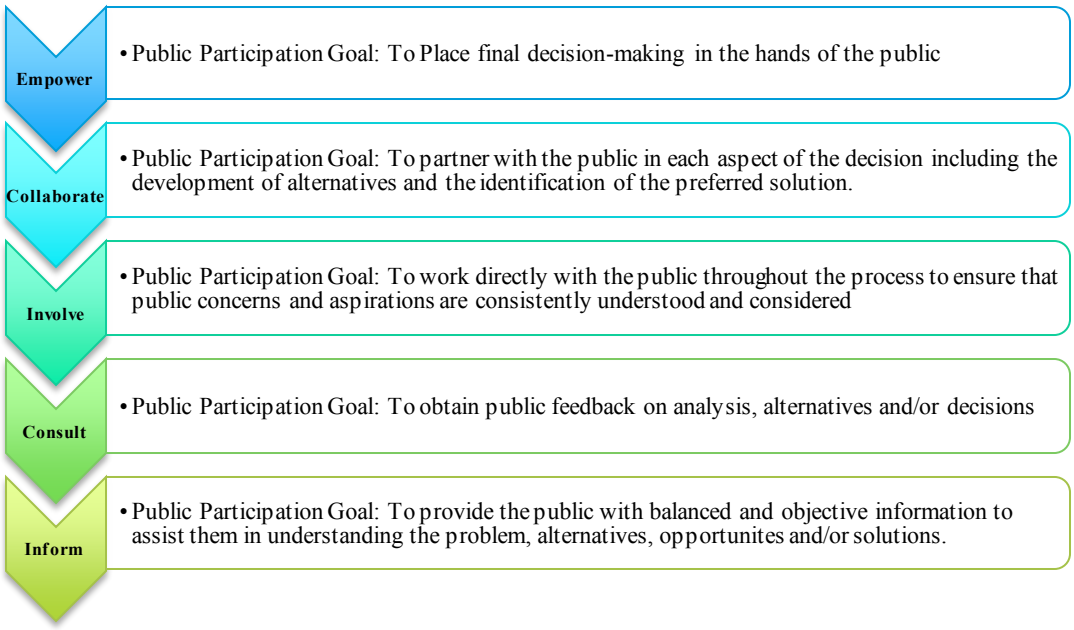


Figure 1: IAP2 Spectrum of Public Participation (Source: www.iap2.org, 2 September 2015)

Although the term "public participation" seems to be rather vague, the practice thereof is encouraged in South Africa because it reportedly improves service delivery, encourages accountability, empowers communities and increases the level of information within community (DPLG, 2005). In addition to the identified benefits of public participation, it is also a legislative requirement in South Africa (DLG, 2000).

2.1.2 South African Public Participation Legislative and Policy Framework

Policies and legislation have been drafted to provide a public participation framework for municipalities undertaking service delivery projects within their areas of jurisdiction. The policies and legislation contain principles that are essential to the success of service delivery projects.

2.1.2.1 The Constitution of the Republic of South Africa (Act 108 of 1996)

The Constitution of the Republic of South Africa Act 108 of 1996 (RSA, 1996) stipulates that local governments are responsible for providing the basic services, which will allow citizens to develop themselves. Local governments are obligated to ensure sustainable environmental management, by providing services in a manner that will not jeopardize citizens' constitutional right to "an environment that is not harmful to their health or well-being; to have the environment protected, for the benefit of present and future generations" (RSA, 1996).

2.1.2.2 Municipal Systems Act (Act 32 of 2000)

The Municipal Systems Act (DLG, 2000) is legislation with the objective of empowering local governments to fulfil their constitutional mandate. Chapter 4 of the Municipal Systems Act deals with the importance of promoting community participation in the developmental activities of the municipality. Municipalities are required to develop municipal governance, which will complement and be representative of a participatory governance system. Local communities must be encouraged to participate in municipal affairs, which include the preparation, implementation and review of the Independent Development Plan (IDP), and the strategic decisions that are made in relation to municipal

services provision (DLG, 2000). According to the Municipal Systems Act, communities should be included in the decision-making on the level of services, quality of services, range of services and the manner in which the municipal services are provided (DLG, 2000). The mechanisms, procedures and processes that municipalities use to engage with communities, must ensure that all community members (regardless of age, gender or literacy level) are able to communicate with the municipality. In addition to the municipality receiving suggestions, comments, complaints etc. from communities, the municipalities must engage in consultative sessions with leaders and appropriate organisations in the communities, and give feedback to the community (DLG, 2000). Figure 2 below illustrates some of the mechanisms, procedures and practices that can be used by municipalities in promoting public participation within their areas of jurisdiction.

Figure 2: Public Participation Mechanisms

Ward committees are statutory bodies established in terms of the Municipal Structures (Act 117 of 1998) consisting of the ward councillor who is the chairperson of the committee, and no more than 10 other persons (DLG, 1998). Ward committees are created with the purpose of enhancing participatory democracy in communities through representing the

needs of community members living in the areas within which the ward committees have been established (PSC, 2008). The Integrated Development Plan (IDP) is a 5 year strategic, inclusive plan adopted by the municipality for the development of the municipality (RSA, 2000). The process of the drafting of the IDP must incorporate public participation through allowing "the local community to be consulted on its development needs and priorities; the local community to participate in the drafting of the integrated development plan; and organs of state, including traditional authorities, and other role players to be identifies and consulted on the drafting of the integrated development plan" (DLG, 2000: 40). In promoting the involvement of the community in the drafting of the IDP, and IDP representative forum must be established. The forum consists of members including the members of the municipal executive committee/mayoral committee/committee of appointed councillors, community representatives, traditional leaders, ward committee chairpersons and Community Development Workers (DPLG, 2007: 62). Community Development Workers (CDWs) are community-based person who facilitate the participation of community members in government initiatives through assisting community members "to obtain information and resources from government resources from government departments" (PSC, 2008:15). Public hearings are gatherings held with the purpose of engaging the general public on matters pertaining to service delivery and policy. Public hearings are organized by various leadership structures of the state (PSC, 2008).

In addition to advocating for the inclusion of communities in municipal governance, the Municipal Systems Act states that the provision of municipal services should be done in a manner that is environmentally and financially sustainable. Environmentally sustainable in relation to the provision of a municipal service, means that the provision of such a service must be done in a manner that ensures that:

(a) The risk of harm to the environment and to human health and safety is minimized to the extent reasonably possible under the circumstances, and
(b) The possible benefits to the environment and to human health and safety, is minimized to the extent reasonably possible under the circumstances (DLG, 2000: 12).

Financially sustainable in relation to the provision of a municipal service, means that "the provision of a municipal service, should be done in a manner that is aimed at ensuring that the financing of that service from internal and external sources, including budgeted income, grants and subsidies for the service, is sufficient to cover the costs of:

(a) The initial capital expenditure required for the service;
(b) Operating of the service; and
(c) Maintaining, repairing and replacing the physical assets used in the provision of the service" (DLG, 2000:13).

2.1.2.3 The White Paper on Local Government (1998)

The White Paper on Local Government is a framework that contains policies, principles and visions for the optimal functioning of local government. This includes the vision of the "developmental local government," which highlights social development as one of the goals of a local government that is developmental. A Developmental Local Government is defined as "local government committed to working with citizens and groups within the community to find sustainable ways to meet their social, economic and material needs and improve the quality of their lives," (RSA, 1998:23).

Included in the White Paper on Local Government, is the nine principles, which should guide municipalities when choosing service delivery options (RSA, 1998:74-75):

1. Accessibility of services
2. Affordability of services
3. Quality of products and services
4. Accountability for services
5. Integrated development and services
6. Sustainability of services
7. Value-for-money
8. Ensuring and promoting competitiveness of local commerce and industry
9. Promoting democracy

The combination of the above mentioned principles, and the vision of the developmental local government, require local governments to continuously involve community members in the planning an implementation of projects within the municipality. This requires a continuous knowledge-sharing/transfer between the local government and the communities they seek to serve.

2.1.2.4 The White Paper on Basic Household Sanitation (2001)

The White Paper on Basic Household Sanitation was drafted with the purpose of highlighting the impact that poor sanitation has on living conditions, health and the environment. It provides a basis for the formulation of sanitation improvement strategies, promotes greater coherence and coordination amongst the different spheres of government and amongst other role players in addressing the sanitation problem. The White Paper ensures adequate funding of sanitation programmes and monitors sanitation improvement programmes (DWAF, 2001).

The White Paper is guided by 12 policy principles, which are to be followed in addressing the sanitation problem in South Africa. The policy principles are linked to existing South African sanitation framework and policies. The policy principles advocate for sanitation projects that are demand responsive and are supported by an intensive health and hygiene programme, are financially sustainable, have environmental integrity and include community participation through avenues such integrated development and planning (DWAF, 2001).

2.1.2.5 National Sanitation Policy

The National Sanitation Policy was drafted by the Department of Water Affairs (DWAF) in 1996 and has since been re-drafted and was made available for public comment by the Department of Water and Sanitation in February 2016. The purpose of the National Sanitation Policy is to provide a framework for strategies that can be adopted in the provision of community sanitation services, and provide people with information on sanitation issues. The policy recognizes that sanitation is not just about building toilets that will facilitate waste removal, but healthy and hygienic practices associated with the

sanitation services are also key to sanitation. The National Sanitation Policy also highlights the importance of ensuring that the provision of sanitation systems does not result in a harmful effect on the environment.

According to the policy, projects should adopt a "help people help themselves" approach wherein community members are involved in the planning, organization and implementation of local sanitation projects.

The Policy highlights main questions, which need to be answered when determining the type of sanitation systems to be constructed, in order to ensure that the proposed sanitation system is suitable and sustainable. These questions include (DWAF, 1996:6-7):

- Is the proposed system affordable to the user, the service supplier and the government?
- What will be the risks to the environment?
- Is it acceptable to people (bearing in mind the cost to them)?
- What is the water supply like? Is it adequate?
- Can it (the sanitation system) be upgraded, when people can afford a more expensive system?
- How much of the system can be built and maintained by local people using materials locally available?

The questions above place particular emphasis on the users of the sanitation system, as they have a major effect on the sustainability and suitability of the sanitation system. These are questions that not only the service providers need to consider, but the sanitation system users need to be made aware of. It is important that understand the decision-making environment in order for them to accept the decision. The original policy was successful in advocating for the involvement of communities in sanitation projects, and the consideration of the socio-cultural context within which sanitation projects were implemented. This further emphasizes the importance of continuous knowledge transfer throughout sanitation projects.

The draft revised National Sanitation Policy comprises Sanitation Service Principles, which are similar to the original Sanitation Policy Principles of 1996. However, the revised policy emphasizes the importance of "prioritizing hygiene and end-user education in sanitation service provision" (Principle 2) and "prioritising operation and maintenance" (Principle 11) (DWS, 2016: 3-4). These amendedmetns echo the importance of healthy and hygienic sanitation practices and education mentioned in the 1996 National Sanitation Policy and in addition, the principles highlight the importance of educating the sanitation service user on "their sanitation rights, responsibility and water conservation and demand management" (DWS, 2016:3). In addition, the establishment of sustainability plans, which will address sanitation system operation and maintenance requirements throughout the sanitation system's life-cycle, is important for each sanitation project (DWAF, 2016). The realisation of these fore mentioned principles will require the consideration of the various aspects affecting the long-term sustainability of sanitation systems, and as previously mentioned, the continuous engagement of all stakeholders in each sanitation projects.

2.1.2.6 National Sanitation Strategy

The purpose of the National Sanitation Strategy is to accelerate sanitation service delivery, with specific focus on rural, peri-urban areas and informal settlements. These areas have been identified as the areas with the greatest backlogs.

The strategy proposes new approaches and methodologies that will have to be adopted in order to eradicate the sanitation backlog. These methodologies include increasing funding for sanitation programmes. A subsidy is proposed for each household, of which a portion will be used for community development. The community development includes health and hygiene education and capacity building (training of community workers to conduct health and hygiene education, and construct toilet facilities). The remainder is to be used for the development of the toilet infrastructure (DWAF, 2002).

The strategy recommends three basic principles, which are essential to successful sanitation programmes. These are:

- Adopting a community-based developmental approach, coupled with a social marketing programme and intensive advocacy
- Integrated planning, which demonstrates sustainability and acceptability of technical options. Resources should be used such that there is "some for all" (i.e. everyone should at least have access to the basic level of service)
- Adequate resources: funding for household infrastructure programmes should be channeled directly to local government as a conditional grant (DWAF, 2002: 7-8).

In order to ensure minimum cost and environmental impact, local indigenous material must be used. A skills-transfer programme must be used to build the capacity of the local community members; who must be included in the decision-making during implementation. If local communities and households benefit directly from the project, they are more likely to accept responsibility for, and ownership of the sanitation programme.

The National Sanitation Strategy recommends two approaches for sanitation projects: *the Contractor-driven approach* and the *Community development approach.*

The *Contractor-driven approach* is one where the municipality contracts with a specialist private company to provide a particular service. This approach is effective if the municipality has an acceptable management structure to manage the tender and contract process, and monitor the implementation stage of the contract. The main focus of the contactor-driven approach is the rapid eradication of the sanitation backlogs. According to the national Sanitation Strategy, using this approach could eradicate the sanitation backlog within 5 years from the year in which the National Sanitation Strategy was drafted (i.e. 2002). The contractor-driven approach generally lacks community participation, which can result in user dissatisfaction with the sanitation services provided, regardless of whether or not the sanitation system has been constructed in a manner that meets construction standards (DWAF, 2002:9).

In the *Community development approach,* there is emphasis on local community participation. The community development approach consists of the utilization of local

labour, capacity building, and health and hygiene education. The principles used in this approach are in line with Integrated Development Planning, and the principles of the Reconstruction and Development Programme (RDP) which was replaced with the Growth, Employment and Redistribution (GEAR) development strategy (Visser, 2004). The holistic approach to service delivery, adopted in this service delivery approach, generally results in affordable and sustainable services (for both the households and municipalities). Although this approach is most the most ideal for sanitation service delivery, the community engagement process can be time-consuming and therefore result in and extended project period (relative to that of the Contractor-driven approach) (DWAF, 2002:10).

2.1.3 Challenges in Public Participation

Although optimized public participation in sanitation projects is ideal, it is not easily achieved. Municipalities usually lack the resources and capacity to encourage public participation. "The opportunities created for public participation, whether through ward committees or public meetings, are overwhelmingly forms of public consultation rather than the actual participation of civil society or local communities in decision-making or implementation" (Buccus et al., 2007:6). It seems as though the communities receiving public services are merely told what will be done or informed of a decision that has already been made, rather than being asked about their opinions and preferred service. They are not given an opportunity to choose a level of service or be involved in the planning, design and implementation process (SAHRC, 2013). The findings of the SAHRC (2013) report concur with Theron et al. in relation to public participation in public service delivery, who further states that the lack of clarity and the uncertainty about the concept of participation has resulted service delivery agents (such as local municipalities) implementing public participation methods and techniques that they are most familiar and comfortable with (Theron et al., 2007: 4-5). These public participation methods and techniques implemented within the South African service delivery context are reportedly on the "consultation" level of the IAP2 (International Association for Public Participation) participation spectrum although this is done with limitations as community members seldom receive feedback from service delivery agents. In most cases, community members are merely informed about project (for example) details (Theron et al., 2007).

As a result of the sanitation backlog in South Africa, municipalities have been under pressure to rapidly deliver sanitation services. Unfortunately, this has resulted in the traditional civil engineering project implementation/supply-driven approach being adopted (Rall, 2001). The supply-driven sanitation service delivery approach is focused on delivering and servicing infrastructure. Community members generally play a minor role in the planning of services; and there is little or no education on operation and maintenance, and health and hygiene practices (DWAF, 2002). This can result in the long-term unsustainability of the sanitation infrastructure.

2.2 Community Engagement

Similarly to the concept of public participation, the concept of community engagement is one that has no consistent definition. As mentioned previously, community engagement involves working collaboratively with community members in order to improve health in the community through encouraging environmental and behavioural changes (CDC, 1997 in CDC 2011). The notion of community engagement isn't, however, limited to health changes. It has been expanded into different sectors including university research and water and sanitation projects.

In order to address the sanitation service backlog and also ensure that the sanitation systems are sustainable, it is important that the users of the sanitation systems are involved throughout the entire project process. Creating that sense of ownership empowers users to ensure long-term sustainability of the sanitation system (Gomez & Nakat., 2009). Community engagement is therefore a necessity for successful sanitation projects. Community engagement also enhances service delivery and development, therefore contributing to effective governance and the deepening of democracy (Buccus et al., 2007).

Close coordination between technical, health and social development is therefore necessary in sanitation service delivery. Various municipalities and NGOs have established sanitation service delivery practices and frameworks, which encourage community engagement. These practices and frameworks are based on the demand-driven approach. The demand-

driven approach consists of community consultation, capacity building, utilizing local labour, and health and hygiene education.

Literature on sanitation projects in South Africa and various other African countries where community engagement was fully encouraged indicates that the projects were sustainable. Genuine community empowerment is achieved, communities take ownership of the sanitation projects and sanitation systems (hence they are willing and able to maintain the systems) and there is an overall health and hygiene improvement in the communities (Rall, 2001). Sanitation projects utilizing the Participatory Health and Sanitation Transformation initiative and the Community-Led Total Sanitation approach are examples of successful projects that encouraged full community engagement.

2.2.1 Community Engagement in practice

2.2.1.1 PHAST Initiative

The Participatory Hygiene and Sanitation Transformation (PHAST) initiative is an approach, which uses specifically developed participatory techniques in order to promote sanitation improvement, hygiene behaviours and management of water and sanitation by community members. The PHAST initiative was developed jointly by the World Health Organization and the United Nations Development Program/World Bank Water and Sanitation Program in 1992. The main objective of the PHAST initiative is to educate community members on hygiene and sanitation concepts, through a participatory process, which involves all community members (WHO, 1997).

The community development principles of the PHAST initiative include:

- ***Principles on hygiene and sanitation promotion:*** Awareness on behavioral and technological aspects of sanitation must be raised in order for the establishment of sustainable sanitation and hygiene improvement.
- ***Principles on learning:*** Learning can only be sustainable in a group context as this provides the group an opportunity to collectively review the existing information and current practices and thus decide on a clear course of action.

- ***Principles on decision-making:*** The decision-making should be done by the people who are closest to the problem, i.e. the community members. Enabling them to contribute their intellectual property through the decision-making process, and also contribute their financial resources, results in a commitment from the community members to ensure the long-term sustainability of the sanitation systems.
- ***Principles on mechanism for information exchange and delivery:*** Allowing communities to learn from one another enables them to recognize the knowledge base within the community. Also, technical information should only be provided in response to a need identified by the community. Should the technical support or information be supplied early, the entire project process can be jeopardized.

The PHAST initiative requires maximum community participation, sufficient personnel, resources, policy commitment, and constant monitoring of community activities and improvements (WHO, 1997).

2.2.1.2 Community-Led Total Sanitation (CLTS)

Community-Led Total Sanitation (CLTS) is based on the concept that people are the driving force for the change in the community, which will result in Open-Defecation Free (ODF) areas (Lagardien et al., 2013:7). CLTS was piloted in Bangladesh in 2001 (Sanan and Moulik, 2007) and introduced in Sub-Saharan Africa in 2005-6, and has resulted in significant sanitation improvement (Bevan and Hickling, n.d).The CLTS methodology focusses on:

- No one being safe unless everyone is safe
- Stopping Open Defecation (OD) as the source of the problem
- Stopping OD to change hygiene behavior

In Asia, Community-led approaches have been found to rapidly improve sanitation improvement in Asia.

CLTS enables community members to find and implement solutions to their sanitation problems that are both cost-effective and suitable to their cultural norms (Bevan and Hickling, n.d). The lack of external support creates a sense of ownership in the community

but has the disadvantage of possible long-term unsustainability (Papafilippou et al., 2010 in Lagardien et al., 2013:12).

The three stages of the CLTS approach are the *Pre-Triggering, Triggering* and *Post Triggering follow-up*. *Pre-Triggering* includes identifying and selecting areas with high OD rates, a low number of sanitation systems or a high prevalence of diarrheal diseases. *Triggering* refers to when the community decides (collectively) to stop OD. A set of simple exercises are done, including a visual demonstration of contamination, mapping of OD, an Action Plan to stop OD and the drafting of a Community Report containing the Action Plan. The Community Report is written by Natural Leaders who are identified by the community. The report is then given to stakeholders identified by the Natural Leaders. The stakeholders are identified based on their influence to stop OD. Often, these stakeholders are administrative officials and civil society leaders. *Post Triggering follow-up* is characterized by constant site visits until the area is Open-Defecation Free (ODF). Natural Leaders are asked about the progress of the Action Plan during this stage of the CLTS (Lagerdien et al., 2013:9).

Although CLTS requires effective and in-depth facilitation to enable communities to work together, it has proven to ensure sustained behaviour change in the villages where it has been implemented through facilitating peer monitoring (Sanan and Moulik, 2007:11).

2.3 Knowledge Transfer in Sanitation Projects

The transfer of knowledge from project facilitators and those who hold knowledge, to the knowledge (and latrine) recipients is key (Owen, 2011). The knowledge that needs to be transferred includes knowledge about the construction and O/M of the latrines, health and hygiene practices associated with the latrines; and project finances and coordination which are fundamental for success of the sanitation projects. The Encyclopaedia of Knowledge Management (Schwartz, 2006) as cited by Paulin and Suneson (2012) defines knowledge transfer as "the focused, unidirectional communication of knowledge between individuals, groups or organizations such that the recipient of knowledge (a) has a cognitive

understanding, (b) has the ability to apply the knowledge, or (c) applies the knowledge" (Schwartz 2006 in Paulin and Suneson, 2012:83).

The factors that can affect knowledge transfer include: the inability of knowledge recipients to absorb or understand the knowledge, an ambiguity and/or uncertainty about the interaction of various aspects of the knowledge and their response to factors in the environment within which the knowledge is being transferred; and the nature of the relationship between the knowledge bearer(s) and the knowledge recipient(s) (Paulin and Suneson, 2012).

Project facilitators need to understand the basics of the knowledge transfer process: why they are engaging, who they need to engage with and when the engagement process needs to be conducted, prior to commencing the knowledge transfer process (Owen, 2011). Owen (2011) further states that project facilitators need to continuously review the knowledge transfer process throughout the project, understand and consider the different stakeholder groups that need to be engaged, their (stakeholder groups) influence over the knowledge transfer process, and the importance of the knowledge that is being transferred to them. The leadership and cultural dynamics within the communities wherein sanitation projects are conducted are therefore important in the knowledge transfer process.

According to Dungumaro and Madulu (2003), the use of indigenous knowledge in Integrated Water Resource Management (IWRM) is vital for the protection of the environment and ensuring the proper use and management of water resources. Similarly, indigenous knowledge is key in the protection of the environment within which latrines will be constructed and ensuring the proper operation and maintenance of the latrines. The knowledge of stakeholders in the communities within which latrines are constructed, can therefore not be ignored in the planning and implementation of sanitation projects.

The transfer of knowledge in projects where new technologies (such as water and sanitation technologies) are being introduced in communities therefore needs to be a two-way exchange of information (Murphy et al., 2009). The knowledge transfer process needs to not only allow for project facilitators to share knowledge, but for local stakeholders to

provide feedback and share their indigenous knowledge (Murphy et al., 2009). The transfer of knowledge in sanitation projects whether through public participation or community engagement, should facilitate a two-way exchange of information throughout the project in order to ensure the success of the project. Both the project facilitators and latrine recipients are thus knowledge holders and knowledge recipients. The physical technology (i.e. the latrine) coupled with a new way of thinking by the latrine users as a result of the knowledge transfer process, contributes to successful development (Murphy et al., 2009).

2.4 Sustainable Sanitation

The concept of sustainable sanitation is a multi-dimensional one, and encompasses aspects such as health and hygiene, technical aspects, the environment, economy and finance; and socio-cultural aspects (Bracken et al., 2005). In order for a sanitation system to be sustainable, each of the aspects encompassed by the concept of sustainable sanitation need to be addressed (SuSanA, 2007).

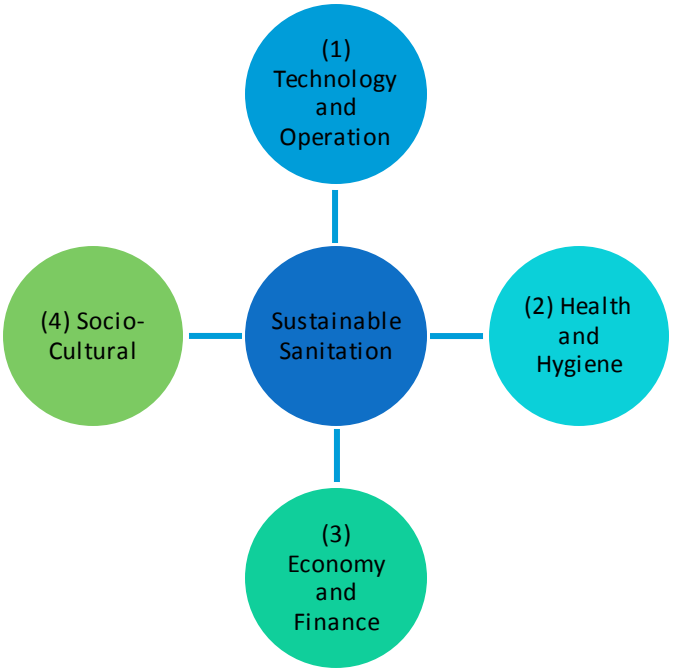


Figure 3: Sustainable Sanitation Criterion

(1) **Technology and Operation**: Refers to the ease with which the sanitation system can be constructed, operated and maintained by the local municipality and/or technical teams. It also includes the robustness and functionality of a sanitation system (SuSanA, 2007). The ease with which the system can be constructed, operated and maintained is largely focused on the ability to use local labor and members of the local community (Bracken et al., 2005). "Most sanitation facilities are not compliant with appropriate technical design standards. Hence they are built in a manner susceptible to quick failure end extreme maintenance difficulties. Secondly, there is a consistent lack of communication with users on why and how to use these facilities, compounding maintenance problems" (SAICE, 2011:16). Public participation is therefore important as effectively engaging community members in education and training on the construction, operation and maintenance of the sanitation system, and training throughout the project process enables the community to effectively operate and maintain the sanitation infrastructure, hence enhancing the sustainability of the infrastructure.

(2) **Health and Hygiene**: This dimension covers issues, which include exposure to pathogens and hazardous substances that could negatively affect the health of humans using the sanitation infrastructure (Bracken et al., 2005). "Sanitation is a process of improvements which must be accompanied by promotional activities as well as health and hygiene education. The aim is to encourage and assist people to improve their health and quality of life" (DWAF, 1996:5). Hence health and hygiene education programs for the entire community receiving sanitation infrastructure must be emphasized in sanitation projects in order for the principle of sanitation being about health and hygiene to be achieved, hence enhancing the sustainability of the system.

(3) **Economy and Finance**: This relates to the costs and benefits of the system. It includes the ability of the householder to pay for the construction, operation and maintenance of the sanitation system (SuSanA, 2007). Local development such as employment creation is one of the benefits of the construction systems. Due to limited resources within government for the construction and O/M of the sanitation systems, the constructed systems have to be affordable to the local municipalities and the households. Communities must be informed of the economic constraints under which government has to provide services and also be made to realize that they are responsible for the continuous maintenance of the sanitation system (DWAF, 1996). Public participation can therefore help community members

understand economic and financial constraints, and thus aid in the choosing and accepting of a cost-effective sanitation level of service and technology.

(4) The **socio-cultural** dimension includes the community's perceptions of the system and its acceptance and appropriateness. The impact that the system has on human dignity and gender issues, and its compliance to legal framework, is also included in this aspect (SuSanA, 2007). According to Eales (2004), "community members are generally pragmatic and willing to accept innovative technologies and approaches when their needs and aspirations are acknowledged, and when they are given an opportunity to engage in informed discussion around their options" (Eales, 2004:9). This further reinforces the importance of public participation and how it can improve the sustainability of sanitation systems.

2.5 Sanitation Technologies

Sanitation technologies are subdivided into two main categories, depending on the manner in which human excreta are handled. Human excreta can either be treated on site and hence does not require conveyance; or it can be treated off site and hence requires conveyance to the treatment site. In each of the two main categories, water may or may not be mixed with the waste. Sanitation technologies can are classified into the four groups shown in table 1 below (CSIR, 2000):

Table 1: Categories of Sanitation Systems (Source: CSIR, 2000: 10-3)

Categories of sanitation systems		
	REQUIRING CONVEYANCE (off-site treatment)	NO CONVEYANCE REQUIRED (treatment, or partial treatment, on site; accumulated sludge also requires periodic removal)
NO WATER ADDED	GROUP 1 Chemical toilet (temporary use only)	GROUP 2 Ventilated Improved Pit (VIP) toilet Ventilated Improved double-pit toilet Ventilated vault toilet Urine-diversion toilet
WATER ADDED	GROUP 3 Full waterborne sanitation Flushing toilet with conservancy tank. Shallow sewers	GROUP 4 Flushing toilet with septic tank and subsurface soil absorption field Low-flow on-site sanitation systems (LOFLOs): Aqua-privy toilet

2.6 VIP Latrines

2.6.1 Design of VIP Latrines

The VIP latrine is a relatively low-cost on-site sanitation technology, which requires no added water. It is ideal for settlements which have limited access to water. When properly designed, constructed, operated and maintained, VIP latrines can be a hygienic sanitation technology (CSIR, 2000). The latrine consists of one lined pit situated beneath a top structure. A ventilation pipe and a fly screen are used to ventilate the top structure. A pedestal and cover slab are located directly over the pit (DWAF, 2002). Figure 4 illustrates the design on the VIP latrine:

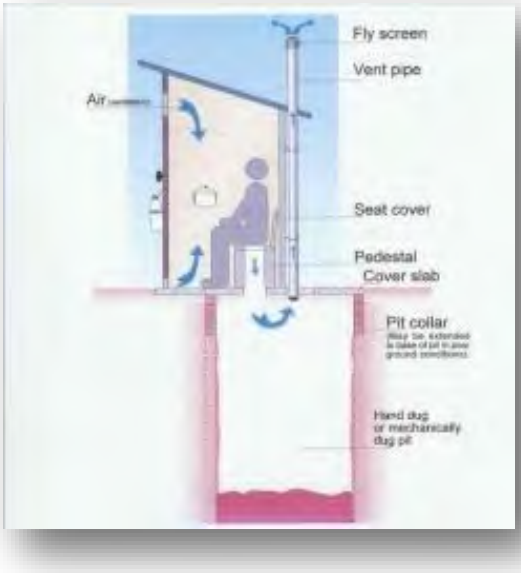


Figure 4: Design on the VIP Latrine (Source: DWAF, n.d)

2.6.2 Operation and Maintenance of VIP latrines

The operation and maintenance of the VIP latrine includes the cleaning of the pedestal and the vent pipe as well as emptying of the pit. The pedestal can be cleaned daily or weekly, and the vent pipe can be cleaned on a monthly basis. Both the cleaning tasks can be undertaken by the latrine owner. The emptying of the pit needs to be done when the pit is

full, by specially trained personnel using a vacuum tanker or hand equipment. The pit can take about 5 to 10 years to fill up (DWAF, n.d.).

2.7 Global Overview of Sanitation

Throughout the world, there is a need for the provision of improved sanitation systems. The United Nations Millennium Development Goals (MDGs) have been created in recognition of this need. Compiled in September 2000, the eight MDGs were drafted by the international community as part of a 15-year plan to combat the indignity resulting from poverty (UNDP, 2015). In relation to water and sanitation services, the MDG target was to halve the world population without access to improved sanitation facilities by September 2015 (Perez, 2012). Improved sanitation facilities include: flush or pour-flush to piped sewer system/septic tank/pit latrine, VIP latrine, pit latrine with slab and composting toilet (WHO and UNICEF, 2006). The MDGs were replaced with the Sustainable Development Goals (SDGs) which were adopted in September 2015 (UN, 2016). Table 2 below indicates the water and sanitation coverage worldwide in 1990 and 2015.

Table 2: Water and Sanitation coverage by region in 1990 and 2015 (Source: UN, 2015)

Region	Coverage (%) in 1990		Coverage (%) in 2015	
	Water Supply	**Sanitation**	**Water Supply**	**Sanitation**
Northern Africa	87	71	93	89
Sub-Saharan Africa	48	24	68	30
Latin America & the Caribbean	85	67	95	83
Oceania	50	35	56	35
Caucasus and Central Asia	87	90	89	96
Southern Asia	73	22	93	47
South-Eastern Asia	72	48	90	72
Western Asia	85	80	95	94
Eastern Asia	68	50	96	77

Although the Millennium Development Goals have not been met by all countries due to urbanization, population growth, and challenges in service provision (Rosemarin et. al, 2008), 77 countries had met the MDG target for sanitation and 29 countries were on track to meet the MDG sanitation target in 2013 (WHO and UNICEF, 2014). Although a total of 95 countries met the MDG target by the end of the period for which MDGs were relevant, the global target for sanitation was missed by 700 million people (WHO and

UNICEF, 2015). In addition, there are 2.5 billion people worldwide who still lack access to improved sanitation, include those who practice open defecation, use an unimproved shared sanitation facility or use a sanitation facility that does not meet acceptable hygiene standards (WHO and UNICEF, 2014). The provision of improved sanitation facilities therefore needs to focus on ensuring that the sanitation facilities meet the minimum acceptable hygiene standards, and encourage people to stop open defecation particularly in countries where open defecation is socially acceptable. Changing the behaviour of people with unhygienic sanitation practices, will require that sanitation projects emphasize knowledge transfer through public participation, in order to ensure that the provision of improved sanitation results in a behavioural change.

2.8 State of Sanitation in South Africa

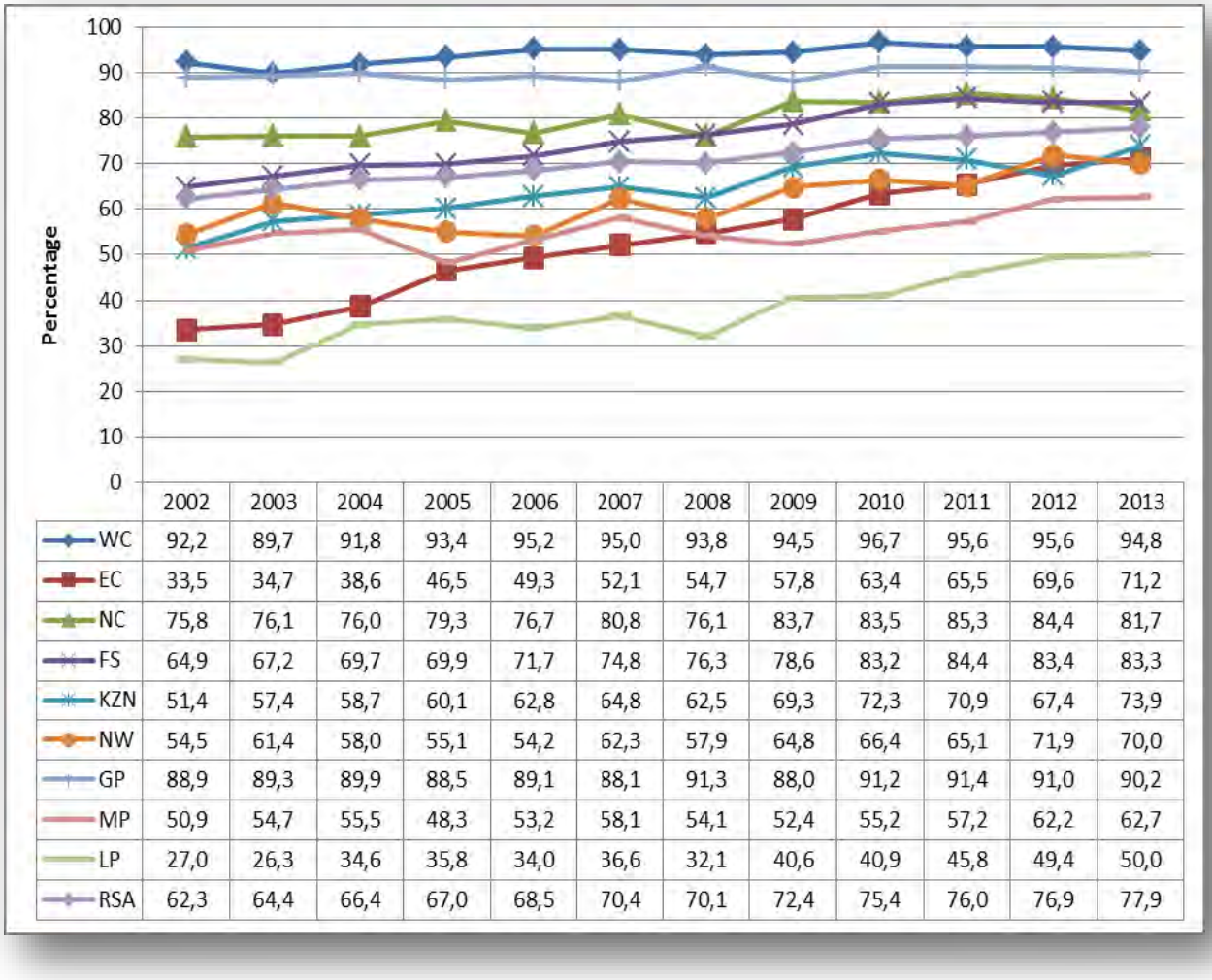
The MDG targets for South Africa were: 88.3% of the population must have access to an improved drinking water source; and 74.65% of the population must have access to an improved sanitation facility by 2015 (StatsSA, 2013). Although South Africa has met its MDG target for water and sanitation provision, it still faces a sanitation provision backlog. South Africa's sanitation problem is represented by service delivery backlogs, extension backlogs, upgrade needs and O/M backlogs (DWAF, 2012). The sanitation backlog in South Africa is highest in the rural areas, townships, informal settlements and former apartheid homelands (SAHRC, 2013).

According to the National Sanitation Strategy, the following factors contribute to the sanitation backlog:

- Sanitation is not a high priority in all spheres of government and on household level
- Inadequate funds are allocated towards addressing the sanitation backlog
- Human capacity in the sanitation sector is very limited
- Understanding and acceptance of the various technical options (for sanitation systems) is inadequate
- Sanitation is not seen as a holistic programme, the focus is still on the mere provision of a toilet structure, with little or no health and hygiene education
- Coordination and integration of planning on levels is inadequate (DWAF, 2012)

The increase in the percentage of households with access to improved sanitation facilities was 15.6% between 2002 and 2013, with an estimated 77.9% of South African households having access to improved sanitation in 2013 (StatsSA, 2014). Only 5.3% of households still use the bucket system. The provinces with the highest proportions of households with the bucket system are Eastern Cape, Free State, Northern Cape and the North West. The Western Cape households have the highest access to improved sanitation (94.8%) and households in Limpopo have the lowest access to improved sanitation in the country (50%) (StatsSA, 2014). Figure 5 below shows the percentage of households with access to improved sanitation in each province. Although access to improved sanitation has improved overall, there are households that either have no access to a sanitation facility, or currently utilize the bucket system. In addition to this, there are households that have problems with the sanitation facilities that they have access to. The abbreviations for the provinces represented in the graph are as follows:

- WC: Western Cape
- EC: Eastern Cape
- NC: Northern Cape
- FS: Free State
- KZN: Kwa-Zulu Natal
- NW: North West
- GP: Gauteng Province
- MP: Mpumalanga
- LP: Limpopo Province
- RSA: Republic of South Africa



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
WC	92,2	89,7	91,8	93,4	95,2	95,0	93,8	94,5	96,7	95,6	95,6	94,8
EC	33,5	34,7	38,6	46,5	49,3	52,1	54,7	57,8	63,4	65,5	69,6	71,2
NC	75,8	76,1	76,0	79,3	76,7	80,8	76,1	83,7	83,5	85,3	84,4	81,7
FS	64,9	67,2	69,7	69,9	71,7	74,8	76,3	78,6	83,2	84,4	83,4	83,3
KZN	51,4	57,4	58,7	60,1	62,8	64,8	62,5	69,3	72,3	70,9	67,4	73,9
NW	54,5	61,4	58,0	55,1	54,2	62,3	57,9	64,8	66,4	65,1	71,9	70,0
GP	88,9	89,3	89,9	88,5	89,1	88,1	91,3	88,0	91,2	91,4	91,0	90,2
MP	50,9	54,7	55,5	48,3	53,2	58,1	54,1	52,4	55,2	57,2	62,2	62,7
LP	27,0	26,3	34,6	35,8	34,0	36,6	32,1	40,6	40,9	45,8	49,4	50,0
RSA	62,3	64,4	66,4	67,0	68,5	70,4	70,1	72,4	75,4	76,0	76,9	77,9

Figure 5: Percentage of households that have access to improved sanitation per province, 2002-2013 (Source: StatsSA, 2014)

Figure 6 below shows the difference between the ideal (universal access to improved sanitation) and the actual access to sanitation systems in South Africa. The South African government set a target to achieve universal access to adequate basic sanitation by 2014 (Zhwawakinyu, 2012:15). The target was unfortunately not met. From figure 6, it is clear that it was near impossible for South Africa to achieve universal access to adequate basic sanitation by 2014. Constant population growth has been identified as one of the reasons why universal access to adequate sanitation in South Africa has not yet been achieved. For

example, the rural-urban migration that has resulted in the growth of informal settlements, has increased sanitation backlogs in these areas (DWAF, 2012).

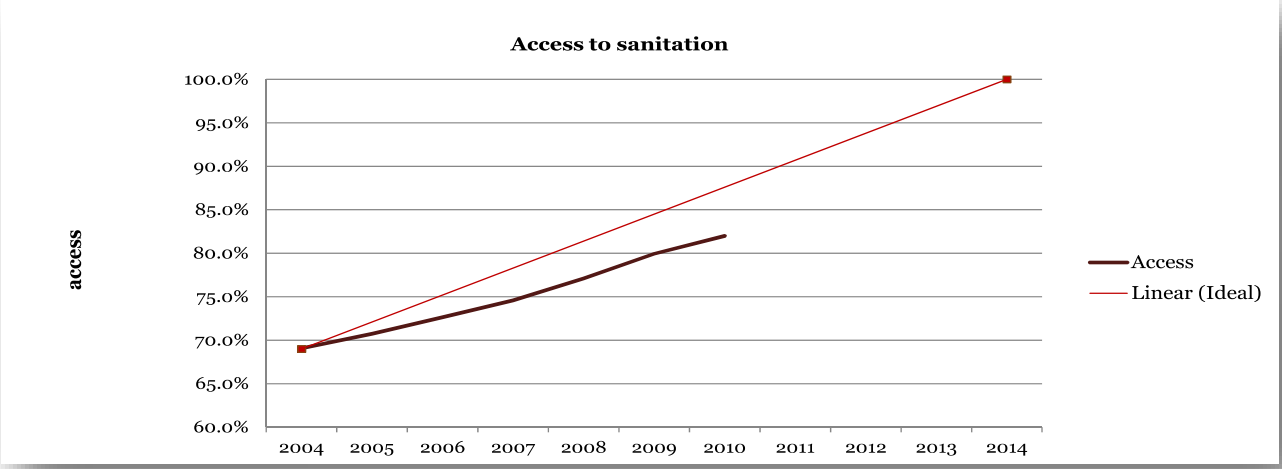


Figure 6: Pace of sanitation service delivery in South Africa (Source: DWAF, March 2012)

The current target is to eradicate bucket systems completely by the end of December 2015. Though this goal addresses the need for improved sanitation, it does not deal with the issues that have been identified with the quality and sustainability improved sanitation system. These include water shortages to flush toilets and wash hands, toilet blockages and poor maintenance of the latrines. Sanitation projects therefore need to prevent and address these problems, ensuring that sanitation facilities are sustainable in the long-term and hence remain adequate improved sanitation.

2.9 Summary

The literature review explored public participation policies and practices particularly for sanitation service delivery projects in South Africa. It further explored community engagement practices, knowledge transfer in sanitation projects, sustainable sanitation, the global and South African overview of sanitation, and sanitation technologies with particular focus on VIP latrines.

It was shown that public participation and community engagement facilitate the transfer of knowledge. Authors highlighted that the facilitation of a two-way knowledge transfer process through public participation methods and mechanisms can be limited. Public participation is a legislative requirement in South Africa. It is regarded as a means through which service delivery can be improved, and accountability can be encouraged. Some of the mechanisms used for public include budget and IDPs, ward committees, petitions and public meetings. Although IAP2 has developed a spectrum indicating the five levels of public participation, in the South African context public participation in relation to the spectrum is limited to "consultation," which is usually one-way communication with very little opportunity given to community members to raise concerns, influence decisions or be involved in the planning of projects. Furthermore, the challenges identified with public participation indicate that optimized public participation in sanitation projects is not easily achieved.

Community engagement, which is similar to public participation, facilitates close coordination between stakeholders in a project and hence promotes enhanced service delivery and development, and effective governance. Based on the assessment of community engagement in practice, the methods and mechanisms used in community engagement seem to facilitate the efficient transfer of knowledge. Additionally, community engagement enhances service delivery and development, achieves genuine community empowerment and ownership of projects, and contributes to effective governance and the deepening of democracy.

The nature of the global and national state of sanitation, and the design, operation and maintenance of the VIP latrine necessitate that knowledge transfer be encouraged in VIP latrine sanitation service delivery projects in South Africa. The best methods and mechanisms of involving communities within which the projects are implemented, need be established in order to promote VIP latrine sustainability.

3. Methodology

This chapter describes the methodology used in the study. The aim of the study was to assess how knowledge transfer through community engagement and/or public participation can be used to support the sustainability of VIP latrines, and address the negative perceptions that people have of the VIP latrine. A case study was done in order to assess the research problem in a natural environment. The selection of the case study sites was therefore done primarily on the basis of the relevance of the characteristics of the VIP latrine sanitation projects (implemented in each study site) to the study. Details on the case study sites can be found in chapter 4. Findings were then deducted from the collected data. Data was collected for the purpose of determining user perceptions on the VIP latrines, assessing the involvement of the community in the project and obtaining information on the VIP latrines in each household. A combination of two methods was used to analyse the collected data, namely the Sustainability Assessment Index and the Critical Systems Heuristics (CSH). Details of these methods are provided in section 3.1 and 3.2 respectively.

The Sustainability Assessment Index was used to assess the sustainability of the VIP latrines in the respondents' households, and rank them according to their sustainability; hence answering the second research question: *What are the general user perceptions of the VIP latrines? (In terms of technical, socio-cultural, economic and health aspects of the latrine)*. The CSH analysis was used to determine the methods used to involve the community in each project and hence establish an answer to the first research question: *What are the differences in the effectiveness in knowledge transfer between the use of public participation and community engagement methods and mechanisms in VIP sanitation projects?*

In order to determine the effect that the public participation or community engagement and knowledge transfer methods had on the overall sustainability of the sanitation project and hence that of the VIP latrines, the ranking of the sustainability of each sanitation project was compared to the findings of the CSH analysis. The CSH analysis provided insight into the key stakeholders, power structures and knowledge transfer in the two methods to

involve the community that were assessed. The linking of the public participation and community engagement practices to the sanitation sustainability was used to answer the third research question: *How has public participation been used to improve the sustainability of the VIP latrine?* And also show whether or not knowledge transfer through the use of effective community engagement and/or public participation methods can address the negative perceptions that users have of the VIP latrines and hence result in the provision of sustainable VIP latrines.

3.1 Sustainability Assessment

The sustainability assessment of the VIP latrines was done using the *Model for integrated assessment of sustainable development,* as described by Krajnc and Glavic (2004). The model was originally developed as part of a study to monitor and evaluate the economic, environmental and social performance of a company by obtaining the composite sustainable development index (Krajnc and Glavic, 2004). The model was later adapted by Amour Seleman (2012) for a study *"Assessing Sustainability of Sanitation Technologies."* Seleman (2012) used the model to compare multiple sanitation technologies through the computation of the composite sustainable development index. Seleman's study is referred to in order to obtain guidance on using the model for integrated assessment of sustainable development and for the assessment of sustainable sanitation. This section describes how the composite sustainable development index (ICSD) was calculated for the purpose of this study. The questions included in the household questionnaire for the purpose of the sustainability assessment, can be found in Appendix B. Figure 7 below shows the stepwise procedure for calculating the ICSD.

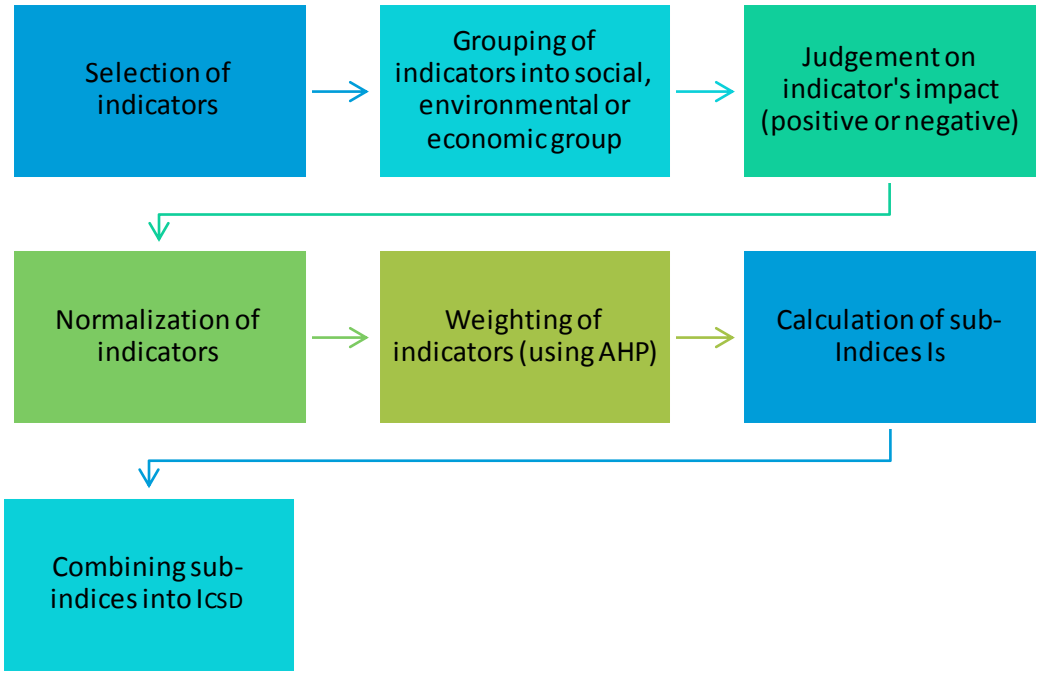


Figure 7: The stepwise procedure for calculating ICSD (Adapted from Krajnc and Glavic, 2004)

The composite index consists of multiple sustainability dimensions. Within each sustainability dimension, there are multiple indicators (Seleman, 2012). Once the indicators within each sustainability dimension have been selected, the positive or negative impact of each indicator is determined. The indicators are grouped as sustainability sub-indices (IS). The composite sustainable development index can then be calculated using the following formula:

$$I_{\mathrm{CSD},t} = \sum_{jt}^{n} W_j \cdot I_{\mathrm{S},jt}$$

Equation 1: Composite Sustainable Development Index (Krajnc and Glavic, 2004)

Where:

Wj = weight of each sustainability sub-group

Is = Sustainability sub-index for each sustainability sub-group, j; j= 1, 2, 3, 4 which are the sustainability dimensions, namely health and hygiene, technology and operation, economy and finance, and socio-cultural aspects.

3.1.1. Selection of sustainability dimensions and indicators

Each sustainability dimension is considered as a sub-index (IS) that can have multiple indicators. The first step in the calculation of the composite index, is the identification of the sustainability dimensions. The dimensions were selected on the basis of the sustainable sanitation table obtained from the Sustainable Sanitation Alliance (SuSanA, 2007). The four sustainability dimensions that were selected for the purpose of this study are health and hygiene, technology and operation, economy and finance, and the socio-cultural aspects of the VIP latrine. Details on the dimensions of sustainable sanitation can be found in section 2.4. The sustainability dimensions were considered as sustainability criteria sub-groups. The aspects encompassed by each sustainability dimension, were used to formulate sustainability indicators, which were considered as relevant to the context of the study. Two health and hygiene indicators, four technology and operation indicators, three economy and finance indicators, and three socio-cultural indicators were selected. A description of each indicator was drafted in order to provide guidance for the household questionnaire and hence the sustainability assessment process. Table 3 below shows the sustainability dimensions and the indicators in each dimension, adapted (by the author) from the SuSanA table.

Table 3: Sustainability dimensions and criteria

Sustainability criteria sub-groups (j)	*Indicators Sub-Indices (Is)*	*Description*
1. Health and hygiene	Improved hygiene practices	Has the latrine resulted in the overall improvement in hygiene practices and thus a

Sustainability criteria sub-groups (j)	*Indicators Sub-Indices (Is)*	*Description*
		decrease in waterborne diseases?
	Risk of exposure to hazardous materials	Are the latrine users at risk of being exposed to hazardous materials in the?
		toilet as a result of an unlined pit, no ventilation and no handwashing facility
2. Technology and Operation	Operation and Maintenance	Can the latrine be easily operated and maintained by householders?
	Competence requirements	Were local artisans used to construct the latrines?
	Vulnerability toward water shortages	Is the latrine able to function properly even when there are water shortages?
	Durability/Lifetime	What is the expected lifespan of the latrine before the pit has to be emptied/a new latrine has to be constructed?

Sustainability criteria sub-groups (j)	*Indicators Sub-Indices (Is)*	*Description*
3. Economy and Finance	User ability to pay	Are the latrine users able to pay for the operation and maintenance of the latrine?
	Willingness to pay	Willingness to pay for the continuous operation and maintenance of the latrine
	Contribution to local development	Has the construction of the latrine contributed to the overall socio-economic development of the community?
4. Socio-cultural	Appropriateness to current local cultural context	Is the latrine acceptable to use and maintain by all members of the household?
	Convenience	How convenient the latrine is for use by people in the household? This includes comfort, personal security, smell and privacy.
	User perception of the latrine	Overall user perception of the system: complexity, compatibility and observability

3.1.2 Values and Weights of Indicators

Through the use of the SuSanA specifications for sustainable sanitation, VIP latrine design and O/M requirements (refer to section 2.6) and the assessment of local conditions, valuation rubrics were developed for each indicator. The scales of the rubrics varied 1 to 3, 0 to 3, 0 to 2, 1 to 4, and 1 to 2; with the smaller number being inferior and the bigger number being superior. As an example Table 4 is the rubric scale for the Economy and Finance sustainability dimension. Rubrics scales for the other sustainability dimensions can be found in Appendix E.

Table 4: Rubric scale for the Economy and Finance dimension

Indicators	*Explanation*	*Description for rating*	*Unit*
User ability to pay	Number of people able to pay for the operation and maintenance of the latrine	0%-30% able to pay for O/M of latrine	1
		31%-60% able to pay for O/M of latrine	2
		61%-100% able to pay for O/M of latrine	3
User willingness to pay	Number of people willing to pay for the operation and maintenance of the latrine (including the emptying of the pit once full)	0%-25%	0
		25%-50%	1
		51%-75%	2
		76%-100%	3
	Project contribution to overall socio-	Latrine project did not contribute to any socio-	0

Indicators	*Explanation*	*Description for rating*	*Unit*
Contribution to local development	economic development	economic development in the community	
		Latrine project contributed to the socio-economic development in the community	1

Once values had been assigned to each indicator, the weight of each indicator was developed. The weight of each indicator is an indication of the importance thereof. For the purpose of this study, the sum total of the weights of each indicator was assumed to be equal to one. The weight of 1 was therefore distributed among the indicators, based on the overall assumed effect of the indicator on the sustainability of the latrine. The indicators that were affected by (whether directly or indirectly) the knowledge transfer methods were allocated a higher percentage, in each indicator, of the weight of 1. These indicators include: improved health and hygiene practices, operation and maintenance, user perception of the system, and user willingness to pay. Each of these indicators were assumed to be most affected by the knowledge transfer methods used in each project and were thus allocated a higher percentage in their respective sustainability criteria sub-group.

For the Economy and Finance dimension, user willingness to pay 40, the user ability to pay was allocated a percentage of 30, and contribution to local development 30. For the Technology and Operation dimension, operation and maintenance, use of local labour, vulnerability to water, and durability/lifespan of the latrine were allocated percentages of 40, 20, 20 and 20 respectively. For the socio-cultural dimension, appropriateness to local cultural context, convenience and user perception of the system were allocated percentages of 25, 25 and 50 respectively. For the health and hygiene dimension, the weight was distributed equally, with each indicator (namely improved health and hygiene practices,

and risk of exposure to hazardous materials) being allocated a percentage of 50%. The weights are then multiplies by normalized indicators in order to obtain the sustainability sub-index (Isi).

3.1.3 Impact of Indicators

The next step in the calculation of the ICSD is the judgement of the impact of each indicator. In each sustainability criteria, there are indicators increasing value has a negative impact (I^-) and indicators whose increasing value has a positive impact (I^+) (Krajnc and Glavic, 2004). For example an increased risk of exposure, in the health and hygiene sustainability dimension, has a negative impact (I^-).

3.1.4 Normalization of Indicators

All the sustainability indicators were expressed in varying units of measurements (e.g. the number of people willing to pay for latrines; latrine acceptability and convenience etc.) and therefore need to be normalized in order for them to be used in the computation of the ICSD (Krajnc and Glavic, 2004). Normalizing of indicators offers the possibility of incorporating various quantities with different units of measurement (Krajnc and Glavic, 2004). The normalizing of indicators is done using one of the following equations, depending on whether the impact of the indicator is positive (I^+) or negative (I^-):

$$I^-_{N,ijt} = 1 - \frac{I^-_{A,ij} - I^-_{min,j}}{I^-_{max,j} - I^-_{min,j}}$$

Equation 2: Normalization of Negative Indicators

$$I^+_{N,ijt} = \frac{I^+_{A,ij} - I^+_{min,j}}{I^+_{max,j} - I^+_{min,j}}$$

Equation 3: Normalization of Positive Indicators

Where:

$I^-_{N,ijt}$ is the normalized indicator i (with negative impact) for the group of indicators, j and $I^+_{N,ijt}$ is the normalized indicator i (with positive impact) for the group of indicators, j.

$I_{A,ij}$ is the measured value of the given indicator,

$I_{min,j}$ is the minimum value of a given indicator, and

$I_{max,j}$ is the maximum value of a given indicator.

3.1.5 Calculating Weights of Sustainability Criteria

The sustainability index (Is) for each of the four selected sustainability dimensions is calculated by multiplying each sustainability sub-index (Isi) by the weight of the sustainability dimension (Wj). A more practical method of determining sustainability criteria weights is therefore the Analytic Hierarchy Process (AHP) (Krajnc and Glavic, 2004). The AHP was thus used for the purpose of this study.

The process includes making pair-wise comparisons between each of the sustainability dimensions. In making the comparisons, the evaluator has to ask, "Which of the two indicators *i* and *j* is more important with respect to Sustainable Development?" (Krajnc and Glavic, 2004). The answer to this question for each pair-wise comparison is expressed on a factor scale from 1 to 9. The value 1 indicates that the two indicators are of equal importance to one another, and the value 9 indicates that the one value is extremely (9 times) more important than the other. Table 5 indicates the comparison scale of the AHP.

Table 5: Comparison scale of analytic hierarchy process (Source: Hafeez et al., 2002 in Krajnc and Glavic 2004)

Factor of preference, p	*Importance definition*
1	Equal importance
3	Moderate importance of one over another
5	Strong or essential importance of one over another
7	Very strong or demonstrated importance of one over another
9	Extreme importance of one over another
2,4,6,8	Intermediate values
Reciprocal, 1/*p*	Reciprocal for inverse comparison

Factor ratios are calculated for each of the pair-wise comparisons, the weight of the sustainability is then computed as the average of the factor ratios in the row for each of the respective factor ratios. Table 6 shows the pair-wise comparisons and the final weights for each sustainability criteria. The pair-wise comparison in Table 6 was done by the researcher. The comparison was done using the reviewed literature and the assumed effect that knowledge-transfer, through either community engagement or public participation, had on each of the sustainability dimensions.

Table 6: Pair-wise matrix for sustainability criteria

Factors	*Health*	*Technology*	*Economy*	*Social*
Health	1	3	½	¼
Technology	1/3	1	1	1/3

Factors	*Health*	*Technology*	*Economy*	*Social*	
Economy	½	1	1	1	
Social	4	3	1	1	
Sum	**5.8333**	**8**	**3.5**	**2.58333**	
	Factor Ratios				***Weights***
Health	0.1714	0.375	0.1429	0.0968	0.2
Technology	0.0571	0.125	0.2857	0.129	0.15
Economy	0.0857	0.125	0.2857	0.3871	0.22
Social	0.6857	0.375	0.2857	0.3871	0.43

The AHP also requires the computation of a consistency ratio, Rc, in order to check the consistency of each judgement in the pair-wise comparison. The computation of the consistency ratio was done on a Microsoft Excel Spreadsheet using the procedure written by Bunruamkaew (2012). Exaggerated judgements or careless errors usually results in inconsistency (Krajnc and Glavic, 2004). A consistency ratio of 0.1 is regarded as acceptable. The consistency ratio of 0.1 indicates the judgements are 10% inconsistent or 90% consistent. Any Rc that is above the acceptable ratio of 0.1 is unacceptable. The Rc for this study was calculated as 0.0631 thus the judgements made in the pair-wise comparisons are 6.31% inconsistent.

Once the factor ratios had been determined, the average weights were calculated. The sum of the average weights for each sustainability criteria was assumed to be equal to 1. Socio-cultural aspects were ranked the highest, with an average weight of 0.43, and technology and operation was ranked the least with an average weight of 0.15. Economy and finance,

and health and hygiene had average weights of 0.2 and 0.22 respectively. The average weights are illustrated in figure 8.

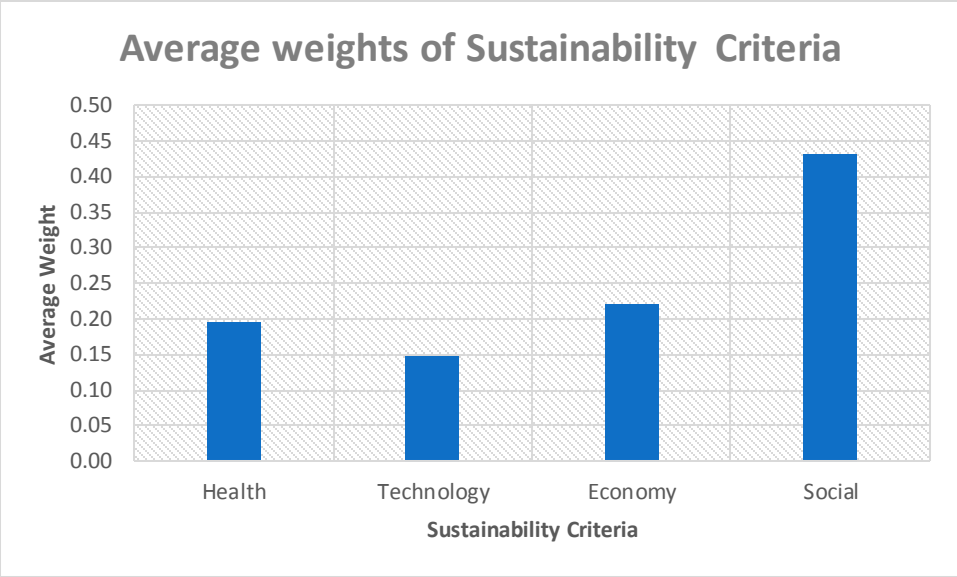


Figure 8: Sustainability criteria average weights

3.1.6 Combining Sub-indices into ICSD

Using the calculated weights of each sustainability dimension, and the sustainability sub-indexes (calculated from the normalized indicators), the composite sustainability index was computed, in a Microsoft Excel spreadsheet, using equation 1. The sum of sustainability sub-indexes was multiplied by the respective average weights in figure 10 to calculate the sustainability indexes for each village.

The ICSD was calculated for the VIP latrines constructed in both projects. The sanitation projects were then ranked according to the value of the ICSD. The project with the higher ICSD was considered as the more sustainable VIP latrine project.

3.2 Critical Systems Heuristics

The Critical Systems Heuristics (CSH) framework was used to assess the effect that public participation and effective knowledge transfer processes have on the sustainability of the VIP latrine. In doing so, the research considered the stakeholders and sanitation system

aspects that should be considered as relevant in the implementation of VIP latrine sanitation projects. Werner Ulrich developed the CSH framework in 1983. It is "a philosophical framework to support reflective practice" (Ulrich & Reynolds, 2010). CSH can be applied to a situation or area associated with human beings, whether collectively or individually. CSH is typically used in the evaluation of planning processes and plans (Reynolds, 2007). According to Venable (2009), "CSH provides a philosophically and theoretically grounded framework and means for critical consideration of the choices of stakeholders considered to be relevant to any system under consideration" (Venable, 2009:1). The CSH framework enables the evaluation of power structures, built-in values and knowledge base of a system of interest (Reynolds, 2007). On the basis of the foregoing information, CSH was therefore identified as an appropriate framework for the assessment of knowledge transfer methods in the processes used to involve community members in VIP latrine sanitation projects, as it allowed for the establishment of who should be considered as key stakeholders in VIP latrine sanitation projects. Additionally, it provided insight into the power sharing that should occur in the public participation or community engagement processes, and the values that should guide both processes.

3.2.1 CSH Boundary Questions

The CSH framework incorporates 12 questions known as "boundary questions," which are used to define the boundary or scope of a system. The boundary questions cultivate an enhanced understanding of situations with regards to values and motivations, power structures that influence the problem in the system of interest, the knowledge basis in a system of interest, and the moral basis on which those not involved yet affected by the system of interest will have to deal with the consequences thereof (Ulrich & Reynolds., 2010:245). Each question is asked in the "what is" and "what ought to be" mode. The questions are grouped according to four sources of influence, each with its own kind of stakeholder (Venable, 2009). The four kinds of stakeholders are the client, decision-maker, professional and the witness. Table 7 summarizes the boundary questions, showing how each stakeholder is linked to each boundary issue.

Table 7: Critical Systems Heuristics Questions for Evaluation (Source: Reynolds, 2007:2-3)

Sources of Influence	*Question*
Sources of Motivation	1. Beneficiary: Who should be/is the client or beneficiary of the service or system to be evaluated?
	2. Purpose: What should be/is the purpose of the service or system of interest?
	3. Measure of success: What should be/is the service or system's measure of success (or improvement)?
Sources of Control	4. Decision maker: Who should be/is the decision maker (in command of resources necessary to enable the service or system)?
	5. Resources: What components of the service or system ought to be/are controlled by the decision maker?
	6. Decision environment: What conditions ought to be/are part of the service or system's environment i.e. not controlled by the service or system's decision maker and therefore acting as possible restraint?
Sources of Expertise	7. Expert (or designer): Who ought to be/is involved as providing expert support for the service or system?

Sources of Influence	*Question*
	8. Expertise: What kind of expertise or relevant knowledge ought to be/is part of the design of the service or system?
	9. Guarantor: What ought to be/is providing guarantor attributes of success for the service or system and hence what might be/are false guarantor attributes of success?
Sources of Legitimation	10. Witnesses: Who ought to be/is representing the interests of those affected by but not involved with the service or system, including those stakeholders who cannot speak for themselves (e.g. the handicapped, future generations and non—human nature)?
	11. Emancipation: To what degree and in what way ought/are the interests of the affected free from the effects of the service or system?
	12. Worldview: What should be/is the worldview underlying the creation or maintenance of the service or system? I.e. what visions or underlying meanings of "improvement" ought to be/are considered. And how ought they be/how are they reconciled?

3.2.2 CSH Evaluation Technique

The CSH evaluation technique used in this study is one described by Reynolds (2007). The first step in the technique described by Reynolds is the identification of the system of interest for the CSH evaluation. The system of interest identified is "A system to facilitate

knowledge transfer through public participation and community engagement in a VIP latrine sanitation project." Reynolds uses the terms "monological" and "dialogical" to refer to the two-fold CSH assessment of a system of interest. The monological appraisal answers the CSH questions using experience and/or reviewed literature, it builds an ideal picture of the system of interest through answering the CSH boundary questions in the "what ought to be" mode (Reynolds, 2007). A dialogical picture of the system of interest was then drawn through interviews that were conducted with the identified key stakeholder groups. The dialogical appraisal is a picture of the system of interest from the stakeholders' perspective. It is a picture of the system drawn through the stakeholder's answers to the CSH questions in both the "what is" and "what ought to be" mode during interviews. The stakeholders interviewed included: Ward Committee members, Community Development Forum workers (CDFs), project beneficiaries, Village Health Workers (VHWs) and Project Managers/Facilitators. The interview questions were drafted by adapting the CSH questions in order "to systematically unfold a perspective of the system of interest from each stakeholder group" (Reynolds, 2007). The adapted questions can be found in Appendix C. A narrative report of the CSH evaluation was then written, using the four CSH sources of control topics. The report also comprises of a comparison of the monological and dialogical appraisals.

3.3 Fieldwork Study Methods/Data Collection Methods

A total of 58 householders were interviews for the purpose of the study, which represented 10 percent of the total number of households in each village that received the toilets as part of each sanitation project. In Village A, 23 households were visited, and 35 households in Village B. Sampling of households for the household survey was done using purposive sampling by selecting every second household. The household questionnaire and community focus group questionnaire can be found in Appendix C and Appendix D respectively. For the purpose of assessing the methods used to involve community members in the sanitation projects, focus group discussions were conducted with a total of 18 individuals. Two focus group discussions were held with 9 individuals in each village. The focus group discussion participants included Ward Committee members, Community

Development Forum workers, Village Health Workers, construction workers who were employed for the respective projects, and community members who were project beneficiaries. In addition to the interviews conducted with community members, one-on-one interviews were conducted with the key representatives of the implementing agents in each project respectively. The language that is predominantly spoken in both villages is Xitsonga and as a result Xitsonga speaking fieldwork assistants were appointed to assist with translation during some interviews. The fieldwork assistants were given training on the interview process, and details of the study was explained to them. The author accompanied the research assistants on some of the household interviews in order to facilitate the process when necessary. The author is, however, a fluent speaker of Xitsonga and was thus able to communicate with interviewees when research assistants were not available.

4. Site Description

4.1 Study Area

This chapter describes the study site. It contains a description of the study area, the study area demographics, and an overview of both sanitation projects.

The study was conducted in the Bushbuckridge Local Municipality. The Bushbuckridge Local Municipality is situated in the North East side of the Mpumalanga Province, South Africa. Bushbuckridge Local Municipality forms part of the five Local Municipalities of the Enhlanzeni District Municipality in the Mpumalanga Province. According to the Statistics South Africa 2011 census, the population of the Bushbuckridge Local Municipality is 545 811(BLM, 2013). The Municipality is known for its agricultural and tourism attractions (BLM, 2013). The challenges faced by the Bushbuckridge Local Municipality include crime, unemployment, service delivery backlogs, high poverty levels and high illiteracy (BLM, 2013). Poverty and unemployment are the core development challenges faced by the municipality (BLM, 2015). Bushbuckridge Local Municipality provides a link to major tourism areas including Hazyview, Pilgrim's Rest, Graskop, Hoedspruit, and the Kruger National Park (BLM, 2015). The average household size in the municipality of 4.02 (BLM, 2015) is higher than the national average household size of 3.6 (StatsSA, 2011). Nationally, the number of households that receive at least one social grant is 45.5% (StatsSA, 2014). The high dependency on child support grants and old age grants in Bushbuckridge Local Municipality (BLM, 2015) is reflective of the national statistics on social grants dependency. The Municipality consists of 37 wards. Figure 9 below illustrates the locality of the Bushbuckridge Local Municipality.

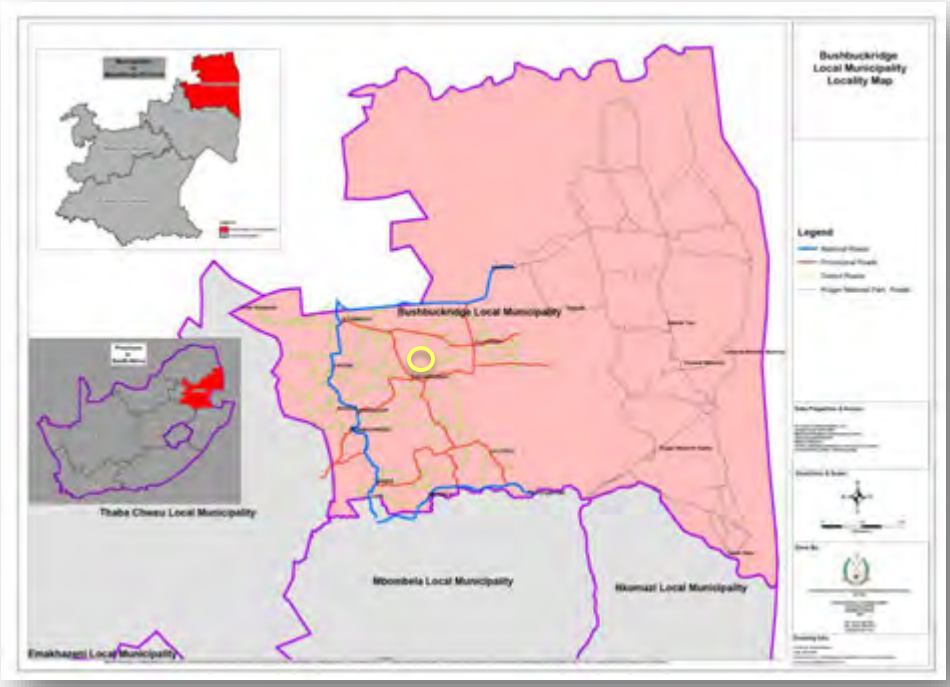


Figure 9: Bushbuckridge Local Municipality locality map (Source: BLM, 2013)

For the purpose of this study, the villages of Godide and MP Stream were selected. Both villages are located in Ward 28 about 40km North East of the town of Bushbuckridge. The study sites were selected on the basis of the similarities their characteristics, the type of sanitation system implemented as part of each sanitation project, the different methods of involving the community and their relevance to the study; and the rural nature of the study sites. The identified homogeneity between the two villages allowed for a better assessment of the success of the sanitation systems and the methods used to involve the community. The villages are rural in nature. Unemployment is also a problem, roads are not tarred, and yard taps are the main source of water. Though there are a few households that still have thatch-roofed huts in their yards, the dwelling types are predominantly brick and cement houses, most of which are not painted. Figures 10 and 11 illustrate a typical road and house in the villages.

Figure 10: Typical road in Godide and MP Stream (Author's own)

Figure 11: Typical house in Godide and MP Stream (Author's own)

The villages are low-income areas as many of the households in the villages depend on social grants or sustenance farming. The dominant age group in both villages is representative of that in the municipality, which is 15-34. The ratio of females to males is similar to that of the local municipality, with a higher number of females than males. Additionally, many of the households in both villages are female-headed households. Due to ethical requirements of the University of Cape Town, the author had to ensure the anonymity of participants. This was done by referring to the sites as Village A and Village B.

4.2 Case Study Overview

4.2.1 Village A Sanitation Project

The Rural Household Infrastructure Programme (RHIP) was a four-year programme, which was established by the National Treasury in 2010 and was directed by the Department of Human Settlements. As part of the programme, R1.2 billion was allocated for the provision of on-site sanitation and water facilities to rural communities in South Africa.

The focus of the RHIP projects was on provinces, which face sanitation and water supply backlogs in rural communities. The RHIP was aimed at supporting municipalities within those provinces, to address sanitation and water supply backlogs. Addressing these backlogs would also contribute towards South Africa meeting the UN MDGs.

The programme prioritized beneficiary involvement/community engagement in order to enhance the spirit of ownership, allow beneficiaries to develop skills and to move towards sustainable rural communities. The increased beneficiary involvement was also aimed at alleviating poverty (as beneficiaries were employed in the employment of these projects). RHIP therefore emphasizes the use of Community Based Organisations (CBOs), NGOs and Public Entities as these will help maximize community involvement (DHS, 2011). "The RHIP places strong emphasis on project sustainability by integrating infrastructure development, stakeholder participation, empowerment of beneficiary communities, promoting local economic development, hygiene and user education, and operation and

maintenance" (Klu, n.d:18). A precast concrete VIP latrine was selected as the sanitation system that would be provided to rural households.

The Department of Rural Settlements selected 2 service providers in the implementation of the RHIP projects in Bushbuckridge (DHS, 2011).

The sanitation project in Village A was implemented in 2012 as part of the RHIP. The Department of Human Settlements appointed a National NGO to manage the implementation of one of the RHIP projects in Village A. The NGO was therefore the implementing agent in the project. The project entailed the construction of 204 Ventilated Improved Pit Latrines for 204 households in Village A. The project was implemented with emphasis on community engagement, and health and hygiene education. User education, O/M training and health and hygiene promotion were thus coupled with provision of the VIP latrines. Local community members were appointed to construct the latrines and educate users on the appropriate health and hygiene practices, the NGO facilitated the training for those who were appointed.

4.2.2 Village B Sanitation Project

The Municipal Infrastructure Grant (MIG) is a single consolidated grant, which combines capital grants such as the Water Services Project, Community Based Public Works Programme, Urban Transport Fund, and the Local Economic Development Fund into a grant for the funding of municipal infrastructure (DPLG, n.d.).

MIG was established in order to overcome challenges associated with infrastructure grants that were previously managed by various government departments. In addition to the previous uncoordinated management of infrastructure grants, municipalities had no control over infrastructure projects within their municipalities. As a result planning for basic services was not integrated and cost effective (DPLG, n.d).

MIG aims to provide a basic level of service to all South Africans. There are three infrastructure categories that the MIG can be used to fund; namely, households, public municipal facilities and institutions other than municipal facilities (such as churches, schools and clinics). Through the provision of access to basic services, the MIG also aims

to create employment, alleviate poverty, empower communities, facilitate local economic development, and decentralize service delivery (DPLG, n.d).

The sanitation project in Village B was implemented in 2011. The Bushbuckridge Local Municipality appointed a project management consultancy as the implementing agent to oversee the construction of latrines in Village B. The project was funded from the municipality's MIG and managed by the project management firm appointed as the implementing agent. A total of 400 VIP latrines were constructed for 400 households.

The involvement of the community was incorporated in the project process through informing the community about the project, user education on the health and hygiene practices associated with the latrines, and O/M requirements of the latrine. Local community members were appointed to construct the latrines and educate users on the appropriate health and hygiene practices. The Technical Manager (employee of the Project Management firm) facilitated the latrine construction training for the community members that were appointed to construct the latrines.

4.2.3 Amalooloo VIP latrines

The Amalooloo top structure was used for the construction of VIP latrines in both sanitation projects. The Amalooloo system is a holistic system designed by Bertram (Pty) Ltd in 2008 (Bertram, n.d.). The superstructure is made up of a base panel, 4 side panels, 2 back panels, 1 roof panel and one door. The panels are made of non-corrosive materials such as PVC, brass and stainless steel (Bertram, n.d.). The super structure comes in kit form and can be easily assembled on site. It requires minimal training and can be assembled by unskilled persons regardless of gender. The structure can also "be dismantled and re-erected elsewhere" (Bertram, n.d:1). It is erected over a pit sub structure, but can be upgraded to a waterborne system. Upgrading the system does not require any structural changes to the super structure. The door of the structure has a locking mechanism that allows privacy and safety for the user.

Figure 12: Amalooloo superstructure (Source: Author's own)

The pedestal in the Amalooloo system is designed to separate solids and fluids at the source. The separation of the solids and fluids enables the pit to fill up at a slower rate, as the additional volume that is added by the fluids, is reduced. A separate pipe is installed in a trench, and directed toward the garden area on each property. The pipe transports the urine, which fertilizes the soil in the garden area. This can facilitate the establishment of an ecologically friendly vegetable garden (Bertram, n.d.). The pedestal is reported to be safe and comfortable for both adults and children to use. A hand washing facility is placed above the pedestal. The hand washing facility consists of "a reservoir, hand washbasin, and a cistern" (Bertram, n.d:7). The facility enables the latrine user to wash their hands under running water (each wash only requires 300-350ml of water) (Bertram, n.d.). Figure 15 illustrates the hand washing facility within each Amalooloo super structure.

Figure 13: Amalooloo pedestal and hand washing facility (Source: www.amalooloo.com, 26 May 2015)

The reported advantages of the Amalooloo system include the fact that it is safe, prevents bad odour and flies, increases pit lifespan, allows for complete health and hygiene, and can promote the social aspect of sanitation as it enables women to be involved in sanitation improvement, the system is also reportedly cost-efficient and easy to construct (Bertram, n.d.).

4.3 State of Sanitation in the Bushbuckridge Local Municipality

The performance of the Bushbuckridge Local Municipality with regards to sanitation service delivery has not been good. According to the 2011 Statistics South Africa Census, only 10.41% of the entire municipality has access to adequate sanitation. Also, the municipality was given an overall green drop score[1] of 28.5%, which was one of the lowest green drop scores in the province (BLM, 2013). In order to address the sanitation service

[1] The green drop score is a percentage score used to quantify the state of the sanitation in the municipality. It is a Performance Indicator which is a reflection on the Municipality's wastewater practices and compliance. The green drop criteria that are assessed include: Process Control, Maintenance and Management skill; Wastewater Quality Monitoring Programme, Wastewater Sample Analysis; Submission of Wastewater Quality Results; Water Quality Compliance; Wastewater Quality Failures Response Management; Stormwater Demand Management; Bylaws; Wastewater Treatment Facility Capacity; Publication of Wastewater Management Performance; and Wastewater Asset Management (DWA, 2011).

delivery backlog, the Bushbuckridge Local Municipality decided to focus on the construction of VIP latrine and bulk sewer infrastructure. The Municipality's Integrated Development Plan (IDP) states that the VIP latrine is the Municipality's choice of sanitation system as VIP latrines will achieve the Municipality's objective of "providing environmentally friendly sanitation services to the people for the promotion of healthy living amongst individuals" (BLM, 2013:71).

4.4 Demographics

4.4.1 Age and Gender Distribution

The number of households that were visited was 10% of the total project size (i.e. 10% of the total number of households that received VIP latrines as part of each sanitation project). The total number of households visited in Village A was 23 and the total number of households visited in Village B was 35. The age of respondents in Village A ranged from 21 to 63. In some households, the head of the household was not home during the household survey and hence the other members of the household were interviewed. The majority of the respondents were females, with both villages having very similar gender distribution: 35% of the people interviewed in Village A were males and 65% were females; 34% of the people interviewed in Village B were males and 66% were females. The high ratio of females to males is common throughout both villages and the municipality as a whole. The high number of female respondents is a result of many of the households being headed by single or widowed women. Figures 14 and 15 below show age and gender distribution of survey participants in each village.

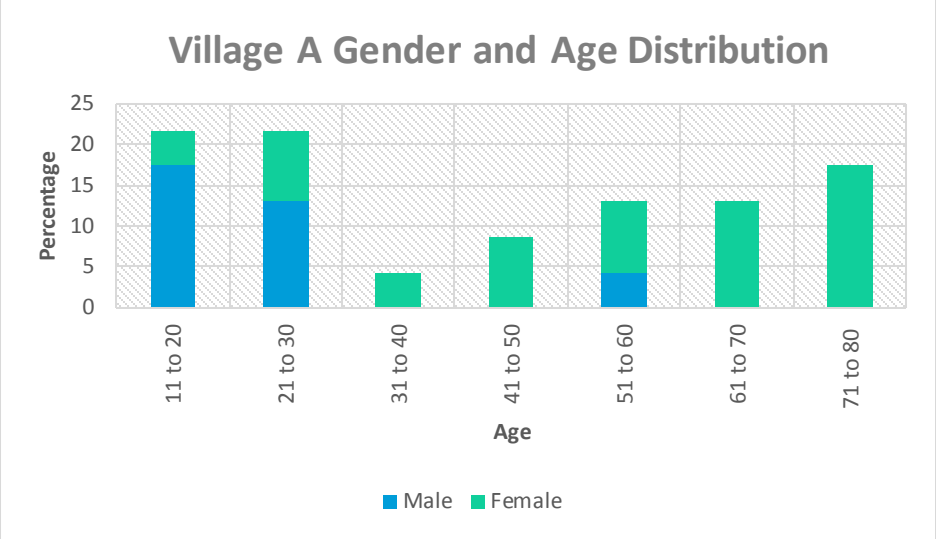


Figure 14: Age and gender distribution in Village A

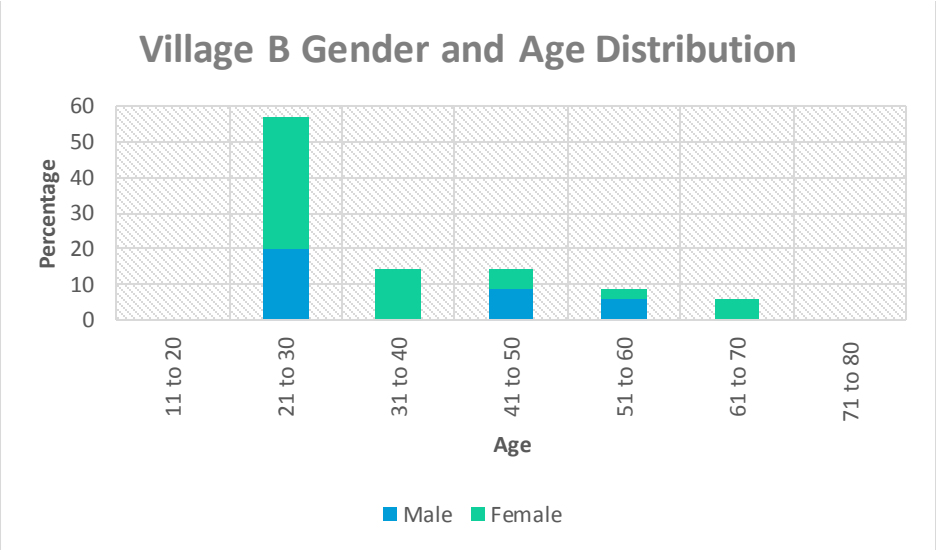


Figure 15: Age and gender distribution in Village B

4.4.2 Education Level

The level of education of respondents in each village varied, with majority of the respondents indicating that they had obtained a secondary school level qualification. Approximately 44% of the respondents in Village A have obtained a secondary school level qualification. In Village B, 68% of the respondents have obtained a secondary school level qualification. The respondents who indicated that they had obtained a secondary

school level qualification were either referring to Grade 11 or matric. Those who had a matric qualification had been unable to pursue a tertiary education either due to financial constraints or the inability to be accepted into a tertiary institution. This seems to be a persistent problem in both communities. Those who indicated that they had no formal education, ABET (Adult Based Education and Training) and Primary School education, were those who are above 50 years old. The recorded education level statistics in both villages were representative of the level of education of the entire village population. The national percentage for persons over the age of 20 without formal education is 5.6%. Mpumalanga is the province with the highest percentage (10.6%) of persons above the age of 20, with no formal schooling nationally (StatsSA, 2014). The percentage of people in Village A with no formal education is 2.4% higher than the provincial average and more than two times higher than the national average of 5.6% (StatsSA, 2014). The percentage of respondents in Village B without formal education was lower than both the national and provincial averages. In addition, the percentage of respondents that had either completed or had some level of primary school level education was higher than the national average of 15.9% (StatsSA, 2014). The education level in Village B was therefore higher than the national estimates. Figures 16 and 17 below indicate the education levels of the respondents in each village.

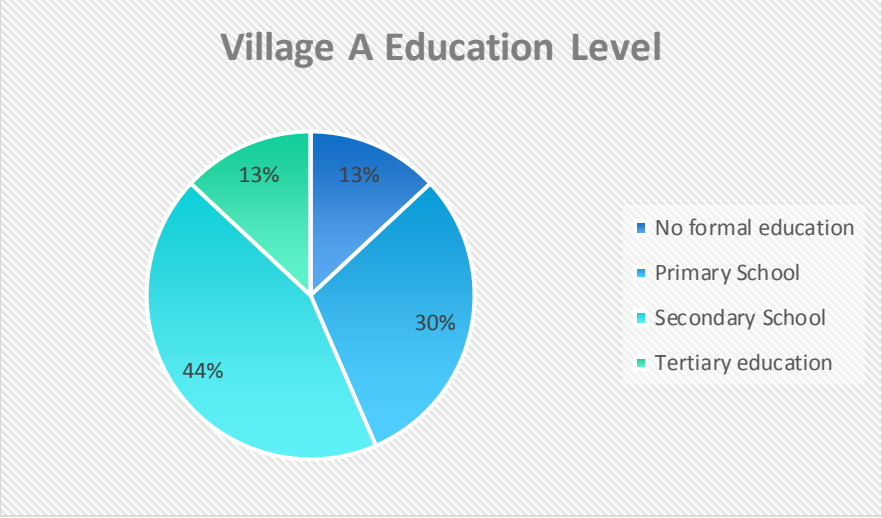


Figure 16: Education level in Village A

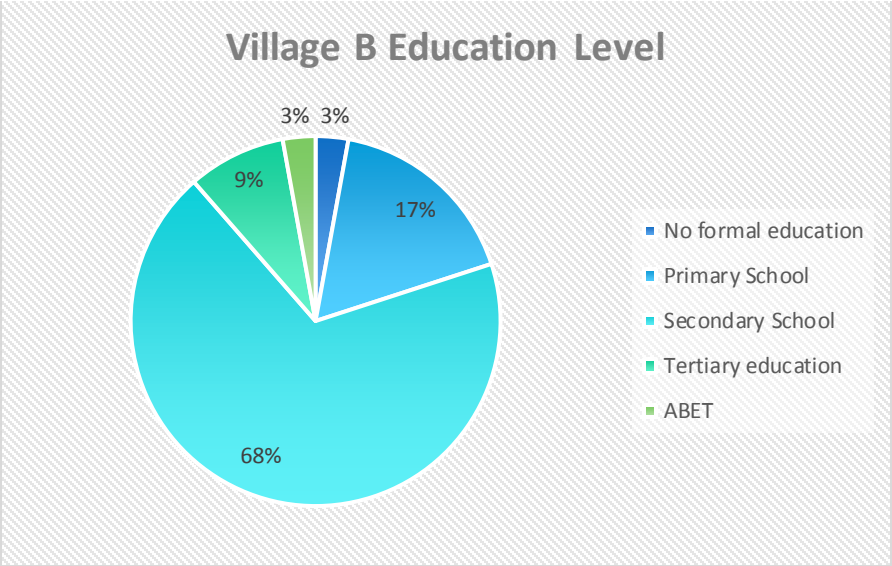


Figure 17: Education level in Village B

4.4.3 Socioeconomic Status of the Villages

Unemployment in the surveyed villages was high, reflecting the unemployment level in South Africa, which is currently 26.4% (StatsSA, 2015). In Village B, the unemployment rate of the respondents was higher than the national rate with 57.1% of the respondents indicating that they are unemployed, and only 28.6% of the respondents are either employed full-time, part-time or self-employed. In Village A, the unemployment rate of the respondents was also higher than the national average, 34.8% of the respondents indicated that they are unemployed, and only 13% are employed part-time or are self-employed. There were no respondents who indicated that they are employed full-time as the survey was conducted during work hours. On the contrary, full-time employees were respondents in the Village B survey as majority of the household surveys in Village B were conducted on a public holiday when most people were not working. The recorded employment status is Village A is therefore not an accurate reflection of the overall population of the village.

The government child support grant and pensioner grant are the main source of income for many of the residents in both villages. 30.4% of the respondents in Village A were

pensioners above the age of 60 and thus received the government grants. In Village B, 6% of the respondents in Village B were pensioners. This was reflected in the more than 40% of households in each village whose total monthly income ranges between R1001-R2000. The estimated mean income in Village B was R1486, and the mean and modal group was the income range of R1001-R2000. In Village A, the estimated mean income was R1272, which was lower than the mean income in Village B. The mean and modal group for Village A was also the R1001-R2000 income range. Although the number of respondents in Village B who are pensioners was lower than that of Village A, many respondents in Village B indicated that they lived with a pensioner whose grant was the main source of income for the household. Some of the households that were within the R1001-R2000 range, and many of those in the R100-R1000 range were depended on child support grant. In many cases, the child support grant received was for more than one child. Figures 18 and 19 illustrate the monthly income in each household.

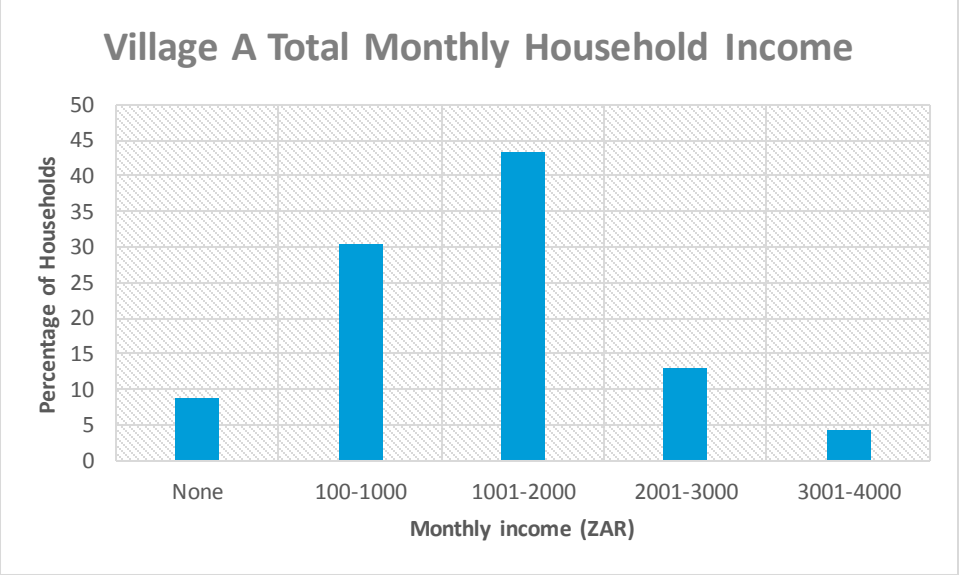


Figure 18: Total monthly income in Village A

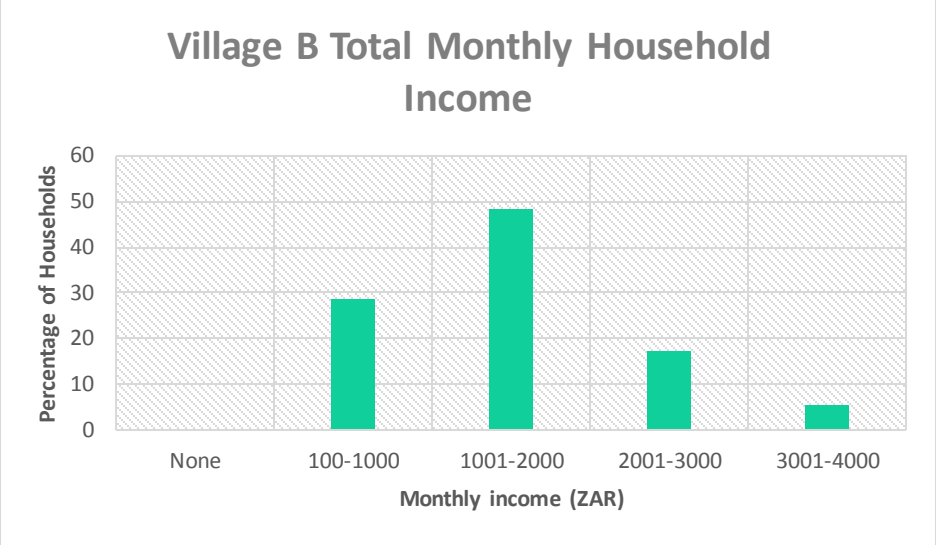


Figure 19: Total monthly income in Village B

5. Results and Discussion

This chapter presents the findings and an analysis according to the methodology described in chapter 4. The sustainability assessment conducted for both projects is presented in the first section and in the second section, the CSH assessment is shown. A comparison of the projects in terms of their sustainability and the effect of the methods used to involve the community on the overall sustainability of each project is also done.

5.1 Sustainability Assessment of Latrines

The composite sustainable development index for each village is presented in Figure 20.

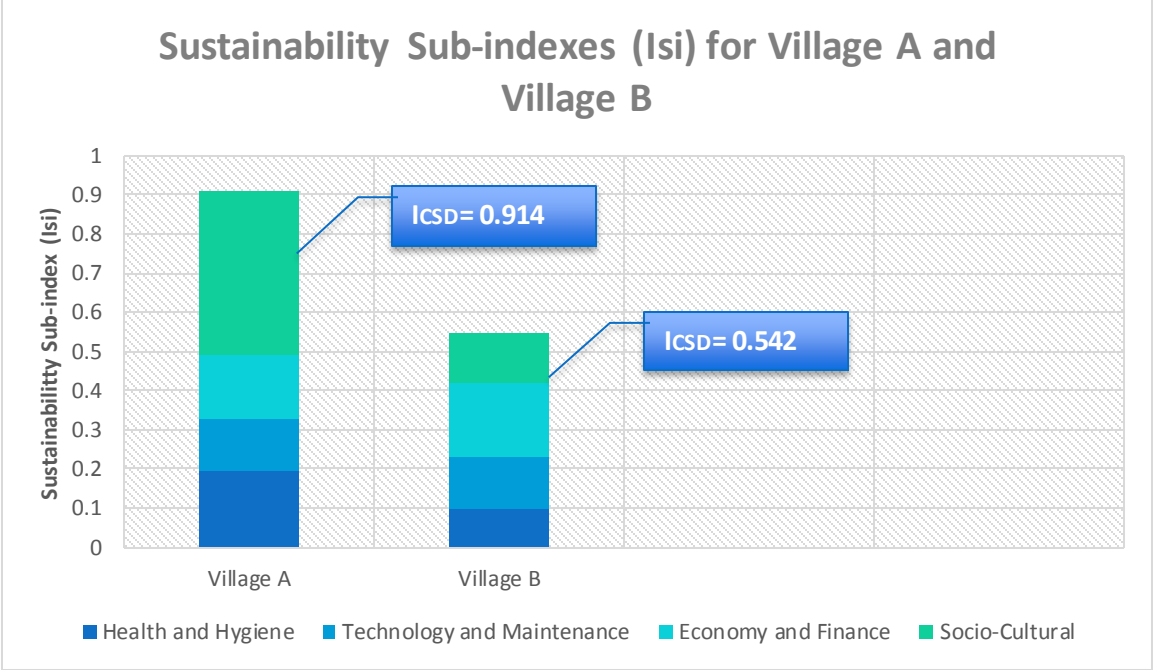


Figure 20: ICSD and Sustainability Sub-indexes for each Village

The ICSD for the sanitation project in Village A was determined as 0.914 and that of Village B as 0.542. The VIP latrines in Village A, and hence the project itself, were the most sustainable. Figure 20 also illustrates a breakdown of the values of the sustainability sub-indexes for each project. For Village A, the health and hygiene, technology and maintenance, economy and finance, and socio-cultural criteria sustainability sub-indexes had values of 0.198, 0.133, 0.16 and 0.42 respectively. All, except for the economy and

finance, sub-indexes in Village B were lower than those in Village A. The economy and finance indicator had a value of 0.19. The health and hygiene, technology and maintenance, and socio-cultural criteria has sustainability sub-index values of 0.098, 0.131 and 0.12 respectively. The values of the sustainability sub-indexes prove that the health and hygiene, and socio-cultural criteria of the projects, had the largest contribution to the difference in the sustainable development index. Tables detailing the values obtained during the computation of the sub-indexes and composite sustainable development index, can be found in Appendix F.

5.1.1 Health and Hygiene Sustainability Dimension

The health and hygiene sustainability dimension sub-index value of the project in Village A was higher than that of Village B. There was a difference of 0.099 between both villages. In both villages, latrine users indicated that everyone in the household washed their hands after using the toilet, and that no one had suffered from a waterborne disease ever since the construction of the latrines. Every household had access to clean water either from their yard tap or that of a close neighbour. The lower health and hygiene sub-index value in Village B was a result of 22.9% of the respondents who indicated that either they, or someone else in the household still used the bush to defecate. The main reason given for the defecation in the bush was the unpleasant experience of using the constructed VIP latrine. This is despite the fact that both villages have the same latrine. In Village A open defecation had been eliminated.

The *risk of exposure to hazardous materials* indicator also contributed significantly to the difference in the health and hygiene sustainability sub-index values between the two villages. The extent to which users were exposed to hazardous materials in the latrine, especially when it rained; and the presence of a fully functional pedestal in the latrine, were used to measure the value of this indicator in each village. In Village A, all latrines had a fully functional pedestal and latrine users were not exposed to hazardous materials in the latrine when it rained as the toilets did not overflow. In Village B, all latrines also had a fully functional pedestal. However, 8 households indicated that they were exposed to hazardous materials in the latrine when it rained as the toilet overflowed and some of the

waste in the pit rose to the toilet pedestal and latrine floor. This exposure, however, is not permanent and can be controlled as latrine users close off the latrine until the hazardous material has subsided and the latrine is usable again.

As highlighted by Makhubela (2016), the overflowing of toilet pits is most likely due to the pit lining or the area surrounding the perimeter of the top slab not being sealed adequately thus allowing rain water to seep into the pit (Makhubela, 2016). According to Makhubela (2016) in some instances, not enough compacting of the soil is done after the placement of the slab. The soil around a VIP latrine therefore needs to be checked by the householders on a regular basis in order to ensure that rain water will not penetrate the ground and seep into the pit. The compacting of the soil has to be done for sanitation projects wherein not enough cement has been provided to seal the top of the latrine, although this is not encouraged as the latrines need to be moved once the pit is full. The latrine users therefore have to be capacitated to ensure the proper compacting of the soil around their latrines (Makhubela, 2016).

5.1.2 Technology and Maintenance Sustainability Dimension

The indicators that were included in the technology and maintenance dimension were: operation and maintenance, use of local labour, vulnerability to water shortages, and the expected durability/lifespan of the latrines. The difference in the sustainability sub-index value for this dimension for each village, was minimal. Village A had an Isi value of 0.133 and Village B had an Isi value of 0.131. The slight difference in the values of the sustainability sub-index (Isi) was a result of the expected durability of the latrine. For the latrines in Village A, the project manager indicated that the expected lifespan of the latrines was more than 5 years, although this depends on the household size (Makhubela, 2015). The larger the size of the household, the lower the expected lifespan of the latrine. In Village B, the expected lifespan of the latrines was also indicated as more than 5 years (Mokoena, 2015). However, more than 90% of the latrine users indicated that their pits were not dug deep enough (i.e. less than 2m) and hence their toilets were almost full. The high number (78%) of households with more than 5 people in Village B also contributed

to the fast filling up of the latrines, In Village A, only 52% of the households had more than 5 people living in them.

The other indicators, namely operation and maintenance, use of local labour, and vulnerability to water shortages, were very similar in both villages. Latrine users in both villages were able to operate and maintain the latrine but did so with limitations. In Village B, no one indicated that they were aware of the cleaning method for the ventilation pipe, and hence did not clean the ventilation pipe. In Village A, 4% of the users aware of the cleaning method for the ventilation pipe and hence cleaned it on a regular basis. All latrine users in both villages cleaned their pedestals at least once a week.

Household surveys in many of the households in Village B also showed evidence of users not being fully aware of some of the details for the adequate O/M of the latrines, as they were using chemicals that decreased the lifespan of the latrines and contributed to bad odour in the latrine. The basic O/M requirements of the VIP latrines include the cleaning of the ventilation pipe, pedestal and the area around the pedestal. Latrine users must also avoid adding strong chemicals such as bleach into the pit (Makhubela, 2015). The limitations in the practice of the adequate O/M requirements for the latrines (in both villages) can be attributed to limited/no knowledge-transfer. The limited/no education seems to be more prevalent in Village B as the only O/M information that most latrine users were not aware of in Village A, was the cleaning of the ventilation pipe, with 96% of the interviewed latrine users indicating that they were not aware of the cleaning methods for the ventilation pipe.

Both sanitation projects made use of local labour for the construction of the latrines. The indicator values for *Use of Local Labour* and *Vulnerability to water shortages* were therefore 1 for both villages.

5.1.3 Economy and Finance Sustainability Dimension

The value of the economy and finance sustainability dimension sub-index for Village B was 0.19, and 0.16 for Village A. The three indicators that were included in this dimension are: user ability to pay for latrine O/M, user willingness to pay for latrine O/M, and contribution to local development.

The value for the user ability to pay for latrine O/M indicator was the same for both villages. In both villages 61-100% of the latrine users indicated that they were able to pay for the operation and maintenance of the latrines, with 20% and 4.35% of latrine users in Village B and Village A respectively who indicated that they could not always afford to buy the correct operation and maintenance equipment. The monthly household income has an effect on the extent to which households can adequately operate and maintain their latrines.

The sanitation projects in both villages contributed to the overall socio-economic development of the community as community members were employed either as construction workers or as health and hygiene educators. Those who were employed to work in both projects were given the necessary training prior to commencing their duties. The projects therefore resulted in skills and knowledge development in both villages.

The difference in the overall value of the economy and finance sustainability sub-index between the two villages (0.03) was a result of the user willingness to pay for latrine O/M. In Village B, 51% of the latrine users indicated that they were willing to pay for the emptying of the pit once it was full. In Village A, 43.48% of the latrine users indicated that they were willing to pay for the emptying of the pit once it was full. Village A therefore scored 1 for the *user willingness to pay* indicator, which was 1 point less than that of Village B (indicator value is 2). During the household survey, all of the latrine users in Village B indicated that they had not been informed about the cost implications of or the possibility of emptying the pit once it was full. The limited knowledge on what to do once the pit was full, was a contributing factor to the unwillingness of some latrine users to pay for the emptying of the pit, however, the higher number of latrine users in Village B willing to pay for the operation and maintenance of the latrine, can be attributed to the 70% of households

in Village B who had a monthly income more than R1000; whereas only 60% of households in Village A had a monthly income of more than R1000. The higher income, and not the limited knowledge on pit emptying was the main contributing factor to the difference in user willingness to pay between the two villages.

5.1.4 Socio-cultural Sustainability Dimension

The difference in the socio-cultural sustainability dimension sub-index between the two villages was the most significant with a difference of 0.3 between the two villages. This sustainability dimension was considered to be the most important as it was the sustainability dimension that related the most to the methods used to involve the community in both villages. This sustainability dimension was also considered as the dimension that affected the latrine users the most and hence the overall sustainability of the latrines. The socio-cultural dimension was important for the overall sustainability of the latrine as people will generally look after a latrine and ensure its sustainability if they value it and take ownership over the latrine. The indicators in this dimension were: appropriateness to local cultural context, convenience and user perceptions of the system.

In both villages, there were households where not everyone in the household was able to use the latrine: 4.3% in Village A and 22.9% in Village B. Not all the latrines were therefore appropriate to use by all members of the household regardless of age or gender. Some of the reasons given for the inability of some household members to use the latrine, include: the state of the latrine which some householders considered to be unhygienic, preference of utilizing the bush to defecate and some household members were considered to be too young (by the older household members) to safely use the latrines without assistance and hence were prevented from using the latrines. The unhygienic state of some latrines could either be a result of poor O/M and/or poor construction which has inhibited the long-term adequate functionality of the latrines.

The *convenience* indicator was measured according to how convenient the latrine was to use based on privacy, comfort and odour in the latrine. The value of the convenience indicator in Village A was higher than that of Village B. Latrines in Village A were reported as latrines that provided privacy and comfort although this was with limitations

as 9.7% of households indicated that there was a constant bad odour in the latrine. In Village B, all the households indicated that the latrines provided privacy and comfort with limitations. 42.9% of households complained about a constant bad odour in the latrine whilst 65.7% complained about flies and other insects in the latrine. The combination of the bad odour and insects in the latrine made the experience of using the latrine unpleasant. The bad odour and flies that some latrine users mentioned in the household survey, was contrary to the Amalooloo specifications of the latrines. According to the latrine specifications, the latrine is designed to prevent the presence of a constant bad odour and flies (Bertram, n.d). The bad odour mentioned by some users was therefore indicative of either inappropriate operation and maintenance methods, or faulty construction of the latrine.

The *user perception of the latrine* indicator was considered as the most important socio-cultural indicator and was given a weight of 0.5. This indicator was given a high weight as the user's view of the latrine (whether positive or negative) can greatly affect the effort they put into ensuring its sustainability. This indicator was measured based on the user satisfaction with the latrine (measured as a percentage) and whether or not the users considered the latrine as a permanent solution to their sanitation problem. In Village B, the combination of user satisfaction and whether or not people considered their latrines as a permanent solution to their sanitation problem was only 40%. In Village A, the combination of user satisfaction and whether or not people considered their latrines as a permanent solution to their sanitation problem, was 82.6%. User satisfaction in Village A was therefore more than twice as high as that of Village B. This can be attributed to the methods used to involve the community in the project and hence the knowledge transfer to the community about the latrines that were constructed, as the methods used to involve the community and knowledge transfer contribute to user ownership of the latrines. In Village A, one of the community meetings was used to give community members details on the VIP latrines that would be constructed. In addition, a demo model of the VIP latrine was constructed in the school, providing the community members a visual example of the latrines that would be constructed (Makhubela, 2015).

Latrines that are properly operated and maintained generally receive a positive perception by the users. This is evident in the high positive user perception of the system in Village A, which correlates with the high number of latrine users (95.35%) who are able to operate and maintain the latrine. The consideration of the latrine as a permanent solution can also be affected by the rate at which the latrine is filling up. Some latrine users in Village B who indicated that they would not consider the latrines as a permanent solution to their sanitation problem mentioned that their pits were filling up too quickly and hence they would not be able to use the latrines for much longer. Also the unpleasant experience of using the latrine and the desire for waterborne sanitation were given as reasons for the latrines not being considered as a permanent solution be some latrine users in Village B. In Village A, the main reasons given for the latrines not being considered as a permanent solution was the desire for waterborne sanitation systems. The user perception of the latrine can also be affected by user pre-conceptions of the latrines, which can be addressed during the process of involving the community during which knowledge on the latrine can be shared with the community members. The methods used to involve the community in each project are discussed in the CSH analysis in the next section. Furthermore, section 5.3 describes how the methods used to involve the community in each project affected each sustainability dimension.

5.2 CSH Evaluation

The CSH evaluation of the methods used to involve the community in each village was two-fold: The first step involved a monological appraisal, which was the "ideal" mapping of the processes followed in the involvement of the community; and the second step was a dialogical appraisal which was a description of the actual processes in each project. Both the monological appraisal and dialogical appraisal are described below.

5.2.1 Monological Appraisal

The monological appraisal for the CSH analysis was undertaken using the literature review. The policies, legislation, articles and various other sources referred to in the literature

review, which provide an outline on the ideal participatory methods to be used in water and sanitation projects, were used for the purpose of the monological appraisal. Table 8 illustrates the ideal mapping for the system of interest, using the 12 CSH questions in the "what ought to be" mode. The ideal mapping for both projects is the same.

Table 8: Ideal mapping for public participation and community engagement in VIP latrine sanitation projects

Role	*Role-specific concerns*	*Key problems*
Sources of Motivation		
Beneficiary Community members residing in the communities that will benefit from the sanitation project i.e. recipients of the latrines. Also, the communities at large, particularly those who are part of the marginalised (women, old, unemployed, poor etc.)	*Purpose* Promote democratic governance, create user ownership of the latrines, health and hygiene improvement, improve sustainability of the latrines and educate latrine users of the O/M requirements of the latrine.	*Measure of improvement* Overall socio-economic development in the community, improved sanitation and health and hygiene practices, and the provision of latrines that are sustainable in the long-term.

Sources of Power		
Decision-maker	*Resources*	*Decision environment*
Elected community representatives, key leaders in the community including CDW's, Ward committees and councillors; NGO officials/Project Managers, local municipality and the Donor Agency (Department of Human Settlements**).**	Necessary components that enable Public Participation and community engagement including: i. Human ii. Finances iii. Knowledge/skills	i. Selection of project beneficiaries ii. Expertise within the community iii. Protection of the natural environment iv. Community members affected by the project
Sources of Knowledge		
Expert	*Expertise*	*Guarantee*
NGO/Project managers and the key leaders in the community including CDW's, project steering committee and ward committee/councillor.	i. Technical knowledge and skills (for latrine construction and maintenance) ii. Health and hygiene education (particularly for those who will educate the rest of the community) iii. Environmental consciousness and responsibility iv. Facilitation skills for community meetings v. Project coordination	Involvement of all stakeholders in the project (including community members) and the full participation of all stakeholders. Adequate skills transfer resulting in the construction of robust latrines. Health and hygiene education throughout the community, and capacity building/skills development of the various community members directly involved in the project.

Sources of Legitimation		
Witness	*Emancipation*	*Worldview*
The community members, ward committees and councillors, CDWs, NGOs and the various policies and legislature in South Africa, which provide specifications of how public participation should be done in the context of water and sanitation service delivery. The legislation and policies also ensure that human rights (including those who are affected but cannot speak for themselves) are considered.	Freedom from: i. Degradation of the environment through the pollution of groundwater sources and soil ii. Marginalization through the provision of the latrines and the public participation process iii. Deception iv. Potential political influences	Public participation and effective knowledge transfer in VIP latrine sanitation projects depends on continual engagement of stakeholders throughout the project process, particularly the engagement of latrine users. Capacity must be built in community members, with whom project managers and coordinators must remain in a continuous dialogue. Projects must result in socio-economic development.

5.2.2 Dialogical Appraisal

Once the ideal mapping was done and stakeholders had been identified, interview schedules were designed for each stakeholder. The interview schedules were semi-structured adaptations of the 12 CSH questions in the "what is" and "what ought to be" mode, hence allowing the unfolding of the perspective of each stakeholder on the system of interest (Reynolds, 2007). In addition to the CSH questions, more general questions were asked about the project (finances, project overview, project duration), stakeholder relations, political influences in the project and possible barriers and enablers throughout the entire project process. The interview schedules can be found in appendix C and D. Tables 9 and 10 present summaries of the final critiques of each project, which are based on the interviews conducted with the stakeholders in each project.

Table 9: Final critique for the methods used to involve the community in the Village A VIP latrine sanitation project

Village A VIP latrine Sanitation Project	
Motivation ***Critique***	The community engagement process commenced with the calling of a community meeting to introduce the project. At the community meeting (called by the ward councillor and committee), the implementing agent, together with the department of Rural Settlements and municipal representatives, were given an opportunity to explain what the project was all about and how it would be implemented. A project steering committee (within the community) was also elected by the community members during the first meeting. In the subsequent community meetings, the project steering committee and implementing agent gave a progress report on the project, and appointed community workers who would work on the construction of the latrines and peer education (Village Health Workers/VHW's). The appointed community members were given training by the implementing agent. The main *beneficiary* of the community engagement process was the community. The implementing agent is also a beneficiary as the process enables them to bring clarity to any confusion that may hinder progress during the project. The *purpose* of the community engagement process is to involve community members in the decision-making, explanation of the project details and enable community members to ask questions, and create community ownership of the latrines, which is believed to ensure the long-term maintenance of the latrines by the community. The engagement of the community was also done to ensure seamless progress of the project. The *measure of improvement* of the community engagement process in the project was the extent to which communities accepted the latrines, progress of the project without hindrances (such as theft and protests) from the community, the

Village A VIP latrine Sanitation Project	
	involvement of community members in the project, householders' willingness to assist those who were constructing the latrines by providing materials such as water; and the overall socio-economic development of the community through the appointment of community members to work on the project. The socio-economic development was considered as key by the community members who experience the plight of unemployment on a daily basis. Community members also valued constant feedback and information-sharing throughout the project, and considered this as a measure of improvement as well.
Control ***Critique***	The main *decision-maker* in the community engagement process of the project was the project steering committee. The ward committee and councillor made decisions in the initial stages of the process through organizing of the first community meeting and assisting with the selection of latrine beneficiaries. The *resources* controlled by the project steering committee were those of human resources and to an extent, finances. The project steering committee had the power to "hire and fire," guide all workers in the project, select beneficiaries, monitor payment of staff, supervise things such as the selection and delivery of material, organize community meetings and resolve conflict. The implementing agent and donor agency also checked the proposed beneficiary list in order to ensure that the project beneficiary selection was fair. The project steering committee's *decision environment* did not include control of the finances of the project, construction of the latrines and certain knowledge/skills required in the project. The implementing agent was the overseer of the knowledge/skills transfer with regards to the construction and health and hygiene education. Also, the implementing agent managed the finances of the project.

Village A VIP latrine Sanitation Project	
	Though the finances and actual construction are not directly part of the system of interest (facilitation of knowledge transfer through public participation and/or community engagement) they can affect the system of interest and hence the extent to which the community engagement and knowledge transfer process is successful.
Expertise ***Critique***	The *experts* in the project were the ward committee and ward councillor, the implementing agent, the Bushbuckridge Local Municipality, the Department of Health and the householders. Each expert provided the following *expertise*: • Ward committee and councilor: Provided a beneficiary list to the implementing agent. The compiling of the list was based on the committee and councilor's expert knowledge of the water and sanitation needs in their community. The list gave the implementing agent, donor agency and the local municipality, necessary guidelines when planning for the project. • Implementing agent: Coordinated project (in terms of finances, planning and stakeholder engagement), knowledge and skills transfer for the construction and O/M of the latrines and the health and hygiene practices associated with the latrine. • Bushbuckridge Local Municipality: Facilitated environmental consciousness through the provision of the groundwater protocol, which would enable the contractors to avoid the contamination of ground water through the digging of toilet pits in inappropriate areas. • Department of Health: Monitored the health and hygiene aspects of the project. One of the stakeholders indicated that clinics ought to be involved in the project, on behalf of the

Village A VIP latrine Sanitation Project	
	department of health in order to provide health and hygiene education to the community members. This education should not only be limited to the project duration, but should be an on-going process. • Householders: Shared their expert knowledge with contractors on the most ideal place to construct the latrines in their yard. Though the groundwater protocol gave the contractors guidelines on how to prevent groundwater pollution, knowledge shared by the householders gave the contractors specific knowledge on the exact location of groundwater on each plot. Also, the householders shared knowledge on the location of rocks in the ground that could prevent the proper digging of toilet pits with sufficient depth. The success of the knowledge transfer and community engagement process was *guaranteed* by the general positive consensus amongst the experts and community members, involvement of the community in the project, health and hygiene improvements in the community, and the construction of robust latrines. The post-construction meeting held with the community members and stakeholders, provided a guarantee that the project plan had been implemented. The implementing agent also conducted an inspection of the latrines prior to the post-construction meeting, in order to ensure that the latrines met the required standards.
Legitimation ***Critique***	The implementing agent, ward committee, Community Development Forum (CDF) and the community members who attended the community meetings throughout the project process acted as *witnesses* on behalf of those who were affected by the project process but not involved in it. The ward committee and CDF did a door-to-door

Village A VIP latrine Sanitation Project	
	inspection of each household in order to ensure that the beneficiaries of the project were truly in need of a latrine. Also, this enabled those who were too young/old to attend the community meetings, and these whose schedules did not allow them to attend the community meetings, to be fairly represented throughout the project process. Some community members attended the community meetings on behalf of their fellow family members and neighbours who could not attend the community meetings, in order to represent them. The implementing agent checked the beneficiary list, further ensuring a fair representation of all community members including those who could not speak for themselves, and future generations. The representation of people who could not speak for themselves also provided *emancipation* for them, allowing them to be secure from the premises and promises of those involved. The local municipality, contractor and the implementing agent served as witnesses for the environment, ensuring that the latrine construction did not result in environmental degradation. The limited involvement of political figures in the project reduced the possible occurrence of political influence, which could affect the project success. The determining *worldview* for the project was constant engagement of, and communication with the community in order to ensure community buy-in to the project, project success, health and hygiene improvement, socio-economic development in the community, and community ownership of the latrines (which contributes to the long-term sustainability of the latrine).

Table 10: Final critique for the methods used to involve the community in the Village B VIP latrine sanitation project

Village B VIP latrine Sanitation Project	
Motivation ***Critique***	The public participation process commenced when the ward councillor and the CDF called a meeting with the community members. During the meeting the project was introduced to the community. Those who wanted to be recipients of the latrines were given an opportunity to sign up. The meeting was also used for recruitment purposes, introducing the project to anyone who wanted to be employed in the project, those who wanted to be appointed submitted copies of their Identity Documents. The appointed community members were trained by the implementing agent for the tasks they were expected to complete throughout the project. The project steering committee was elected and lead by the ward councillor, it consisted of the CDF, ward committee and community members with whom the ward councillor works for various projects in the community. The *beneficiaries* of the public participation process were both the implementing agent and the community. The community benefits from the opportunity to be informed about the project, employed to work on the project and receive latrines that will contribute to the overall health and hygiene improvement in the community. The implementing agent is also a beneficiary of the public participation process as they are given the opportunity to explain all the details of the project to the community and therefore prevent any issues that may arise and hinder the successful progression of the project. The *purpose* of the public participation process was to inform the community about the project, find beneficiaries and recruit community members to work on the construction of latrines and peer education phases of the project. The process was also used to inform the community about important details

Village B VIP latrine Sanitation Project	
	of the project. In addition to this, the public participation was intended to create a sense of ownership amongst the recipients of the latrines. The *measure of improvement* was different for each stakeholder. The technical manager considered the lack of riots from the community as a measure of improvement of the public participation process. The entire project process was completed without any resistance or protest from the community. For the community members, the employment of community members in the project, and the provision of latrines to some members of the community, was regarded as a measure of improvement. Employment (of community members) was important as the unemployment rate in the community is high. A total of 62 jobs (builders, brick casters, pit diggers and health workers) were created in the area during the project implementation. Community members indicated that they valued the efforts made to inform them about and include them in the project at the initial stages of the project, but indicated that they would've appreciated more feedback and information-sharing throughout the project as this would bring clarity about issues around why certain people did not receive latrines.
Control ***Critique***	The main decision-maker in the public participation process was the ward councillor and project steering committee. The ward councillor and project steering committee made decisions in the public participation process of the project, through the organizing of community meetings, selecting the latrine recipients and assisting with the recruitment of labourers in the project. It was the sole responsibility of the project steering committee to call for and coordinate community meetings throughout the project. The interviewed stakeholders indicated that only two community meetings were held throughout the

Village B VIP latrine Sanitation Project	
	project: one for the introduction of the project, and another for the recruitment of labourers and selection of latrine recipients. The *resources* controlled by the project steering committee were those of human resources. The project steering committee had the power to appoint labourers, monitor the training process (of the labourers), select beneficiaries, organize community meetings and resolve any conflict that occurred between the community and the implementing agent. The project steering committee's *decision environment* did not include control of the finances of the project, construction of the latrines, firing of labourers, supervising of any construction/health and hygiene-related issues and certain knowledge/skills required in the project. The implementing agent was the overseer of the knowledge/skills transfer with regards to the construction and health and hygiene education. Also, the implementing agent managed the finances of the project. Though the finances and actual construction are not directly part of the system of interest (facilitation of knowledge transfer through public participation), they can affect the system of interest and hence the extent to which the public participation and knowledge transfer is successful.
Expertise ***Critique***	The experts in the project were the ward councillor, project steering committee, the implementing agent and the householders. Each expert provided the following expertise: • Ward councilor: Compiled and provided a beneficiary list to the implementing agent. The compiling of the list was based on the project steering committee and the ward councilor's expert knowledge of the water and sanitation needs in their community. The ward councilor was also responsible for

Village B VIP latrine Sanitation Project	
	coordinating all the community meetings throughout the project and the recruitment of local laborers. • Project steering committee: Assisted the ward councilor in the compilation of the beneficiary list, the recruitment of local laborers and identifying local building material suppliers. • Implementing agent: Coordinated project (in terms of finances, planning and contracting), knowledge and skills transfer for the construction and O/M of the latrines and the health and hygiene practices associated with the latrines. The implementing agent was also responsible for ensuring that they prevented groundwater pollution through providing construction workers information on the ideal places to dig toilet pits. The knowledge on the location of groundwater was based on the implementing agent's expert knowledge on the groundwater protocol in the area. • Householders: Shared their expert knowledge with contractors on the most ideal place to construct the latrine in their yard. Also, householders shared knowledge on the location of rocks in the ground that could prevent the digging of pits with sufficient depth. Some of the householders, who had the construction skills required in the project, were given an opportunity to share their skills in the project as they were employed to be laborers in the project. The success of the knowledge transfer and public participation process was *guaranteed* by a positive quality assessment (of the latrines) survey result (as conducted by the implementing agent), employment creation in the community, and the construction of robust latrines. The visibility

Village B VIP latrine Sanitation Project	
	of the constructed latrines provided a guarantee that the project plan had been implemented.
Legitimation ***Critique***	The implementing agent, project steering committee, community members who were labourers in the project and the community members who attended the community meetings throughout the project process, acted as witnesses on behalf of those who were affected by the project process but were not involved in it. Some community members attended the community meetings on behalf of their fellow family members and neighbours who could not attend the community meetings, in order to represent them. The community members who were labourers in the project were essential witnesses as they gave feedback on the project process to some of the community members who were not involved in the project. This feedback was essential as it seems the community meetings throughout the project were non-existent or insufficient. The implementing agent and contractor ensured that the construction of the latrines did not contaminate any groundwater or borehole resources, thus protecting the environment and serving as a witness for the environment. In addition to the latrine beneficiary list compiled by the project steering committee, community members were also given an opportunity to sign up as latrine recipients at the second community meeting. The recipient selection procedure enabled those who were too young/old to attend the community meetings, those whose schedules did not allow them to attend the community meetings, and those who the project steering committee may not have been aware of in the initial beneficiary selection stages of the project, to be fairly represented in the beneficiary selection stage of the project. However, some interviewees in the focus group

Village B VIP latrine Sanitation Project	
	discussion indicated that they considered the latrine recipient selection process to be unfair and complicated. They indicated that there seemed to be favouritism in the selection of recipients, and some community members whose application to be latrine recipients was unsuccessful were not given an explanation. The representation of the people who could not speak for themselves also provided *emancipation* for them, allowing them to be secure from the premises and promises of those involved although it is evident that this emancipation was not sufficient. Those who were not directly involved in the project and/or could not speak for themselves were thus not completely free from the premises and promises of those involved as decision-makers in the project. The determining worldview for the project was the engagement of the community in order to ensure community buy-in to the project, project success, health and hygiene improvement, socio-economic development in the community, and community ownership of the latrines (which contributes to the long-term sustainability of the latrines).

Table 11: Differences and similarities between the community involvement approaches used in Village A and Village B

	Village A	*Village B*
Similarities	• In both projects, there was an initial meeting to introduce the project to community members • Both projects made use of local labor • Peer education on Health and Hygiene was conducted by Village Health Workers • The Community was regarded as the main beneficiary of the process of involving community members	
Differences	• Limited political influence as the Ward Councilor and Committee has limited control and involvement in the project • The implementing agent has continuous contact with the community throughout the project. The implementing agent also organized community meetings throughout the duration of the project, as a means to provide feedback to the community and address comments/concerns • Process of involving the community facilitated a constant 2-way communication between the community and the implementing agent • User education on the latrine was provided • An opportunity was given to the users to select certain latrine specifications (i.e. whether or not they wanted the pit to be lined with concrete) • Collaborative decision-making • Community governance promoted • Shared responsibility between the stakeholders • **Community Engagement methods** • Latrine recipient selection process: The Project Steering	• Ward Councilor and Committee were involved as decision-makers throughout the project process • Only two community meetings were held throughout the entire project process • The Project Steering Committee organized and coordinated the community meetings • Purpose of the community meetings was mainly to inform the community on certain project details, recruit project workers and compile a list of project beneficiaries. Community members were provided with little/no opportunities to raise concerns • Limited communication between the community and implementing agent • Implementing agent was also considered as a beneficiary of the process of involving the community • Community governance and involvement in the decision-making process was limited

	Village A	*Village B*
	Committee compiled a list of latrine recipients based on the sanitation needs in the community. The list was verified by the implementing agent in order to ensure that the beneficiary selection was a fair and correct representation of the sanitation needs in the village.	• Public participation methods • Latrine recipient selection process: The Project Steering Committee, Ward Councilor and Committee compiled a list of latrine recipients based on the sanitation needs in the community. Some people were also given an opportunity to sign up as potential recipients although it was the sole responsibility of the Project Steering Committee to select recipients.

5.3 Linking Sustainability to Methods used to Involve Community Members

The long-term sustainability of a VIP latrine is largely dependent on the latrine users. Though the construction element of the latrine is key, it is somewhat redundant to construct a robust latrine, which does not result in health and hygiene improvement. But a sanitation system can only remain robust if it is well operated and maintained. In the Village A sanitation project, the latrines were found to be more sustainable than the latrines in Village B, with a difference of 0.38 in the ICSD. The high values of the socio-cultural, and health and hygiene dimensions indicate that the community engagement and knowledge-sharing methods used in the Village A sanitation project had a significant effect on the overall long-term sustainability of the latrines. The difference in the methods used to involve community members in the two villages is that the methods used in Village B were predominantly public participation methods, whereas the sanitation project in Village A predominantly made use of community engagement methods and principles in the involvement of the community.

The positive user perception of the latrines in the Village A project can be attributed to the emphasis on creating user ownership of the latrine, community governance in the project and the constant knowledge and information-sharing throughout the project. The user perception indicator was considered as the most important socio-cultural indicator as the user's view of the latrine can greatly affect the effort they put into ensuring its sustainability. The user satisfaction with the latrine (measured as a percentage) and whether or not the users considered the latrine as a permanent solution to their sanitation problem, were used to measure the user perception indicator. In Village A, the combination of user satisfaction with the latrine and whether or not users considered their latrines as a permanent solution, was more than double that of Village B (40% in Village B and 82.6% in Village A). The frequent community meetings in Village B, attended by the project steering committee, implementing agent and community members, enabled the implementing agent to explain the constraints within which the latrines were being provided, explain the benefits of the VIP latrine and hence address the stigma towards the VIP latrine. Similarly to the Community Led Total Sanitation projects, the effective engagement of and communication with community members in sanitation projects, also encourages them to ensure that their communities remain Open Defecation-Free, and the proper operation and maintenance of the latrines. In addition, the education of community members (done by the VHW's) about the O/M requirements of the latrine and the health and hygiene practices associated with the latrine also contributed to the overall sustainability of the latrine.

Although both sanitation projects utilized user education through VHW's, the sanitation project in Village B facilitated minimal communication between the implementing agent and the community. As a result, the success of the project in addressing the negative user perceptions and hence ensuring long-term sustainability of the latrine was limited. Community members were not given a sufficient platform to have their questions and concerns addressed. As a result, the establishment of a sense of ownership amongst users has been limited, and many regard the VIP latrines constructed for them as a temporary solution to their sanitation problem. It is important to note, however, that the users' consideration of the latrine as a permanent solution to their sanitation problem is also a

function of the rate at which the pit is filling up and the overall state of the latrine. Both these factors can be attributed to the construction of the latrines (and therefore the knowledge and skills transfer during the training of construction labourers) and the O/M education given to users, as it seems that some latrine users in Village B were not fully aware of the correct O/M methods for their latrines. The inadequately maintained latrines have in turn resulted in some latrine beneficiaries resorting to defecating in the bush as the VIP latrine had become unpleasant to use. Both public participation and community engagement therefore have a domino-effect on the sustainability of the latrines. The methods used to involve community members have a significant effect on the health and hygiene and socio-cultural dimensions of sustainability, a moderate to significant effect on the technology and maintenance dimension, and a minor effect on the economy and finance dimension (although the methods used to involve community members can enhance the latrine users' willingness to pay for latrine O/M, this is largely dependent on the financial state of the household).

6. Conclusion

The aim of this study was to assess how knowledge transfer through either community engagement or public participation supported the sustainability of VIP latrines, and addressed the negative perceptions on the VIP latrine. In South Africa, sanitation backlogs remain prevalent. The South African government faces the challenge of addressing the sanitation backlog whilst protecting the scarce natural resource of water. Some sanitation projects therefore have to make use of dry sanitation in order to address the sanitation backlog. The most commonly used dry sanitation system in South Africa is the Ventilated Improved Pit latrine, which is also the legislated basic minimum acceptable level of sanitation in South Africa. Although the VIP latrine has been found to be robust and an appropriate solution to the sanitation problem in South Africa, there is a stigma that the VIP latrine has acquired. Some sanitation projects utilizing the VIP latrine have been unsuccessful as a result of issues including poor construction and lack of community buy-in. Community buy-in in a sanitation project has shown to be key for the overall sustainability of the latrine. Effective knowledge transfer through community engagement rather than public participation was shown to increase the success of sanitation projects.

6.1 Knowledge transfer Through Public Participation and Community Engagement in VIP latrine Sanitation Projects

By definition, knowledge transfer is a unidirectional communication of knowledge. In projects involving the introduction of new technological innovations, however, the transfer of knowledge whether through public participation or community engagement, should facilitate a two-way exchange of information throughout the project in order to ensure the success of the project. Both the project facilitators and latrine recipients are knowledge holders and knowledge recipients. In Village A, knowledge transfer process through the use of community engagement facilitated a two-way exchange of information throughout the project. The implementing agent adopted community engagement principles and practices in order to involve the community and facilitate the transfer of knowledge. Throughout the project, meetings were held between the implementing agent, community

members and the Project Steering Committee. During these meetings, the implementing agent presented a progress report, addressed concerns that arose and when necessary, appointed community members to work on the construction of the latrines or as Village Health Workers who educated latrine users on the health and hygiene, and O/M requirements of the latrines. The community meetings were organized and coordinated by the Project Steering committee, which consisted of some ward committee members and members of the community thus minimizing political influence which can limit the opportunities that some community members have to raise their concerns. Community members shared knowledge on the most ideal place to construct the latrines in their yards as they had knowledge on the exact location of the groundwater and rocks. The Department of Health, Bushbuckridge Local Municipality, Ward committee and Ward councillor also shared knowledge and information that was key for the success of the project.

The CSH framework proved to be useful in the identification of who was and who ought to be the key stakeholders in the project. Additionally, it provided insight into other sources of influence (such as resources, purpose, measure of success etc.) that not only define the practices adopted for the involvement of community members in sanitation projects, but affect the overall sustainability of VIP latrines as well. The main beneficiary of the community engagement process was the community. The purpose of the process was to bring clarity to community members on the project details, involve community members in the decision-making and implementation processes of the project and hence create community ownership of the latrines which is believed to ensure the long-term sustainability thereof. The stakeholder considered as the beneficiary, and the guiding purpose of the community engagement process, are key factors as they define the focus of the process.

6.2 User Perceptions on the VIP Latrines

The user perception indicator was considered as the most important socio-cultural indicator as the user's view of the latrine can greatly affect the effort they put into ensuring its sustainability. The indicator was measured based on whether or not people considered their latrines as a permanent solution to their sanitation problem. The user perception of the

latrine is thus a function of many factors that affect whether or not latrine users consider the latrines as a permanent solution to their sanitation problem. These include the other three sustainability dimensions namely: technology and operation, economy and finance, and health and hygiene.

Methods used to involve the community and the knowledge shared with the community about the latrines can affect user perception of the latrine in a positive or negative manner. The user perception of the VIP latrines was much higher in Village A than in Village B; with 82.6% and 40% of latrine users in Village A and Village B respectively indicating that they considered the VIP latrines as a permanent solution to their sanitation problem. Knowledge transfer through community engagement proved to be successful in addressing the negative pre-conceptions that community members may have had of the VIP latrines (e.g. the VIP latrine being a poor man's solution to the VIP latrine). Additionally, knowledge transfer through community engagement is also efficient in addressing the other factors that can affect user perceptions. This was evident in the results of the study which indicate that the latrines that were generally better maintained and resulted in a greater improvement in the health and hygiene practices in the community (i.e. latrines in Village A), were perceived in a more positive light by their users. The positive user perception in Village A is in agreement with Kathy Eales (2004), as the VIP latrine became an acceptable form of sanitation for community members in Village A, predominantly as a result of the involvement of the community in the planning and decision-making process, and constant engagement with community representatives. The constant engagement with the community proved to increase community buy-in to the project and the VIP latrines.

6.3 Effect of Public Participation and Community Engagement on VIP Latrine Sustainability

The composite sustainable development index for Village A was calculated as 0.93 and 0.55 for Village B. The VIP latrines were therefore more sustainable than those in Village B, with a difference of 0.38 in the ICSD values. The sustainability dimensions that contributed significantly to the difference in the ICSD values of both villages were the

socio-cultural aspects, and health and hygiene dimensions. The high values of the socio-cultural, and health and hygiene dimensions indicate that the community engagement and knowledge-sharing methods used in the Village A sanitation project had a significant effect on the overall long-term sustainability of the latrines; as the two dimensions have to do with addressing perceptions, cultural practices and behavioural change. Such changes amongst community members not only depend on the infrastructure that is constructed, but on the transfer of knowledge on the infrastructure, and practices associated with it as well. The sanitation project in Village A placed emphasis on creating ownership (and hence addressing negative perceptions on the VIP latrines) of the latrines, health and hygiene improvement, user education and the promotion of community governance throughout the sanitation project. The frequent community meetings facilitated constant knowledge transfer which proved to be beneficial. Additionally, the meetings facilitated constant communication between stakeholders in the project, and provided the community members the ability to hold the Project Steering Committee and the Implementing Agent accountable. Constant communication between all stakeholders in the project was encouraged, the beneficiary selection process was open and fair, and the entire project process facilitated collaborative decision-making and promoted community governance. The sanitation project in Village B placed emphasis on creating a sense of ownership of the latrines, health and hygiene improvement, and employment creation in the community. Unfortunately the infrequent community meetings throughout the project, lack of accountability, limited community governance and involvement of the community in the decision-making process failed to create and enhance community ownership of the latrines, resulting in a minimal positive contribution (with respect to Village B) in the socio-cultural aspects, and health and hygiene sustainability dimensions. The public participation process left some community members in Village B displeased with the entire sanitation project and the latrines as a whole. There is thus a strong relationship between the sustainability of the latrines and the methods used to involve the community throughout the project. Projects where community engagement and constant knowledge transfer are highly emphasized are more sustainable.

Involving communities in sanitation projects can deepen democracy, ensure the transfer of knowledge and skills to community members, and enhance the sustainability of sanitation systems. Additionally, it gives project coordinators the ability to implement successful sanitation projects within the resource constraints. It is possible for latrine users to take ownership of their latrines, ensure latrine sustainability and understand that sanitation is about dignity, not flushing.

7. Recommendations

Based on the study results, the following recommendations for policy, practice and further study are made:

1. Community engagement must not be limited to the mere information of community members about the project, and recruitment of community members. Communities must be fully involved in the project, including involvement in some decision-making processes. The involvement of the community in sanitation projects should therefore not be limited to public participation methods and mechanisms but should extend further to incorporate community engagement principles and practices.
2. Knowledge transfer throughout the project process and a constant dialogue between all stakeholders in sanitation projects, must be emphasized. All stakeholders should be given an opportunity to share knowledge and information.
3. Although the community may not be fully involved in the decision-making process in some projects as the decision for the type of latrine that will be constructed may be made prior to the engagement of the community, it is important to involve all stakeholders in the other (and perhaps smaller) decisions to be made in the duration of the project. This also helps community members accept the decisions that have already been made by the municipal authorities, project managers and funding agencies.
4. Although it is important to involve key leaders in the community such as the ward councilor and committee members, political influences should be minimized. The organizing and coordinating of mass community meetings in relation to the project should not be the sole responsibility of key political leaders only as this can hinder the extent to which important knowledge about either the project or the latrines themselves, is shared with the community. Also, political influence has the potential of limiting the opportunities that community members have to raise their concerns or questions about the project and/or latrines.
5. Latrine users must be adequately informed about the latrine Operation and Maintenance requirements, which are relevant to their socio-cultural and economic

contexts. This includes sharing information on the emptying of the pit once it is full.

6. Institutional capacity must be created within municipalities in order to enable municipal officials to coordinate sanitation projects in a manner that will emphasize effective knowledge transfer through the use of effective community engagement and public participation methods within the financial and human resource constraints of the municipality.
7. Based on the CSH analysis in this study, a checklist for VIP latrine sanitation projects can be drafted. The checklist will serve as a guideline for public participation and community engagement principles and practices that are significant for ensuring long-term sustainability of VIP latrines.
8. The findings on the methods used to involve the community and knowledge transfer methods and principles in this study can be used to inform future projects that will make use other dry sanitation systems particularly in the South African rural context.
9. For further study, case studies or more villages could be done in order to get a deeper insight into the use of community engagement and public participation in the provision of sustainable VIP latrine sanitation. Additionally, the research methodology used in this research could be used to assess the effect of various other methods of involving the community on the sustainability of both wet and dry sanitations systems.

8. References

AUSTIN, L and VAN VUUREN, S. 2001. Sanitation, public health and the environment: looking beyond current technologies: technical paper. *Journal of the South African Institution of Civil Engineering*. 29-33.

AUSTIN, L, DUNCKER, LC, MATSEBE, GN, PHASHA, MC and CLOETE, TE. 2005. Ecological Sanitation- Literature Review. Republic of South Africa: Water Research Commission. Available: www.wrc.org (Accessed: 7 March 2014)

BERTRAM [2015] *Amalooloo Brochure*. Online brochure. Available: www.amalooloo.com/Downloads (Accessed 9 April 2015)

BEVAN, J AND HICKLING, S. Scaling up CLTS in sub-Saharan Africa. In: *Participatory Learning and Action 61*. Ashley, H; Kenton, N and Milligan,A, eds. London: Park Communications Ltd: 51-62.

BRACKEN, P, KVARNSTRÖM, E, YSUNZA, A, KÄRRMAN, E, FINNSON, A and SAYWELL, D. 2005. Making sustainable choices–the development and use of sustainability oriented criteria in sanitary decision-making. *Third International Conference on Ecological Sanitation (EcoSan): Proceedings*.

(BLM) BUSHBUCKRIDGE LOCAL MUNICIPALITY. 2013. *Bushbuckridge Local Municipality Final Integrated Development Plan 2013/2014*. Available: http://www.bushbuckridge.gov.za/Publications (Accessed: 30 September 2013)

(BLM) BUSHBUCKRIDGE LOCAL MUNICIPALITY. 2015. *Bushbuckridge Local Municipality Final Integrated Development Plan 2015/2016*. Available: http://www.bushbuckridge.gov.za/Publications (Accessed: 29 August 2015)

BUCCUS, I, HEMSON, D, HICKS, J and PIPER, L. 2007. *Public Participation and Local Governance*. Durban, South Africa: Centre for Public Participation.

BURUANMKAEW, K. 2012. *How to do AHP analysis in Excel*. University of Tsukuba: Graduate School of Life and Environmental Sciences. Available: www.researchgate.net (Accessed: 16 May 2016)

(CDC) CENTERS FOR DISEASE CONTROL AND PREVENTION. 2011. *Principles of Community Engagement*. 2nd ed. (Online) Available: http://www.atsdr.cdc.gov/communityengagement/pdf/PCE_Report_508_FINAL.pdf (Accessed: 4 September 2014)

(CSIR) COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH: BUILDING AND CONSTRUCTION TECHNOLOGY. 2000. *Human Settlement Planning and Design*. Vol 2. Pretoria, South Africa: Capture Press.

(DHS) DEPARTMENT OF HUMAN SETTLEMENTS. 2011. *Rural Household Infrastructure Programme (RHIP)*. (Online) Available: www.dhs.gov.za (Accessed: 21 October 2013)

(DLG) DEPARTMENT OF LOCAL GOVERNMENT. 1998. *Municipal Structures Act 117 of 1998*. Pretoria, South Africa: Government Printers.

(DLG) DEPARTMENT OF LOCAL GOVERNMENT. 2000. *Municipal Systems Act 32 of 2000*. Pretoria, South Africa: Government Printers.

(DPLG) DEPARTMENT OF PROVINCIAL AND LOCAL GOVERNMENT. n.d. *The Municipal Infrastructure Grant 2004-2007 From programme to projects to sustainable services*. Republic of South Africa: DPLG. Available: www.cogta.gov.za (Accessed: 25 August 2015)

(DPLG) DEPARTMENT OF PROVINCIAL AND LOCAL GOVERNMENT. 2005. *Draft National Policy Framework for Public Participation*. Pretoria, South Africa: Government Printers.

(DPLG) DEPARTMENT OF PROVINCIAL AND LOCAL GOVERNMENT. 2007. *National Policy Framework for Public Participation*. Pretoria, South Africa: Government Printers.

DUNGUMARO, EW and MADULU NF. 2003. *Public Participation in Integrated Water Resources Management: the case of Tanzania*. In: Physics and Chemistry of the Earth. Pp. 1009-1014

(DWA) DEPARTMENT OF WATER AFFAIRS. 2011. *2011 Green Drop Report*. Republic of South Africa. Available: www.dwa.gov.za/Documents/GD/GDIntro.pdf Accessed: 19 November 2015

(DWAF) DEPARTMENT OF WATER AFFAIRS AND FORESTRY. 1996. *National Sanitation Policy*. Republic of South Africa: DWAF.

(DWAF) DEPARTMENT OF WATER AFFAIRS AND FORESTRY. 2001. *The White Paper on Basic Household Sanitation*. Republic of South Africa: DWAF.

(DWAF) DEPARTMENT OF WATER AFFAIRS AND FORESTRY. 2002. *Framework for a National Sanitation Strategy: Bringing Sanitation up to Speed*. Republic of South Africa. Available: www.dwa.gov.za (Accessed: 7 August 2013)

(DWAF) DEPARTMENT OF WATER AFFAIRS AND FORESTRY. 2012. *Report on the Status of sanitation services in South Africa.* Republic of South Africa. Available: https://www.info.gov.za (Accessed: 12 August 2013)

(DWS) DEPARTMENT OF WATER AND SANITATION. 2016. *Draft National Sanitation Policy.* Government Gazette, 12 February 2016 (Regulation Gazette No. 39688)

(DWAF) DEPARTMENT OF WATER AFFAIRS AND FORESTRY. n.d. *Sanitation Technology Options.* Republic of South Africa: Department of Water Affairs and Forestry.

EALES, K. 2004. *Innovation Insights 2.* Centre for Public Service Innovation. Pretoria, South Africa: Centre for Public Service Innovation. Available: http://unpan1.un.org/intradoc/groups/public/document/CPSI/UNPAN019299.pdf (Accessed: 4 March 2014).

FOURIE, AB and VAN RYNEVELD, MB. 1993. *Environmental impact of on-site sanitation: A literature review with particular application to South Africa.* Republic of South Africa: Water Research Commission. Available: www.wrc.co.za (Accessed: 9 March 2014)

GOMEZ, JD and NAKAT, AC. 2009. *Community Participation in Water and Sanitation.* In: Water International, 27:3. pp 343-353.

KLU. n.d. *Lessons from the Rural Household Infrastructure Programme.* (Online) Available: www.mvula.co.za Republic of South Africa: The Mvula Trust. (Accessed: 8 July 2013)

KRAJNC, D and GLAVIČ, P. 2005. *A model for integrated assessment of sustainable development. Resources, Conservation and Recycling.* 189-208.

LAGARDIEN, A, COUSINS, D, SABELA-RIKHOTSO, P and NGAYE, N. 2013. *Applicability of Community-Led Total Sanitation in South Africa: A case-study experience of opportunities and challenges.* Republic of South Africa: Water Research Commission. Available: www.wrc.org.za (Accessed: 21 February 2014)

MAKHUBELA, DC. 2015. *Interview with Ms Dorcas Makhubela, Project Coordinator, on 28 April 2015, Nelspruit.*

MAKHUBELA, DC. 2016. *Email correspondence with Ms Dorcas Makhubela, Project Coordinator, on 5 February 2016.*

MOKOENA, M. 2015. *Interview with Mr M Mokoena, Technical Director on 29 April 2015, Bushbuckridge.*

MOKONYANE, N. 2015a. *Address by the Minister of Water and Sanitation, Ms. Nomvula Mokonyane, National Council of Provinces Budget Review- Parliament 10 June 2014.* Republic of South Africa: Department of Water and Sanitation. Available: https://www.dwa.gov.za/Documents (Accessed: 2 July 2015)

MOKONYANE, N. 2015b. *Closing Remarks by Ms. Nomvula Mokonyane, Minister of Water and Sanitation at the Sanitation Indaba held at Enkosi Albert Luthuli in Durban, Kwa-Zulu Natal.* Republic of South Africa: Department of Water and Sanitation. Available: https://www.dwa.gov.za/Documents (Accessed: 2 July 2015)

MURPHY, HM; MCBEAN, EA; FARAHBAKHSH, K. 2009. *Appropriate Technology- A Comprehensive Approach for Water and Sanitation in the Developing World."* Guelph, Canada: University of Guelph.

OWEN, D. 2011. *Knowledge Transfer-a non-academic perspective.* Available: https://www.surrey.ac.uk (Accessed: 28 January 2016)

PAULIN, D and SUNESON, K. 2012. *Knowledge Transfer, Knowledge Sharing and Knowledge Barriers- Three Blurry Terms in KM.* Gothenburg, Sweden: Department of Management and Economics, Chalmers University of Technology.

PEREZ, W. 2012. *Millennium Development Goals in Nicaragua- Analysing progress, social inequalities, and community actions.* PhD Thesis. Uppsala University, Sweden.

PUBLIC SERVICE COMMISSION. 2008. *Report on the Assessment of Public Participation Practices in the Public Service.* Pretoria, Republic of South Africa: The Public Service Commission.

RALL, M. 2001. Partnerships for Sustainability: The Mvula Trust Experience. (Online) Available: www.mvula.co.za (Accessed: 24 February 2014).

ROSEMARIN, A; EKANE, N; CALDWELL, L; KVANSTRÖM, E; MCCONVILLE, J; RUBEN, C & FOGDE, M. 2008. *Pathways for Sustainable Sanitation: Achieving the Millennium Development Goals.* Sweden: Stockholm.

(RSA) REPUBLIC OF SOUTH AFRICA. 1996. *Constitution of the Republic of South Africa.* Act 108 of 1996. Pretoria, South Africa: Government Printers.

(RSA) REPUBLIC OF SOUTH AFRICA. 1998. *The White Paper on Local Government.* Pretoria, South Africa: Government Printers.

REYNOLDS, M. 2007. *Evaluation Based on Critical Systems Heuristics.* Point Reyes California, United States of America: EdgePress. 101-122.

ROSEMARIN, A; EKANE, N; KVANSTROM, E; MCCONVILLE, J; RUBEN, C and FOGDE, M. 2008. *Pathways for Sustainable Sanitation: Achieving the Millennium Development Goals.* Report published in Stockholm

(SAICE) SOUTH AFRICAN INSTITUTE OF CIVIL ENGINEERS. 2011. *SAICE Infrastructure Report card for South Africa 2011.* (Online) Available: http://www.saice.org.za (Accessed: 19 July 2013)

(SAHRC) SOUTH AFRICAN HUMAN RIGHTS COMMISSION. 2014. *Report on the Right to Access Sufficient Water and Decent Sanitation in South Africa: 2014*. Republic of South Africa: SAHRC. Available: http://www.sahrc.co.za (Accessed: 8 June 2014)

SANAN, D AND MOULIK, SG. 2007. *Community-Led Total Sanitation in Rural Areas: An Approach that Works.* New Delhi, India: Water and Sanitation Programme South Asia.

SCOTT, R. 2009. An analysis of public participation in the South African legislative sector. Master of Public Administration Thesis. University of Stellenbosch, Stellenbosch, Republic of South Africa.

SELEMAN, A. 2012. *Assessing Sustainability of Sanitation Technologies Recommended for Rural Settings: A Case Study of Morogoro District, Tanzania.* Master of Science Thesis. Florida International University, Miami, Florida. Available: http://digitalcommons.fiu/edu/etd/690 (Accessed: 17 March 2015)

SMITH, G. 2009. *Democratic Innovations: Designing Institutions for Citizen Participation.* Cambridge, United Kingdom: Cambridge University Press.

(STATSSA) STATISTICS SOUTH AFRICA. 2011. *Census 2011.* Republic of South Africa: STATSSA. Available: http://www.statssa.gov.za/publications (Accessed 2 September 2015)

(STATSSA) STATISTICS SOUTH AFRICA. 2015. *Work and Labour Force Statistics.* Available: http://www.statssa.gov.za/?page_id=737&id=1 (Accessed: 19 August 2015)

(STATSSA) STATISTICS SOUTH AFRICA. 2014. *General Household Survey 2013.* Available: www.statssa.gov.za/publications (Accessed: 18 July 2015).

(STATSSA) STATISTICS SOUTH AFRICA. 2013. *Millennium Development Goals Country Report 2013.* Available: www.statssa.gov.za/wp-content/uploads/2013/10/MDG_Octorber-2013.pdf (Accessed: 16 May 2016)

(SuSanA) SUSTAINABLE SANITATION ALLIANCE. 2007. *Towards more sustainable sanitation solutions.* Available: www.susana.org (Accessed: 19 September 2013).

THERON, F; CEASER, N and DAVIDS, I. 2007. *Participation According to IAP2 Principles: Opportunity or Challenge for Integrated Development Planning in South Africa?* (Online) Available: http://www.iap2.org/associations/4748/files/Journal_Isuue1_IDP.doc.pdf (Accessed: 3 September 2015)

TISSINGTON, K. 2011. *Socio-economic Rights Institute of South Africa: Basic Sanitation in South Africa: A Guide to Legislation, Policy and Practice.* Available: http://www.escr-net.org/sites/default/files/SERI%20Guide%20on%20Basic%20Sanitation%20SA.pdf (Accessed: 8 June 2013)

(UN) UNITED NATIONS. 2016. *Sustainable Development Goals* (Online). Available: www.un.org/sustainabledevelopment/sustaianble-development-goals/ (Accessed: 16 May 2016)

(UN) UNITED NATIONS. 2015. *The Millennium Development Goals Report 2015*. New York, United States of America: UN (Online) Available: www.un.org (Accessed: 16 May 2016)

(UNDP) UNITED NATIONS DEVELOPMENT PROGRAMME. *Post-2015 A New Sustainable Development Agenda.* Online article. Available: http://www.undp.org/content/undp/en/home/mdgoverview.html (Accessed: 5 July 2015)

ULRICH, W and REYNOLDS, M, 2010. Critical Systems Heuristics. In: *Systems Approaches to Managing Change: A Practical Guide.* M. Reynolds and S. Holwell eds. London: Springer: 243-292.

VENABLE, JR. 2009. *Identifying and addressing stakeholder interests in design science research: An analysis using critical systems heuristics.* In: Information Systems-Creativity and Innovation in Small and Medium-Sized Enterprises. 93-112

VISSER, W. 2004. *"Shifting RDP into GEAR." The ANC Government's Dilemma in Providing and Equitable System of Social Security for the "New" South Africa.* Paper presented at the 40th ITH Linzer Konferenz, 17 September 2004.

(WHO) World Health Organization. 1997. *Participatory Hygiene and Sanitation Transformation: A new approach to working with communities.* Geneva, Switzerland: World Health Organization.

(WHO) World Health Organization 2011. *10 Facts on Sanitation.* Available: http://www.who.int/features/factfiles/sanitation/facts/en/ (Accessed: 30 May 2014).

(WHO and UNICEF) World Health Organization and United Nations Children's Fund. 2006. *Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade.* Geneva, Switzerland: WHO Press.

(WHO and UNICEF) World Health Organization and United Nations Children's Fund. 2014. *Progress on Drinking Water and Sanitation 2014 update.* Geneva, Switzerland: WHO (Online) Available: www.unicef.org (Accessed: 5 July 2015)

(WHO and UNICEF) World Health Organization and United Nations Children's Fund. 2015. *Progress on Sanitation and Drinking Water- 2015 Update and MDG Assessment.* Geneva, Switzerland: WHO Press.

ZHWAWAKINYU, M. 2012. *Water 2012: A review of South Africa's water sector.* Pretoria, South Africa: Cramer Media (Pty) Ltd.

Appendix A: Informed Consent Form

Informed Consent Form: Bushbuckridge Local Municipality Sanitation Project

Consent for Participation in Interview Research

Introduction

This research investigates the possibility of promoting the provision of sustainable VIP sanitation through the use of effective knowledge transfer through public participation. As part of the project, we will investigate the various public participation methods used in two different VIP sanitation projects in the Bushbuckridge Local Municipality, and analyse the sustainability of each project. As part of the sustainability assessment, the Technology and Operation, Health and Hygiene, Socio-cultural and Economy and Finance aspects of the latrines will be analysed.

The interview process will take 30-45 minutes.

By signing this form, you are agreeing to the following:

1. I volunteer to participate in a research project conducted by Lulama Ngobeni from the University of Cape Town. I understand that the project is designed to gather information about VIP sanitation services and public participation methods in the Bushbuckridge Local Municipality.
2. My participation is voluntary. I understand that I will not be paid for my participation.
3. If I feel uncomfortable in any way during the interview session, I have the right to decline to answer any question or to end the interview.
4. Participation involves being interviewed and notes will be taken during the interview.
5. My response to the questions may be identifiable but will be confidential and used for the purposes of this research only.

6. I have read and understood the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.
7. I understand that this research has been reviewed and approved by the University of Cape Town Commerce Faculty Ethics in Research Committee.

Who to Contact

If you have any questions about the study or about your rights and treatment as research subjects, feel free to contact at any time:

Ms Lulama Ngobeni
Department of Information Systems
University of Cape Town
076 127 2570
Prof Ulrike Rivett

Department of Information Systems

University of Cape Town

021 650 5280

Certificate of Consent for Interview Participants

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked, have been answered to my satisfaction. I consent voluntarily to be a participant in this study and understand that I have the right to withdraw from the study at any time without in any way affecting my position in my organization.

_____ _____

My Signature Date

_____ _____

My printed Name Researcher's Signature

Appendix B: Household Questionnaire

ASSESSMENT OF PUBLIC PARTICIPATION IN SANITATION PROJECTS AND ITS ABILITY TO PROMOTE THE PROVISION OF SUSTAINABLE SANITATION

Household Questionnaire

1. Age:
2. Gender: Male/Female
3. Occupation:

    a) Full-time employment
    b) Part-time employment
    c) Self-employed
    d) Pensioner
    e) Student
    f) Unemployed
    g) Other (please specify)…….

4. Education level:

    a) No formal education
    b) Primary School
    c) Secondary School
    d) Tertiary
    e) Other (please specify)…….

5. Household size:

    Number of Adults (18 and older)……..
    Number of Children (3-17 years old) ……
    Number of infants (0-2 years old)……..

6. Total Income Level:
    a) None

b) R100-R1000
c) R1001-R2000
d) R2001-R3000
e) R3001-R4000
f) Over R4000

7. Do you have a toilet in your house?
8. Do you use the toilet?
9. If not, why don't you use the toilet?

Health and Hygiene related questions

10. Common waterborne diseases in your household:

Disease	Before Construction		After Construction	
	Yes	***No***	***Yes***	***No***
Malaria				
Cholera				
Dysentery				
Bilharzia				
Worms				

11. Is there a facility for you to wash your hands outside/inside the toilet? Yes/No
12. Were you given the necessary education on the health and hygiene practices associated with your toilet? Yes/No
13. Do you wash your hands after using the toilet?
14. Do you/your family members use the bush/any area other than the latrine to defecate?
15. Where do you access water from?
16. Is the water that you use clean?
17. If not, do you boil it/add bleach to it in order to purify it?
18. Is there a pedestal and seat on your toilet?
19. How often do you clean your toilet pedestal?

Everyday
Once a week
Every two weeks
Once a month
Other (please specify)

Technology and Operation questions

20. Have you been educated on the correct operation and maintenance of the toilet?
21. Do you know how to clean the ventilation pipe?
22. How often do you clean the ventilation pipe?
23. Are you able to cover the cost of correctly operating and maintaining the toilet? (This includes the cost of toilet paper, cleaning material and the toilet hand washing facility)
24. Who built your toilet? (i.e. are the builders residents of the local community)
25. Does your pit overflow when it rains?

Economy and Finance questions

26. Did you pay for the construction of your toilet?
27. If you did, how much did you pay?
28. Were you informed about the cost of emptying the pit once it is full?
29. Will you be able or willing to pay for the cost of emptying (or is that the responsibility of the municipality)?

Socio-cultural questions

30. Is everyone in the household able to use the latrine?
31. Are you satisfied with the latrine? (Percentage scale)
32. Can you consider it as a permanent solution to the sanitation problem? (or would you prefer a different toilet in the future)
33. Where is the latrine located? Is it located ideally?
34. Does the latrine ensure privacy for anyone who is using it?
35. Is there a constant bad odor that comes from the latrine?
36. Are there any flies, cockroaches or any other insects in the latrine?

Appendix C: Community Focus Group Questionnaire

Bushbuckridge Local Municipality

Critical Systems Heuristics Analysis of Public Participation in VIP latrine Sanitation Projects

Introduction

Due to the democratic nature of South Africa, local municipalities not only have to provide basic services to communities, they have to do so in a manner that will create and encourage conditions for local communities to participate in the affairs of the local municipality. This is done through public participation. Public participation refers to the involvement of local communities in local governance, whether it is for the drafting of the IDP, project planning, project implementation or even decision making on certain issues.

Public participation can be done through various methods such as public meetings, ward committees and community-based planning. In the context of projects that are being implemented by the municipality, public participation can also include the use of local labor, involvement in decision-making and involvement in planning.

The following seeks to assess the public participation methods that were used in the provision of your VIP sanitation latrines. The questions asked will therefore be in the context of the project. You will also be expected to answer questions on the basis of how public participation should be done when considering a sanitation project of that nature.

Background Questions

- Was Public participation done in the provision of your VIP latrines?
- If so, how was the public participation done?
- Were you satisfied with the manner in which the public participation was done?

CSH Questions for the Community

1. Who was the public participation done for? When it was implemented, who were the main people it was intended to serve?
2. Who should public participation be done for? Who are the main people that it should be intended for?
3. In the context of sanitation projects, what is the purpose of the public participation process? For example, is it for the sake of informing you about the project, educate you on the VIP latrines or involve you in some aspects of the decision making?
4. What should the purpose of public participation in in sanitation projects be?
5. How does one determine/decide that the public participation process has been successful? What serves as evidence that the process has fulfilled its intended purpose or was successful?
6. How should one determine/decide that the public participation process has been successful? What should be evidence that the public participation process has been successful? (For example, is it the number of people attending the meetings, level of community involvement in the project, user acceptance of the latrine etc.)
7. Who is the decision-maker in the public participation process for the sanitation projects? Who decided how and when the process was done? Who made the major decisions in the sanitation project?
8. Who should be the decision-maker in the public participation for the sanitation projects? Who should decide how and when the process should be done? Who should make the major decisions in the sanitation projects?
9. What resources did the decision-maker control? How much power did the decision-maker have in the public participation process and the sanitation project process?
10. What resources should the decision-maker control? How much power should the decision-maker have in the public participation process and the sanitation project planning process? *This looks at the public participation frequency and methods, human resource aspects, finances and project management
11. What did the decision-maker not control?
12. What shouldn't the decision maker control in the public participation process and the decision-making process throughout the sanitation process?
13. Who was involved as a planner in the planning process of the sanitation project and the public participation process?
14. Who should be involved as a planner in the planning process of the sanitation project and the public participation process?
15. In the provision of the VIP latrines, who was involved in the project to provide knowledge? What knowledge or skills did each stakeholder be asked to provide?
16. Who should be involved in the project to provide knowledge? What knowledge or skills should each stakeholder be asked to provide?
17. For those not involved in the planning process or the public participation process, how did they see that the sanitation project plan was implemented? Who provided a guarantee that the plan was implemented?
18. For those involved in the planning process, how should they see that the sanitation project plan was implemented? Who should provide a guarantee that the plan will be implemented?
19. Who spoke on behalf of those affected by the provision of the toilets but were not involved in the actual project? This includes the young, old, handicapped etc. who was responsible for protecting the environment? [If the community was not given an opportunity to speak for themselves in the sanitation project planning and implementation process, who represented them?]
20. Who should speak on behalf of those who are affected by the provision of the latrines? Who was responsible for protecting the environment?
21. How were the views of those affected but cannot argue their views (children, old, handicapped, the environment) taken into consideration?

22. How should the views of those affected but cannot argue their views be taken into consideration?
23. What were the key things that the public participation process and the sanitation project sought to improve? What is the main purpose of the public participation process?
24. What are the key things that the public participation process and the sanitation project seek to improve? What should the main purpose, that the public participation process seeks to serve, be?

Appendix D: Implementing Agent Interview Questions

Project Overview

1. Is there a sanitation backlog in the Bushbuckridge Local Municipality
2. If so, what is the extent of the backlog?
3. What type of sanitation system (toilet) has the Bushbuckridge Local Municipality decided to build in order to address the backlog efficiently and effectively?
4. What is the reason behind the choice of the sanitation system?
5. When was the sanitation project in question implemented?
6. Please provide a brief overview of the project (Who was the service provider, project manager, contractor etc. How many toilets were constructed in the Village B area as part of the project)
7. Was local labor used in the project? (Please elaborate)
8. Can local labor be used in such projects?
9. How was the community involved in the project?
10. What was the purpose of involving the community in the project?
11. Was the material used for construction sourced locally? If not, is it available locally?
12. What is the expected lifespan of the toilets?
13. Who is responsible for the emptying of pits when they are full?
14. Will the municipality or the community members bear the cost of emptying the pits?
15. What was the total cost of the construction of the toilets?

CSH Questions

1. Who was the public participation done for? When it was implemented, who were the main people it was intended to serve?
2. Who should public participation be done for? Who are the main people that it should be intended for?
3. In the context of sanitation projects, what is the purpose of the public participation process (in terms of the actual consequences and results)? For example, is it for the sake of informing you about the project, educate you on the VIP latrines or involve you in some aspects of the decision making?
4. What should the purpose of public participation in in sanitation projects be?
5. How did you determine/decide that the public participation process has been successful? What serves as evidence that the process has fulfilled its intended purpose or was successful?
6. How should one determine/decide that the public participation process has been successful? What should be evidence that the public participation process has been successful and fulfilled its intended purpose? (For example, is it the number of people attending the meetings, level of community involvement in the project, user acceptance of the latrine etc.)
7. Who is the decision-maker in the public participation process for the sanitation projects? Who decided how and when the process was done? Who made the major decisions in the sanitation project?

8. Who should be the decision-maker in the public participation for the sanitation projects? Who should decide how and when the process should be done? Who should make the major decisions in the sanitation projects?
9. What resources did the decision-maker control? How much power did the decision-maker have in the public participation process and the sanitation project process?
10. What resources should the decision-maker control? How much power should the decision-maker have in the public participation process and the sanitation project planning process?
    *This looks at the public participation frequency and methods, human resource aspects, finances and project management
11. What did the decision-maker not control?
12. What shouldn't the decision maker control in the public participation process and the decision-making process throughout the sanitation process?
13. Who was involved as a planner in the various stages of the planning process of the sanitation project and the public participation process?
14. Who should be involved as a planner in the planning process of the sanitation project and the public participation process?
15. In the provision of the VIP latrines, who was involved in the project to provide knowledge? What knowledge or skills did each stakeholder be asked to provide?
    *Whether in terms of the contractor, the health workers, municipal officials or ward councillors and the public.
    *This goes beyond someone to show how toilets will be built/used but for example, is there indigenous knowledge that is within the community that can contribute towards the overall success of the project?
16. Who should be involved in the project to provide knowledge? What knowledge or skills should each stakeholder be asked to provide?
17. For those not involved in the planning process or the public participation process, how did they see that the sanitation project plan was implemented? Who provided a guarantee that the plan was implemented?
18. For those involved in the planning process, how should they see that the sanitation project plan was implemented? Who should provide a guarantee that the plan will be implemented?
19. Who spoke on behalf of those affected by the provision of the toilets but were not involved in the actual project? This includes the young, old, handicapped etc. who was responsible for protecting the environment? [If the community was not given an opportunity to speak for themselves in the sanitation project planning and implementation process, who represented them?]
20. Who should speak on behalf of those who are affected by the provision of the latrines? Who considered the environmental sustainability of the sanitation projects? Also, who considers the human rights aspect of the sanitation project?
21. How were the views of those affected but cannot argue their views (children, old, handicapped, the environment) taken into consideration? Were they given an opportunity to take their fate into their own hands and make their own decisions or do the experts decide what is right for them?
22. How should the views of those affected but cannot argue their views be taken into consideration?
23. What were the key things that the public participation process and the sanitation project sought to improve? What is the main purpose of the public participation process?
24. What are the key things that the public participation process and the sanitation project seek to improve? What should the main purpose, that the public participation process seek to serve, be?

Appendix E: Sustainable Sanitation Rubric Scales

Rubric scale for Health and Hygiene indicators

Indicators	Explanation	Description for rating	Unit
Improved health and hygiene practices	The extent to which the health and hygiene practices of the community have improved as a result of the latrines and associated health and hygiene education	Health and hygiene practices have not improved at all	0
		Health and hygiene practices have improved but there are still signs of practices that are unhygienic	1
		Health and Hygiene practices have improved completely	2
Risk of exposure to hazardous materials	User exposure to hazardous materials in/from the latrine	No exposure	2
		Partial exposure, which can be controlled	1
		Fully exposed to hazardous material	0

Rubric scale for Technology and Operation indicators

Indicators	Explanation	Description for rating	Unit
Operation and Maintenance	Are the householders able to operate and maintain the toilet? This includes cleaning of the ventilation pipe and pedestal	Users are unable to operate and maintain the latrine	0 (bad)
		Users are able to operate and maintain the latrine with limitations	1
		Users are able to adequately operate and maintain the latrine	2 (good)
Use of Local Labour	Was local labour available and used in the construction of the latrines?	Local labour was available and used for the construction of the latrines	1
		Local labour was unavailable and/or not used for the construction of the latrines	0
Vulnerability to water shortages	The extent to which the functionality of the latrine is affected by water shortages	Latrine is vulnerable to water shortages	0
		Latrine s not vulnerable to water shortages (does not need water in order to fully function)	1
Durability/Lifespan of the latrine	Expected lifespan of the latrine before the pit has to be emptied or a new latrine must be constructed	Expected lifespan is less than 5 years	1
		Expected lifespan is more than 5 years	2

*Perhaps there is a reason why the lifespan is less than 5 years so we can't give it a 0 and make it a completely bad thing. Also, a toilet with a short lifespan is better than not having a toilet at all

Rubric scale for Economy and Finance indicators

Indicators	Explanation	Description for rating	Unit
User ability to pay	Number of people able to pay for the operation and maintenance of the latrine	0-30% Able to pay for O/M of latrine	1
		31%-60% able to pay for O/M of latrine	2
		61%-100% able to pay for O/M of latrine	3
User willingness to pay	Number of people willing to pay for the Operation and maintenance of the latrine (Including the emptying of the pit once full)	0-25%	0
		25%-50%	1
		51%-75%	2
		75%-100%	3
Contribution to local development	Project contribution to the overall socio-economic development of the latrine	Latrine project did not contribute to any socio-economic development in the community	0
		Latrine project contributed to the socio-economic development in the community	1

Rubric scale for Socio-cultural indicators

Indicators	Explanation	Description for rating	Unit
Appropriateness to local cultural context	Appropriate to use and maintain by all members of the household regardless of age or gender	All members of the household can use the latrine	2
		Some members of the household can use the latrine	1
		None of the members of the household can use the latrine	0
Convenience	Latrine is convenient to use. Based on privacy, comfort and odour in toilet.	Latrine provides privacy, comfort and there is no bad odour	2
		Latrine provides privacy, comfort with limitations and there is a controllable bad odour	1
		Latrine doesn't provide privacy, comfort and there is a constant bad odour	0
User perception of the system	User satisfaction with the latrine	User satisfaction 81%-100	4
		User satisfaction 71&-80%	3
		User satisfaction 51%-70%	2
		User satisfaction 0%-50%	1

Appendix F: Computing ICSD

Village A

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
Improved health and hygiene practices	The extent to which the health and hygiene practices of the community have improved as a result of the latrines and associated health and hygiene education	Health and hygiene practices have improved completely: There is no one who has suffered from a waterborne disease ever since the construction of the latrines. Also, people wash their hands after using the bathroom and they longer go to the bush to relieve themselves.	(+)	2	1	0.5	0.5	0.1965	0.09825
Risk of exposure to hazardous materials	User exposure to hazardous materials in/from the latrine	No exposure: Latrine users are no not exposed to hazardous materials in the toilet when it rains, and the toilet does not overflow as a result of rain. There is a pedestal on the toilet which also prevents direct exposure.	(-)	2	1	0.5	0.5	0.1965	0.09825

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
						1	1	0.1965	0.1965

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Sub-index (Isi)	Weight of Index	Sustainability Index
Operation and Maintenance	Are the householders able to operate and maintain the toilet? This includes the proper cleaning of the ventilation pipe and pedestal	Users are able to operate and maintain the latrine with limitations: A lot of the users mentioned that they do not know how to clean the ventilation pipe. However, most of them clean their pedestals etc. regularly.	(+)	1.48	0.74	0.4	0.296	0.1492	0.0441632
Use of Local Labor	Was local labor available and used in the construction of the latrines?	Local labor was available and used for the construction of the latrines: Members of the community were appointed to construct the latrines	(+)	1	1	0.2	0.2	0.1492	0.02984

Indicators	Explanation	Description for rating	Impact	Valu e	Normalized Indicators	Weight of Indicator	Sustainability Sub-index (Isi)	Weight of Index	Sustainability Index
Vulnerability to water shortages	The extent to which the functionality of the latrine is affected by water shortages	Latrines are not vulnerable to water shortages: They do not need water in order to fully function: The latrine forms part of dry sanitation.	(-)	1	1	0.2	0.2	0.1492	0.02984
Durability/Lifesp an of the latrine	Expected lifespan of the latrine before the pit has to be emptied or a new latrine must be constructed	Expected lifespan is more than 5 years: The expected lifespan of the latrines is 5-10 years. However, this can decrease if the household is large	(+)	2	1	0.2	0.2	0.1492	0.02984
						1	0.896	0.1492	0.1336832

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
User ability to pay	Number of people able to pay for the operation and maintenance of the latrine	61%-100% able to pay for O/M of the latrine: 95.65% are able to pay for the correct O/M materials required	(+)	3	1	0.3	0.3	0.22088	0.066264
User willingness to pay	Number of people willing to pay for the Operation and Maintenance of the latrine (Including the emptying of the pit once full)	25%-50%: 43.48% are willing to pay for the emptying of the pit. The reluctance to pay is due to limited finances and people not being foretold about the cost implications of emptying the pit. People are, however, willing to pay for the digging of a new pit and the moving of the top structure as this is something that they can do themselves.	(+)	1	0.333333333	0.4	0.1333	0.22088	0.0.02945

Indicators	Explanation	Description for rating	Impact	Valu e	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
Contribution to local development	Project contribution to the overall socio-economic development of the community	Latrine project contributed to the socio-economic development in the community: community members were employed in the project and given an opportunity to lead certain aspects of the project. Also, the project resulted in skills and knowledge development within the community.	(+)	1	1	0.3	0.3	0.22088	0.066264
						1	0.7333	0.22088	0.161979

Indicators	Explanation	Description for rating	Impact	Valu e	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
Appropriatenes s to local cultural context	Appropriate to use and maintain by all members of the household regardless of age or gender.	All members of the household can use the latrine: There was one household where the interviewee indicated that the latrine is too small for one household members and therefore they do not use it.	(+)	1.96	0.98	0.25	0.245	0.43338	0.1061781
Convenience	Latrine is convenient to use. Based on privacy, comfort and odor in the latrine.	Latrine provides privacy and comfort with limitations and there is a controllable bad odor: 8.7% of households indicated that there is a constant bad odor that comes from the latrine	(+)	1.83	0.915	0.25	0.22875	0.43338	0.099135675

Indicators	Explanation	Description for rating	Impact	Valu e	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
User perception of the system	User satisfaction with the latrine	User satisfaction 81%-100%: The combination of whether or not users regard it as a permanent solution, and the percentage scale for user perception = 82.6%	(+)	4	1	0.5	0.5	0.43338	0.21669
						1	0.97375	0.43338	0.422003775
ICSD									0.914

Village B

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
Improved health and hygiene practices	The extent to which the health and hygiene practices of the community have improved as a result of the latrines and associated health and hygiene education	Health and hygiene practices have improved but there are still signs of practices that are unhygienic: There are people who indicated that they still use the bush to defecate/urinate sometimes	(+)	1.54	0.77	0.5	0.385	0.1965	0.0756525
Risk of exposure to hazardous materials	User exposure to hazardous materials in/from the latrine	Partial exposure, which can be controlled: Although most households indicated that they are not exposed to hazardous materials in the toilet, there are 8 households that are partially exposed when it rains as the toilet overflows. This exposure,	(-)	1.54	0.23	0.5	0.115	0.1965	0.0225975

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
		however, can be controlled.							
						1	0.5	0.1965	0.09825

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
Operation and Maintenance	Are the householders able to operate and maintain the toilet? This includes the proper cleaning of the ventilation pipe and pedestal	Users are able to operate and maintain the latrine with limitations: Latrine users do not know how to clean the ventilation pipe. All of them clean the pedestal etc. at least once a week.	(+)	1.4	0.7	0.4	0.28	0.1492	0.041776
Use of Local Labor	Was local labor available and used in the construction of the latrines?	Local labor was available and used for the construction of the latrines: Members of the community were appointed to construct latrines.	(+)	1	1	0.2	0.2	0.1492	0.02984
Vulnerability to water shortages	The extent to which the functionality of the latrine is affected by water shortages	Latrines are not vulnerable to water shortages (do not need water in order to fully function): The latrine forms part of dry sanitation	(-)	1	1	0.2	0.2	0.1492	0.02984

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
Durability/Lifespan of the latrine	Expected lifespan of the latrine before the pit has to be emptied or a new latrine must be constructed	Expected lifespan is 5 or less years: The expected lifespan of the latrines is 5 years. However, this can decrease if the household is large. Survey findings indicated that most of the latrines are almost full, despite the fact that most of them have not reached the 5 years expected lifespan	(+)	1	1	0.2	0.2	0.1492	0.02984
						1	0.88	0.1492	0.131296

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
User ability to pay	Number of people able to pay for the operation and maintenance of the latrine	61%-100% able to pay for O/M of the latrine: 80% are able to pay for the correct O/M materials required	(+)	3	1	0.3	0.3	0.22088	0.066264
User willingness to pay	Number of people willing to pay for the Operation and Maintenance of the latrine (Including the emptying of the pit once full)	51%-75%: 51% of householders are willing to pay for the emptying of the pit once full.	(+)	2	0.666666667	0.4	0.27	0.22088	0.0589013
Contribution to local development	Project contribution to the overall socio-economic development of the community	Latrine project contributed to the socio-economic development in the community: community members were employed in the project. Also, the project resulted in skills and knowledge development within the community.	(+)	1	1	0.3	0.3	0.22088	0.066264
						1	0.9	0.22088	0.191429

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
Appropriateness to local cultural context	Appropriate to use and maintain by all members of the household regardless of age or gender.	Some members of the household can use the latrine: 22.9% of the households reported that not all members of their household are able to use the latrine.	(+)	1.77	0.885	0.25	0.22125	0.43338	0.095885325
Convenience	Latrine is convenient to use. Based on privacy, comfort and odor in the latrine.	Latrine provides privacy and comfort with limitations and there is a controllable bad odor: All the households indicated that the latrine provides privacy, however, 42.9% of households complained about a constant bad odor and 65.7% of households complained about flies and other insects in the latrine.	(+)	0.46	0.23	0.25	0.0575	0.43338	0.02491935

Indicators	Explanation	Description for rating	Impact	Value	Normalized Indicators	Weight of Indicator	Sustainability Subindex (Isi)	Weight of Index	Sustainability Index
User perception of the system	User satisfaction with the latrine	User satisfaction 0%-50%: The combination of the user satisfaction and whether or not householders can consider it as a permanent solution=40%	(+)	1	0	0.5	0	0.43338	0
						1	0.27875	0.43338	0.120804675
ICSD									0.542