

**PROJECT MAINTENANCE:  
THE CASE OF RURAL DRINKING-  
WATER  
IN MALAWI**

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**Submitted in Partial Fulfilment of the  
Requirement of the Doctor of Philosophy Degree  
in Project Management**

**University of Salford**

**Salford Business School**

**September 2014**

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## EXECUTIVE SUMMARY

There is an investment of hand-pump technology to improve provision of safe drinking-water for the stakeholder end-users in rural sub-Saharan regions of Africa, yet there are challenges to maintain the assets. In rural drinking-water projects, end-users also assume the responsibility of hand-pump maintenance after projects are handed over to them by project sponsors. This study uses a realist philosophy to analyse the issues that hinder or facilitate effective end-user participation in a successful maintenance of drinking-water projects in Nkhoma and Bvumbwe, Lilongwe and Thyolo Districts of Malawi respectively. Data collection was done by employing secondary data (literature review) and primary data collection using documents, observation, and interviews to establish factors facilitating or inhibiting hand-pump maintenance. Interviews which were the main data collection instrument, recruited 12 Convergence Interviews (CI), followed by 39 Individual Case Interviews (ICIs) and two sets of Focus Groups (FGs) in operational and non-functional hand-pumps. CI processes developed categories related to hand-pump maintenance factors and associated challenges. The CI developed maintenance categories were further cross checked in ICIs that used semi-structured interviews and finally confirmed in FGs, documentary and observational analysis. Convergence Interviews data was analysed using a matrix while ICIs were analysed using likert-type ranking scales to identify the most occurring hand-pump maintenance factors. Focus Groups, observations and documents used content analysis to analyse the hand-pump maintenance factors.

Results show that end-users maintain small- medium hand-pumps faults effectively if they pay a contribution towards maintenance costs and if local political structures are trained to repair the hand-pumps. Moreover, the study identifies lack of sponsor supports as the main factor leading to failure in the management of major faults and hand-pump rehabilitation, as this is beyond local capacity technically as well as economically. Hence, the study introduces a business approach to improving hand-pump maintenance by recommending some minimum standards on the demand-side (end-user level) as well as the supply-side (project sponsor and policy levels).

## ACKNOWLEDGEMENTS

Several people have contributed to the successful completion of this research work. Firstly, I express my heart-felt thanks to my research supervisor, Dr Kevin Kane, who has taken me through ‘percept by percept’. I sincerely appreciate the untiring constructive reviews and support, which was probably every other week, leading me to develop a robust research with practical implications for the rural people of Malawi and beyond. All I can say is that I believe I have not come out ‘half-baked’.

I am also grateful to friends and colleagues, including fellow church members who reviewed the early drafts and many thanks to all who prayed along as ‘we’ stand on the premise that the lord our creator is the source of wisdom. My special thanks and gratitude to the rural stakeholder end-users of Bvumbwe and Nkhoma, particularly the water committees, and the hand pump technicians, the village chiefs and the development committees...‘Zikomo’... for giving me the opportunity to interact with you, above all your willingness to state what concerned you about hand-pump maintenance. In addition, my gratitude to the Malawi WASH Project Manager, Peter, the WVI WASH field worker, Chibisa; for opening the door for me and organising transport to the rural areas. The WASH field worker and the government Health Surveillance Assistants were more than helpful in organising and making all logistical support by transporting my colleague and myself to areas where vehicles would not access. The warm welcome we had was unimaginable and made me to have more empathy for the ‘rural’ people. Many thanks also to Masauko, the Concern Universal Project Manager. Although the drinking water project had phased out, in 2007, Masauko could provide me with some highlights about the Bvumbwe Project, the project documents and even linked me with the Bvumbwe Health Centre team, who made the core support for data collection in Bvumbwe area. My sincere gratitude to the Health Surveillance Assistants, particularly Benias who took a tremendous lead in organising and linking with the rural stakeholders a head of time. Each village we went, we found people gathered with enthusiasm to be interviewed, even beyond the limit of the respondents we needed. Bvumbwe Health Centre Surveillance Assistants committed all their time to take us around in the ‘hard to reach’ areas on their motor-bikes. I can hardly forget the day when the motorcycle broke down, and it was raining heavily.

Though my family does not prefer to be thanked openly, all I can say is, may the Lord Jesus add to your account in heaven for you my husband Lawrence and my precious children Wana, Walu and Wali for all the support particularly in editing the document.

## **DEDICATION**

‘To God the Father, the Son and the Holy Spirit’ from whom comes grace, mercy, favour and wisdom.

## DECLARATION

I the undersigned declare that this work is my own origin and has not been produced anywhere. Appropriate due referencing has been acknowledged.

Signature

Date

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## ABBREVIATIONS

ADC	Area Development Committee
ADCs	Area Development Committees
APM	Association of Project Management
CBRM	Community Based Risk Management Arrangement
CI	Convergence Interviewing
DA	District Assembly
DDPs	District Development Plans
DFID	Department for International Development
DLG	Department for Local Government
EPSRC	Engineering and Physical Sciences Research Council
EU	European Union
FGIS	Focus Group Interviews
GNP	Gross National Product
GTZ	German Technical Cooperation
ICIs	Individual Case Interviews
LDA	Lilongwe District Assembly
MDGs	Millennium Development Goals
NGOs	Non-Governmental Organisations
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
Oxfam <sup>1</sup>	Oxford Committee for Famine Relief.
PRA	Participatory Rapid Appraisal
PM	Project Management
PM BoK	Project Management Body of Knowledge
PMI	Project Management Institute
SEP	Socio-Economic Plan
SH	Stakeholder
SHs	Stakeholders
TA	Traditional Authority
TAs	Traditional Authorities
UK	United Kingdom
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VDCs	Village Development Committees
VHCs	Village Health Committees
VLOM	Village Level Operation and Management
WEDC	Water, Engineering and Development Centre
WHO	World Health Organisation
WVI	World Vision International



## DEFINITION OF TERMS

**Convergent Interviewing:** An in-depth interview where the interview starts unstructured and ends semi-structured. The technique seeks to develop categories from respondents through agreements and disagreements of the previous respondents (Dick, 1990)

**Drinking-water Project:** is a project which is about safe water infrastructures, as a deliverable or product into a form of boreholes commonly called hand (water) pumps. This study focus is hand-pumps because these are predominantly constructed in rural areas, and stakeholders may play a vital role to sustain them. The study will regard one hand-pump as one project. Hence the study will examine nine water projects. One drinking water project may serve a catchment population of about 850-1000 people (NSO, 2004) with a life span ranging between 15-20 years.

**Hand-pumps:** In this study will refer to Afridev and Malda pumps (see figure 1). Deep wells are commonly called boreholes, are machine dug and equipped with Afridev hand-pumps while shallow wells are dug by men and equipped with Malawi Direct Action or Malda pumps, particularly designed to fit wet lands. The name hand-pump or water-pump is used interchangeably.

**Non- Governmental Organisations (NGOs):** These are private sector organisations taking a leading role in social projects aimed to promote rural livelihoods in developing countries. Most NGOs are international, operating in different countries with their central offices in developed countries. The international NGOs in this study will include World Vision International (WVI) and Concern Universal (CU).

**Project End-users:** These are key beneficiaries; they utilize the hand pumps for the provision of safe water for domestic purposes.

**Project Failure:** in this context refers to hand- pumps, which are not operational due to lack of local capacity to repair them (Prokopy,2005).

**Project Sponsor:** Is a project implementing agent or a funding agent. In this context, it will refer to the NGOs, who execute water projects to rural communities.

**Project Success:** in this context will refer to drinking-water projects (hand pumps) which are operational and are maintained by end-users without the external aid (WHO/UNICEF, 2004).

**Rural Project:** Is a project which aims to promote social needs among regions of extreme poverty, particularly in sub Saharan regions of Africa. The study country, Malawi, has 68% of the total population (MDHS, 2005) living in rural areas and most of them live below the World Bank poverty line of less than 1US\$ per day (Gutierrez, 2007: ODI 2004:18). The study rural projects are drinking water projects.

**Stakeholders:** are people who have an interest in the project (PMI, 2008). In this study, they could be end-users, village water committees, local village chief, project team, project sponsor, health centre staff, health surveillance assistants, NGOs, who are project sponsors as well as the district water office. These study main focuses are the project end-users that are beneficiaries and assume the role to maintain the hand-pumps.

**Success Factors (SFs)** These are characteristics, conditions or variables that can have a positive impact upon the project outcome (Papke-shields et al, 2010)

**Village Chief:** A local leader at the village responsible for local administration. One village may have an average of 1000 people (DHS, 2004).

**Water- Committees:** These are local structures at village level, and the members are volunteers. They are responsible to advocate repair of hand-pumps, if well trained. (Kleemeier, 2000)

# **CHAPTER ONE: INTRODUCTION AND STUDY BACKGROUND**

## **1.1 Introduction**

This Ph.D. thesis examines stakeholder end-user roles in the maintenance of drinking-water projects financed by Non-Governmental Organisations (NGOs) in rural areas of Bvumbwe and Nkhoma, in Malawi. Malawi is a country situated in the eastern part of Africa, in the region commonly called Sub-Saharan. Stakeholder end-user; are project recipients, or beneficiaries for the rural drinking water projects; and NGOs are project sponsors, who execute the projects and provide financial and technical investments. End-user roles are important because the NGOs hand over the projects to them for maintenance. During the maintenance period, NGO financial and technical support is withdrawn. Although most stakeholders end users live below the poverty line in Malawi, like in another sub-Saharan Africa, hand pump projects are implemented on the premise that end-users are responsible for the day to day maintenance (Harvey, 2007; Gutierrez, 2005).

Stakeholder end-users assume complex roles when drinking water projects are handed over to them. According to Ashbolt & Barnes, (2010) and Dasgupta & Beard, (2007), end-users input in the management of water projects during and after external aid is withdrawn is a key element in determining the success of drinking water projects. It is vital that end-users are engaged during the various phases of project management, including project initiation, implementation and maintenance (Gine & Perez-Foguet, 2008). However, according to a survey done in rural areas of Malawi (Malawi DHS Survey, 2004), most drinking-water projects are not properly maintained. Furthermore, World Health Organisation (WHO) / United Nations Independent Children Education Fund (UNICEF), (2004); Prokopy, (2009); ODI, (2004); Harvey, (2007); Gutierrez, (2005); Ashbolt & Barnes, (2010) and Disgupta & Beard, (2007), concur that some hand-pumps are worn out, they break down and ultimately deemed non-functional because of poor or lack of maintenance. This study identifies underlying factors that facilitate or hinder the contribution of end-users in the maintenance of rural drinking-water projects in Malawi.

## **1.2 Study Background: Developing Countries and Access to Safe Drinking Water**

Rural areas in developing countries lag behind for access to safe drinking water. According to the Joint Monitoring Programme by UNICEF/WHO (2004), over that 780 million people globally do not have access to an ‘improved’ source of drinking-water, with two thirds living in sub-Saharan Africa (UNICEF/WHO, 2012). Jones, Fisher & Reed, (2012) define an ‘improved’ source of drinking-water as a water source that is protected from outside contamination, particularly from faecal matter. Lack of access to a safe drinking-water source leads the dwellers to collect water from nearby sources like drains, ditches, streams that might be infected with pathogens and bacteria that cause serious illnesses and deaths (WHO/ UNICEF, 2004). Research by World Health Organisation, indicate that lack of clean water is the main cause of children’s deaths in sub-Saharan Africa with millions of people sharing their domestic water point with animals.

In response to the drinking-water problem, there have been international agreements to reduce the proportion of people without access to safe drinking-water, particularly in rural areas. There have been several international agreements and drinking-water treaties since 1979, which have promoted rural drinking-water project approaches for low-income countries, as the solution to high disease and deaths arising from use of contaminated water from unprotected springs (United Nations, 2000). United Nations dedicated the years 1981-1990 as the International drinking-water and sanitation decade in which developing countries and donor agents began focusing on hand (water) pumps for improving the provision of safe drinking-water (Harvey & Reed, 2003) for rural areas of developing countries.

At the 2000 UN Millennium Summit and the 2002 World Summit on Sustainable Development in Johannesburg (WSSD), safe drinking-water was identified as one of the main global concerns and the WHO and UNICEF was charged with acceleration for implementation of drinking-water among the rural poor populations (WHO/UNICEF, 2004). In 2000, Millennial Development Goals (MDGs) were adopted by 189 member countries of United Nations with the overall objective being the eradication of extreme poverty. Eight specific goals were proposed, and

the target for goal number seven was to ‘half proportion of people around the world without access to safe drinking-water by the year 2015’. Millennial Development Goals (MDGs) were set in response to the needs of 1.1 billion people of the world’s population (UNDP, 2004) who did not have access to safe drinking-water at the beginning of the millennium. Despite the initiatives and treaties at international levels, Ashbolt & Barnes (2010) and Harvey (2004) contend that there has been persistent low supply of safe drinking-water particularly in rural sub-Saharan regions of Africa.

### **1.2.1 Research on Drinking-Water Projects in Rural Areas of Sub-Saharan Region**

The high figures of lack of access to safe drinking water in a sub-Saharan region also mask some disparities between the rural and the urban areas. When wealth characteristics are applied, the poor in rural areas have the least access to safe drinking water. Disparity of drinking water service provision between the rich in urban areas and the poor in rural areas is a concern as access to safe drinking water is higher in urban areas than rural areas. Studies done by WHO/UNICEF (2012) indicates that 90% of improved piped water supplies have been installed in relatively rich urban parts of sub-Saharan Africa. However, most rural dwellers do not have piped water supply systems. According to WHO/UNICEF (2009), it is estimated that 80% of the population in metropolitan areas has access to clean water contrary to only 42% in rural areas. It is therefore, imperative that factors that limit the installation and maintenance of water projects in rural parts of sub-Saharan Africa are studied.

There are various factors that make urban areas more practical to implement water projects than rural areas. These include the fact that more people are formally employed in metropolitan areas than in rural areas and therefore, can afford piped water; the central government manages water supply and for political reasons, politicians focus on water supply in metropolitan areas because they are ‘voter rich’ constituencies because municipal areas are densely populated. Water provision in urban areas is often centrally managed by the city council through revenue collection whereas in rural areas, people fend for themselves. For economic reasons,

urban water supply companies, which are profit making organisations, maintain their water provision equipment in order to maximise profit. However, in rural areas because of poverty, it is not viable to start commercial water provision services. In rural areas, central water management is not feasible because of the sparse population and for economic reasons, including the fact that the rural people consider water as a free commodity.

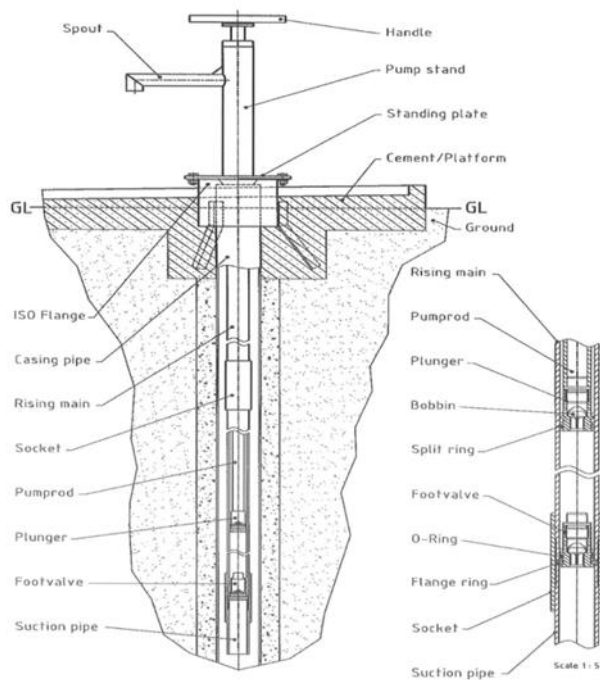
Although rural people are aware of the risks of pathogens, they do not have a choice but to use untreated water because it is freely available in the ponds and other unprotected sources. Economic insecurity predisposes rural people to unclean water because they have limited capacity to pay for the repair of the broken-down hand-pumps because most people fall below the poverty line threshold (Easterly, 2003). Lack of hygienic water leads to poverty and also the state of poverty means most rural poor people cannot maintain hand-pumps leading to a vicious cycle of poverty. Studies by Jalan & Ravallion, (2003) and Mbata, (2006) reveal that properly maintained drinking-water projects reduce water-borne diseases, child morbidity and deaths resulting in improved economic status of the communities. The high morbidity could be reduced with the use of Village-Level Operations & Maintenance (VLOM) hand-pump technology to supply safe water to rural people.

### **1.2.2 Rural Village-Level Operations & Maintenance (VLOM) and Hand-Pump Technology**

The type of hand-pump used in water supply, at the village level is a significant factor in determining whether the locals in the rural areas are able to maintain the asset. Even though standardising hand-pumps is yet to be formalised for rural areas in Malawi, the commonest proposed hand-pump technology is the Village-Level Operations and Maintenance (VLOM) hand-pumps. VLOM hand-pumps are simple hand-pumps, which operate on wells within the depth of 10-45 metres and can be repaired by end-users after receiving some basic training, using ordinary tools. VLOM hand-pump technology is; low cost, considered by international donor agencies like World Bank as easy to operate or maintain, have been proposed as the most viable option for water supply for rural areas of Africa (HTN, 2003; UNICEF/WHO, 2004).

There are two types of VLOM hand-pump technologies proposed for the rural villages. One pump is for deep-wells and the other for shallow wells. The deep-wells' hand-pumps are often called Afridev an acronym for African Development pumps. Afridev hand-pumps comprise of shafts, which are machined, drilled and are constructed by engineers. Installation is calculated and can be situated in wet as well as dry lands up to the depth of 45 metres. The shallow wells' hand-pumps are called Malda pumps in Malawi an acronym for Malawi Direct Action pump, and these are limited to dampening lands (see Figure 1 below). Malda pumps are man-dug and retrieve water at 10 meters beneath the surface (Malawi DHS Survey, 2004). Both deep and shallow wells are poorly maintained in rural areas of Malawi.

## 2.0 Malda Pump Features



**Figure 1: Malda Hand-pump Features**

The number of hand-pumps that are not repaired or maintained is a cause of concern for donors, NGOs and end-users. An average of 30-40% of hand-pumps is non-functional in Africa due to failure to repair them (Ashbolt & Barnes, 2010;

WHO/UNICEF, 2000). This proportion is higher for some countries. Apart from research by WHO/UNICEF (2009), there are other studies on non- functional drinking- water projects that have been conducted in several other African countries, including Nigeria (Sonuga, Aliboh, & Oloke, 2002; Vaija & White, 2008); Botswana (Mbata, 2006); Zambia & Malawi (Gutierrez, 2007); and Cameroon, (Njoh, 2002).

Table 1 below summarises the magnitude of non- operational hand-pumps in different countries.

**Table 1: Hand- pump Data for Selected Countries in Sub-Saharan Africa**

Handpump Data, Selected Countries in Sub-Saharan Africa April 21, 2009

Country	Informant	Estimated Rural Pop. (millions) <sup>1</sup>	Estimated Rural Coverage <sup>1</sup>	Estimated Rural Unservd <sup>1</sup>	Estimated % Served by Handpumps	Estimated Number using Handpumps	Total # Handpumps	# Functioning Handpumps	# Non-Funct. Handpumps	% Non-Functioning	Notes
Angola	Dauda	8.6	40%	5.2	90%	3.10	4,500	3,150	1,350	30%	UNICEF estimate
Benin	S Adokpo	3.7	60%	1.5	45%	1.00	6,700	5,200	1,500	22%	
Burkina Faso		10.5	44%	5.9	62%	2.86	22,400	16,800	5,600	25%	UNICEFcountry Profiles
Cameroon	J.Rihouey	7.7	41%	4.5	50%	1.58	9,000	6,750	2,250	25%	Estimate J. Rihouey
DRC	G. Kazad	35.3	29%	25.1	4%	0.41	1,500	500	1,000	67%	approx. 60% use springs
Ethiopia	B.Muluneh	58.7	11%	52.2	30%	1.94	30,046	19,667	10,379	35%	DHS 2000/HP # calculated
Cote d'Ivoire		9.2	74%	2.4	80%	5.45	19,500	6,825	12,675	65%	UNICEFcountry Profiles
Guinea		5.5	38%	3.4	85%	1.78	12,500	10,000	2,500	20%	UNICEFcountry Profiles
Kenya	P. Nduati	19.6	46%	10.6	15%	1.35	12,000	8,400	3,600	30%	DHS 2003/Estimates
Liberia		1.7	52%	0.8	75%	0.66	1,350	420	930	31%	UNICEFcountry Profiles
Madagascar	R.Herivelo	12.5	34%	8.3	19%	0.81	2,500	2,250	250	10%	functioning rate includes other service types
Malawi		10.0	62%	3.8	77%	4.77	19,000	11,400	7,600	40%	MICS 2000 + 2006/WHO
Mali	S.Sutton	8.6	35%	5.6	50%	1.51	14,200	9,400	4,800	34%	Unicef summaries/Est.
Mozambique	J.Narkevic	12.6	24%	9.6	82%	2.48	17,000	12,700	4,300	25%	Nat. Water Directorate Data
Niger	I. Sanoussi	9.0	36%	5.8	56%	1.81	7,175	5,025	2,150	35%	Min. Hydraulics 2005 for # HP
Nigeria	B.Aleobua	65.3	49%	33.3	35%	11.20	80,000	40,000	40,000	50%	JMP and UNICEF sources/Est.
Sierra Leone		3.0	46%	1.6	55%	0.76	2,500	875	1,625	65%	Unicef summaries/Est./MICS2005
Uganda	S.Mutono	22.0	52%	10.6	60%	6.86	30,000	24,000	6,000	20%	
Zambia	P. Harvey	7.0	36%	4.5	54%	1.36	15,000	10,200	4,800	32%	MLGH estimate
Zimbabwe	P.Morgan	8.5	74%	2.2	60%	3.77	38,200	26,800	11,400	30%	UNICEF inventory/estimate
<b>Totals</b>		<b>319</b>	<b>38%</b>	<b>197</b>	<b>45%</b>	<b>55.5</b>	<b>345,071</b>	<b>220,362</b>	<b>124,709</b>	<b>36%</b>	

**Data Source: WHO/UNICEF 2009**

The figures from Table 1 above indicate that unmaintained, or non-functional pumps are widespread in rural African countries. Non- functional pumps are a concern because when the provision of safe drinking-water ceases, there are adverse consequences to the health of rural people (UNICEF/WHO, 2004). When hand pumps fail to operate, end-users cannot meet some of their domestic needs as water is a basic commodity for drinking, cooking, bathing and washing (Bogale & Urgessa, 2012). Shortage or lack of safe water leads to sanitation problems and water-borne



diseases, including diarrhoea, cholera, dysentery because end-users resort to use polluted surface water in open wells, rivers and dams (Graciana, 2010). Even though the untreated surface water may not be harmful if used for bathing, cleaning and washing, it can have adverse health effects on drinking or cooking (Gine & Perez-Foguet, 2008).

When hand-pumps are not properly maintained, end-users encounter problems because of the negative impact upon their health, social and economic warfare (UNDP, 2004). End-users whose pumps are not repaired resort to using contaminated water sources like streams and unprotected springs predisposing themselves to dysentery and other water-borne diseases and ultimately death (World Bank, 2004). Dysentery is the main cause of deaths among the under five children in developing countries (WHO/UNICEF, 2004). End-user's social life is also affected because individuals who have chronic diarrhoea diseases may be weak, undernourished limiting their full capacity in development activities (Malawi DHS, 2002). For example, a chronically ill dysentery sick man may not be strong enough to participate in pump- maintenance or the engagement of subsistence farming, the main source of their income for rural areas (Malawi, DHS Survey, 2004). This eventually results in the sick members of the community's inability to participate to the required community contribution precipitating poverty in the rural people.

### **1.2.3 Safe Drinking Water and the Concept of Poverty**

Safe drinking water provision is believed to relieve poor people from the condition of poverty. Poverty among the rural people has been broadly defined as is seen as a multidimensional phenomenon. Poverty is defined as inability to have essential assets or materials for well-being like food, clothing, land and clean water (Burkey, 1993; UNDP, 2006). While politically poverty is about oppressive human rights, socio culturally, it is seen as failure to participate in development activities (Burkey, 1993;

UNDP, 2006). Hence poverty capabilities are seen from the socio- economic, dignity and cultural point of view.

Chambers (1993) describes rural level people as poor as they have:

*..... few assets, lives in a small house, made of temporal materials; mud, grass, reeds, wood and hides, household members are seasonally hungry and thin...isolated from the outside world, often illiterate and without a radio. Children do not go to school, or go and drop out early; members do not go to public meetings or go and do not speak. Do not have access to extension services. Powerlessness is reflected in the way with which the rural elites intercept benefits intended for the poor, in the way poor people are robbed, cheated and in the inability of poor people to bargain....(Chambers, 1993)*

Chambers, (1993) concept of poverty shows that the definition of rural poverty has moved from monetary terms (income in sterling pounds or dollars) to issues relating to socio-economic, cultural and power issues. In general, availability of basic community infrastructure or services like clean water, school, clinic, roads where livelihoods can benefit are portrayed as a road to poverty alleviation (UNDP, 2006). Poverty is also still affiliated with powerlessness in terms of social exclusion, lack of knowledge and ignorance. World Bank and other rural investors have also linked poverty with poor policies for economic growth, poor governance and centralised management of rural projects (Collier & Dollar, 2001). This study examines rural peoples' roles as to whether they are in a state to support hand-pump maintenance despite the economic hardship, and a tendency to depend on external (donor) aid for assistance.

#### **1.2.4 Donor Aid Assistance in Drinking-Water Projects**

Non- operational hand-pumps are also a concern for project sponsors and financing institutions as huge monetary investments are made in the form of donor aid. The development of rural drinking-water projects in Africa is largely dependent on financial aid from NGOs, which includes both monetary and non-monetary investment. According to UNDP (2006) estimates, approximately US \$ 133.9 billion

was allocated to safe drinking- water supply in developing countries between 1990 to 1994 (UNDP, 2006; Vaija & White, 2008). Gine & Perez-Foguet (2008) and Gutierrez (2007) estimate that requirements for the annual investment for water and sanitation are 13-20 US\$ million annually, aimed at meeting water and sanitation needs in each of the developing countries. The monetary assistance by donors indicates a commitment by donors to support developing countries with financial investment to improve peoples' livelihoods. Table 2 below summarises UNDP development assistance to several sub-Saharan countries, including Malawi.

**Table 2 Donor Development Assistance**

2004 Human Development Index (HDI) rank	Total Official Development Assistance (ODA) received (US\$ millions)	ODA per capita (US\$)	As % of GDP	Total debt service as % GDP	Total debt service as % of exports of goods, services and net income from abroad
<b>Malawi</b>	<b>476.1</b>	<b>37.8</b>	<b>25.3</b>	<b>3.2</b>	<b>13.5</b>
Ethiopia	1,823.1	24.1	22.8	1.2	6.3
Mozambique	1,228.4	63.2	20.2	1.4	3.2
Developing countries	53,287.0T	10.5	0.5	4.9	7.0
Sub-Saharan Africa	22,733.6T	33.0	–	–	5.8

**Data Source: UNDP, Human Development Report, 2006**

The Human Development Report (2006) shows that UNDP is the main source of external aid to Sub-Saharan countries, including Malawi. Malawi is one of the countries in the sub-Saharan region of Africa, which has the highest poverty levels (Malawi, DHS 2004). UNDP allocates a small share of the aid to Malawi in comparison to other countries, but the country is also heavily in debt (Malawi, DHS Survey, 2004; WHO, 2009). Malawi's external aid constituted 25.3% of its total GDP (GDP is at \$8.272 billion) (WHO, 2009). Due to reliance of external aid for the bulk of financial investment, most hand pump projects lack material as well as technical resources for further maintenance when such aid is withdrawn. This implies that the problem of access to safe drinking water is prevalent. In general although donor

investment has increased in developing countries, the majority of rural communities still do not have access to safe drinking- water either because the dwellers live far from water pump points or the existing water pumps break down and are not successfully repaired; showing there are other roles and responsibilities of stakeholder end-users in addition to the provision of grants or donor aid.

### **1.3 The Case of Malawi: Summary Profile and the Problem of Access to Safe Drinking Water in Rural Areas**

Malawi is one of the poorest countries in the world (World Bank, 2006) and is among the countries which are a prime target of poverty alleviation by World Bank (WB) /International Monetary Fund (IMF). Malawi's poverty made it ideal for debt relief under the highly indebted Poor Countries (HIPC) Initiative by the World Bank and International Monetary Fund. The World Bank and IMF, however, demanded a new version of policies relating to national government commitment to specify economic and governance milestones. As part of debt relief and provision of low income loans to poor countries, in December 2000, the IMF and WB approved US\$643 million as HIPC debt for Malawi. One of the conditions was that Malawi had to prepare and implement the Poverty Reduction Strategy (PRS) with specific economic conditions.

PRS has been processes aligned to reduce poverty. PRS in Malawi like in other Sub-Saharan countries is engineered by the World Bank /IMF. PRS as a poverty reduction strategy emerged in the 1990s. The aim of PRS is to introduce the change from the traditional central government system to local government policies, which include decentralisation. The PRS strategic approach also incorporates rural people participation and ownership in the end-users provision of community-based services at the village level. The PRS provides an evolution of a strategic approach to programme management in Malawi though more rhetoric (Ellis, Kutengule & Nyasulu, 2003). The overall goal of PRS is sustainable development through empowerment of the poor. The key issue in the PRS is to create a conducive environment to enable or initiate the rural poor people to reduce their own poverty (Malawi, 2001). However; the extent to which the poor people can contribute in reducing their poverty is not clearly articulated. To promote rural development,

Malawi created local government system consisting of 39 assemblies in 1990. However, the government has still not been fully keen to disseminate central government functions to local government. In addition, local government lacks the technical capacity to handle the complex managerial, technical and financial systems; and there are also challenges of corruption (World Bank, 2002); showing that reducing poverty for the poor is a complex issue particularly in rural areas.

The poor are more disadvantaged in comparison to their rich counterparts who live in urban areas, due to poor socio-economic conditions in Malawi. Table 3 below highlights some critical indicators about the socio-economic situation of the population based on data from Malawi Demographic and Health Survey of 2000, 2004 and 2011; particularly, those related to rural livelihoods (NSO, 2012).

**Table 3: Malawi Development Indicators**

<b>Characteristics</b>	<b>Value</b>
Total population (millions) (2010)	13.1
Annual population growth rate (%) (1994-2004)	2.4
Life expectancy at birth(years)	42
Infant mortality rate (per 1000 live births)(2004)	76
Under –five mortality rate (per 1000 live births)(2004)	133
Gross National Product (GNP) per capita (2004) (US\$)	160
Per capita total expenditure on health ,2002 at average exchange rate, US\$ (2003)	13
Official development assistance per capita (US\$)(2003)	45.4
Proportion who cannot read at all (2011)(NSO 2011)	16.6 % urban 35.6% rural
Proportion of people using an improved water source (NSO, 2011)	79.3

Malawi is one of the poor countries ranking the Human Development Index (HDI) of 0.404, which is 165<sup>th</sup> of the 177 countries classified as low-income countries by World Bank (World Bank, 2002). The per-capita GDP in 2003 was US\$156 with an annual growth rate of 0.9%. This is much lower than the average values of other low-

income countries in sub-Saharan Africa. The commonest disease burden leading to high infant rates include communicable diseases, particularly diarrhoea. This is also linked to poor access of drinking water. The per-capita total expenditure on health is among the lowest in sub-Saharan Africa much shorter of the US\$34 as recommended by WHO, to provide a basic package of services. The health expenditure, which includes drinking water, by the government, constitutes about 41% of the whole government expenditure (NSO, 2004). This contrasts the Abuja resolution by African head of states to allocate 15% of the national budget for health (Zere et al, 2007). The low budget allocation has an implication in such a way that end- users have to complement with their input in community-based services at the village level as proposed in the PRS among which is drinking water.

One of the aspects defined in the PRS to reduce poverty is the provision of safe drinking water. This is because improved source of drinking water free of faecal contamination is regarded as one of the wealth quintiles determining socio-economic status of households and improvement of their standard of living (NSO, 2012). Based on this, Malawi was one of the 191 United Nations member countries that adopted the Millennium Declaration in September 2000 in which each country was committed to achieve 8 goals to reduce global poverty. The goal 8 and target 7 of Millennium Development Goals (MDGs) focussed on reducing the proportion of people without access to safe drinking water by half by 2015 (DFID, 2004). Malawi had to adopt MDGs because by then 68% of its population had access to safe drinking water of which 95% were in urban areas and 58% in rural areas (NSO, 2002). The 2011 Malawi Demographic Health Survey (DHS) shows that Malawi may meet the 2020 WHO/UNICEF targets as safe drinking water access has improved to 79.3% of the population who use an improved source of drinking water. However, these figures still mask wealth discrepancies as urban areas have 91.1 % while rural have 76.9% as much as 85% of the population live in rural areas (NSO, 2012). Malawi regards an improved source of drinking water in a form of piped water, piped public stand, hand-pumps; a dug-protected well and rain water collection (NSO, 2004). At the same time, issues of maintenance are still unclear as much as uptake is determined by the presence of the improved water sources which could be functional or non- functional.

#### **1.4 Justification: Determining Drinking-Water Project Success Factors**

Determining factors that facilitate the realisation of successful projects is a central issue in project management. Project success factors are benchmarks that determine the accomplishment of objectives. There has been research on project success factors in developed countries (Bryde, 2003; Bryde & Robinson, 2005; Pinto, 2000; Cooke Davies, 2002) and to a smaller scale in developing countries (Diallo, 2004; Diallo & Thuillier, 2005; Ahsan & Gunawan, 2010). Turner (2010) contends that research on project management success factors has primarily been limited to cost, schedule and scope as the main determinants of project success. Project success can reflect the 'hard' or 'soft' issues. While 'hard' issues of project success focus on cost, schedule and scope; 'soft' project success issues relate to stakeholder practices. Soderland, (2004); Smyth & Morris, (2007); and Saynisch, (2010) advocate for the 'soft' issues of Project Management as the main determinant of any project's success. Even though projects in rural African areas, focus on success factors based on cost, schedule and scope during the implementation phase, Ashbolt & Barnes, (2010) advocate for understanding contextual success factors that are unique to development projects, including drinking-water projects. Rural water projects are social projects hence the need to evaluate different perspectives of stakeholder end-users in addition to determining the success from cost, schedule and scope perspectives. End-users' perspectives may explain reasons why though water projects are within budget, timeline, scope and quality, before and during construction as planned by project sponsors, but they may be unsuccessful in the long term-during maintenance (Procopcy, 2005; Gutierrez, 2005).

#### **1.5 Project Management: Research on End-User Roles in Pump – Maintenance of Rural Water Projects and Steps Leading to Project Success**

Rural projects' practices have not been covered in project management. Biedenbach & Müller, (2011); Turner, (2010); White & Fortune, (2002); Winter, Smith, Morris, & Cicmil, (2006) concur that stakeholder end-user practices in rural projects are an overlooked area in project management research. In addition, out of the 44 project management topics by the Association of PM, International PM Association and PM

Institute; topics relevant to rural projects received little or no attention (Dvir, 2005; Muriithi, 2003; Themistocleous & Wearne, 2000). Though the PM Bodies of Knowledge (APM, 2006; Prince, 2007 & PMI, 2008), guide the practices, certifies practitioners and establishes training syllabus; indicate that PM success factors are universal, encompassing all contexts of projects, it is not clear whether the success factors related to rural projects can be the same in profit making and not-for-profit rural drinking water projects. The study, therefore, adds to the debates, whether rural projects' stakeholders in Malawi, the study context as a representative of sub-Saharan Africa at large, should assume overall responsibility of hand-pump- maintenance despite the poverty situation.

The literature review revealed that there is a need to analyse and establish end-user perspectives and experiences in the hand-pump maintenance of rural water projects. There is also a need to establish stakeholder end-user success or failure perceptions because they are the recipients of the hand-pumps. End-user perceptions are particularly important in rural drinking-water projects because if they do not use and maintain the hand-pumps installed by donor agencies, then the projects will have been a loss in terms of 'value for money'. UNICEF/WHO (2008) asserts that maintained hand-pumps are a main pillar of successful drinking- water projects as the stakeholder end-users assume responsibility of maintaining the hand-pumps without the support of external aid. The rationale behind this concept emanates from the fact that developing countries are urged to be 'self-reliant', other than being 'donor-dependent' in sustaining project activities, once they have taken off the ground, with assistance of external aid. However, the situation on the ground is that hand-pumps break down, and stakeholder end-user have lagged behind in taking active steps for maintaining hand-pumps. This has been due to several challenges such as lack of financing mechanisms to replenish the spare parts that are worn out (Harvey, 2007) and /or lack of pump- maintenance knowledge and skills (WHO, 2006). Maintaining the hand-pumps have not been easy for developing countries partly because of the complex roles the stakeholder end-user are expected to assume (Jones, Fisher & Reed, 2012).

Stakeholder end-users have the main 'stake' in hand-pump projects because they are the beneficiaries and are responsible for maintenance. However, there have been



problems in determining end-user roles in the maintenance of hand-pumps' projects in Malawi. Kothari (2001) highlight issues that hinder effective determination of end-user roles in implementing and maintaining rural projects. The main limitation is that end-users depend on donor assistance to initiate and sustain the rural projects. Such assistance could be financial or technical help, which often ceases with phasing out of the donor aid. The other weakness is that the end-user roles mainly depend on volunteers who need to be motivated to sustain the rural projects. End-user stakeholder involvement in this process is, therefore, imperative because they can influence hand-pump- maintenance, assess hand-pump problems, mobilise resources and also assist in mechanical work for repairing the assets to prevent further complications. Ashbolt & Barnes (2010) recommends hand-pump maintenance steps or necessary interventions aimed at determining the success of stakeholder maintenance roles. The WHO & UNICEF (2004) argues that there are a number of steps, which could lead to successful hand-pump maintenance as delineated in the Table 4 below.

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**Table 4: Summary of Hand- Pump- Maintenance Steps**

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- End-users participating in planning and implementation of the hand-pump projects.
- End-users participating in hand-pump maintenance when assets are handed over to them.
- End-users working together as an entity in a form of local structures or committees
- Presence of viable local structures, committees or leaders with capacity to coordinate and involve end-users in maintenance activities.

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**Source: (WHO/UNICEF, 2004).**

The steps reflect a standard of the hand-pump maintenance management process that typically involves; the identification of problems, setting maintenance goals, determination of resources that can facilitate maintenance solutions, and formulation of local structures or committees that facilitate end-user resource mobilisation. The above hand-pump maintenance steps will be further elaborated in the literature review

in a form of conceptual framework and guide data collection in the methodology section.

## **1.6 Study Motivation**

This study has its origin in my own reflective concerns as a Project Manager (PM) of Monkey Bay Safe Motherhood Project conducted by the University of Malawi, College of Medicine and also as a technical officer of Umoyo Network, which was a USAID sub-guarantee. As a project manager, I noticed that some projects encountered problems when donor funds were withdrawn. I personally felt stakeholder management in rural projects was a complex issue. It was my responsibility to follow up project activities after initial funding, and this experience made me identify the gap and how it affected stakeholder end-users between projects, which had the support of external aid and those which had been weaned off.

The other factor which prompted me to conduct this study is the fact that, in Malawi's hand-pump, maintenance has not been clearly defined. Both NGOs and government take a proactive approach to installation of pumps than maintenance. This is evidenced by the proportion of those which break down and are not repaired. Literature is evident that about 35% of the hand-pumps break down and are deemed non-operational (WHO/UNICEF, 2009). Furthermore, Harvey (2005) postulates that hand-pump- maintenance may share similarities while, at the same time, there are some distinctions from country to country. Thus though maintenance has been explored in some few countries, in the developing world, it was still needful to conduct this study in Malawi and its findings contribute to hand-pump maintenance, after being handed over to end-users. The challenge which confronts hand-pumps in African countries is that hand-pumps' projects have NGOs as project sponsors, which provide investment yet do not benefit the deliverable. The deliverable instead is benefited by the end-users who are customers who did not invest in the project. The

hand-pumps are not maintained when they break down either because end-users expect NGOs, who invested financial aspect to repair or end-users are incapacitated to do so. This is different from business projects where investment is related to return on investment or profit generation for the investors. Hence there should be a body of knowledge to fit the scenario of donor funded hand-pumps in the hands of beneficiaries. In addition, it should be noted that, in rural areas of Malawi; end-users' representative assumes a role of 'driving seat', facilitating operations of rural projects; including water, which has been handed over to them. In brief, understanding the operations that occur have in itself implications of how sustainable and cost effective such projects are. This study, therefore, addresses the following main and subsidiary questions:

### **1.7 The Main Research Question and Subsidiary Questions**

The main research question is: 'What factors facilitate or hinder effective end-user participation in the successful operation and maintenance of drinking-water projects in rural areas of Malawi?'

#### **The Subsidiary Questions:**

The subsidiary questions are as follows:

- a) How do the end-user in-put or contributions influence the outcome of the hand-pump maintenance?
- b) What should end-users do to better understand their roles in hand-pump maintenance?
- c) How do end-users perceive hand-pump maintenance success factors?
- d) What are the key challenges affecting the end-user ability to maintain hand-pumps?

## **1.8 Research Aim and Objectives**

### **Research Aim**

To develop strategies and recommendations to reduce rural water project failure and contribute to the body of Project Management research. The main aim of the research was therefore to explore, identify and understand factors that contribute towards the success or failure of effective end-user engagement in hand-pump maintenance so as to make relevant recommendations.

Maxwell (2012) describes such an aim as practical and intellectual. Practical goals or aims in this case focus on accomplishing maintenance of hand pumps, to meet clean water delivery; thus changing the poor health of rural people, arising from drinking contaminated water. Intellectual goals, on the other hand, focus on understanding or gaining insight of why and what is happening about hand-pump maintenance as a studied phenomenon. Both aims form part of the external aspects of the design. Maxwell (2012) further relates intellectual goals as directly linked to the conceptual framework and research questions than practical goals. Intellectual goals have been converted to viable research questions like ‘how did end-user contributions influence the outcome of hand-pump maintenance’? Maxwell (2012) contends that practical goals can be used to develop research questions by employing an intermediate step like: ‘what do end-users need to do, to improve their understanding about their roles in hand-pump maintenance’? ‘What are their perceptions of hand-pump maintenance success factors?’ Since this study uses the realism philosophy, the goal is, therefore, ‘real’ as it is part of the researcher mental process (Bhaskar, 2000).

### **Research Objectives**

There are several objectives that are targeted in order to ensure that the researcher achieve the study aim. These objectives were to:

1. Critically review, examine and analyse existing literature relevant to the study topic.

2. Examine the project maintenance plans at hand.
3. Explore and describe the end-user roles in different project phases.
4. Explore and describe the challenges end-users face in the hand-pump maintenance of water projects in rural areas of Malawi.
5. Make suggestions for changes in drinking-water project maintenance approaches to improve hand-pump sustainability.

## **1.9 Realism Philosophy and the Research Problem**

The study aims to address the problem of non-operational hand-pumps by proposing strategies to promote maintenance. The research objectives were therefore devised to find solutions of hand-pump operations as a phenomenon which is related to ‘everyday life’ of rural populations of Malawi. ‘Real life situations’ as an issue of investigations is encompassed in realism philosophy (Bhaskar, 2002; Acher, 2007; Maxwell, 2012). Realists argue that there is an explanation for the empirical domain. An example of the empirical domain in this case could be end-users drawing water from a hand- pump or end-users using open surface water because the hand- pump is broken down. Realist, based on the premise of ‘cause and effect’, argue that there are causal entities associated with the existence of functional or non-functional hand-pumps that can only be understood by the researcher’s analysis of peoples’ perceptions of operational and non-operational hand-pumps. This reality is subject to the changing views and opinions of the actors who shape that reality, and this postulation formed the basis of realism research philosophy. In other words, hand-pump maintenance practices are always patterned by underlying forces of which end-users may not be fully aware of but are real (Carolan, 2005). These experiences may or may not be observable. Positivists' abstractions which emphasize the way things look, would in this context loose or miss the important hidden mechanisms behind the hand-pumps that are operational or not operational but in a form of perceptions. A realist engages with the study question because there exist real connections between the causes and effects-a totality of internal related parts where cause and effect exist only in the totality of elements (Harre & Madden 1975).

Unlike in social constructionist philosophy where abstract theory is embedded within the data (Strauss & Corbin, 1990) the variables of analysis show that each of the elements is a relationship and not a discrete object. Nevertheless, social constructionists fail to demonstrate power relations, which is the back bone of realism. In this context, power relation exists because there is an element of emancipation from a phase of non-operational hand-pumps (poverty) to operational hand-pumps (rural development). The next section highlights the structure of the thesis.

## **1.10 Structure of the Thesis**

This section provides a glance of the chapters and sections that are covered in this thesis. Each chapter presents a short introduction highlighting the areas that will be covered in the different sections of the chapter. A summary and conclusion are provided at the end of each chapter to help the reader focus on issues that have been discussed and also guide the reader on the subsequent chapter. The thesis is structured into six chapters.

### **1.10.1 Chapter One: Introduction and the Study Background**

This is a summary of the thesis highlighting what the thesis is all about. The section explains circumstances relating to drinking water projects challenges in developing countries, particularly hand-pump maintenance. The section also explains how and why hand-pump maintenance has emerged as a critical problem in rural areas of Sub-Saharan Africa including Malawi. Poor hand-pump maintenance, therefore, emerges as the research problem and research questions are formed to answer or solve the research problem which is formulated. The scope of the study is also briefly presented followed by research questions and objectives. Qualitative realist approach is identified as most ideals to answer the research questions. The section also explains why findings are relevant to solve the research problem; under justification for undertaking the research. The Malawi profile is also highlighted and how it informs operations and maintenance of drinking water projects. Lastly, the structure of the thesis for each chapter is presented.

### **1.10.2 Chapter Two: Literature Review**

The chapter is outlining the literature selection criteria followed by a discussion on the major thematic issues regarding hand-pump maintenance in rural developing countries. The literature review, therefore, positions this thesis within the context of existing research. The chapter also provides analyses of the conceptual constructs of drinking-water project maintenance identified in the literature review and thereafter analyses their interrelationships outlining the unit of analysis. The first part outlines project management scholarship and lays a foundation of studying rural project management, which includes drinking water projects. A brief discussion is made relating to the state of functional /non-functional hand-pumps; government and donor policy commitments, stakeholder roles and risk issues. These discussions assists in bringing out insights of factors related to hand-pump maintenance. The stakeholder and the inclusive rural development models forms the basis for the study theoretical framework. The study focus converges the unit of analysis in a form of a conceptual framework highlighting hand-pump maintenance factors in a of : monetary/material, technical and organisational factors. The theoretical and conceptual framework eventually guides data collection and analysis in the subsequent chapters. The last section but not least, further highlight Malawi situation analysis in terms of demographics, history, politics, geography and trade and how these directly or indirectly informs the hand-pump maintenance in Malawi. Finally, the case study context is also presented in details.

### **1.10.3 Chapter Three: Research Methodology**

The chapter justifies the choice of appropriate methods to lead to data necessary to answer the research questions. Firstly, a diagrammed sketch is provided highlighting interdependences of : the conceptual framework, methods, data collection techniques, findings, recommendations and conclusions. The sketch acts as a guide on how the research is undertaken and also show relationships of different research phases. This chapter introduces philosophical issues related to drinking water research. Common philosophical paradigms namely positivism, interpretivism and realism are reviewed. The differences between positivism, interpretivism and realism are described and a detailed account is given why a qualitative realist approach is most appropriate to answer the research question. Strengths and weaknesses are highlighted when applied to hand-pump maintenance. Based on consideration of research questions and literature review, realism qualitative research emerges as offering more advantages or strengths hence ultimately chosen as a research paradigm in the study. The next section details why case study was the most suitable research approach to answer the research questions in comparison to other forms like experiments, surveys and grounded theory. The case study is chosen as most ideal because it allows to study hand-pump maintenance as a phenomena in details using multiple sources of data while at the same time allows theoretical replication (Yin, 2009). The following section considers data- collection techniques which helped to answer the research question. Data collection methods included secondary as well as primary data. Secondary data was in a form of documents and observations. Primary data collection techniques included Convergence Interviews, Individual Case Interviews and Focus Group Discussions. Data collection process in terms of how hand-pumps were purposively sampled, whilst details are also given related to choice of respondents using snow-ball sampling.



The next section explains how data was analysed using content analysis for documents and reports as described by Sapsford & Jump (2006); Robsons (2011) and Miles & Huberman (1984). Convergence Interviews were analysed using a matrix to identify categories whilst Individual Case interviews used likert-type scales to identify the most occurring hand-pump maintenance categories. Finally Focus Groups are manually analysed using content analysis as well, so as to engage with the data which may not have been possible in computerised analysis. The last section outlines the principles of conducting the study which included validity, reliability and ethical issues. The section also points out methodological limitations which were encountered and measures taken to overcome them. The chapter ends with a summary and conclusions.

#### **1.10.4 Chapter Four : Study Findings and Analysis**

The chapter highlights contextual view of hand-pump maintenance in the villages of Khuwi, Mavule, Chadza, Kachepa, Kamjeda, Mphenzu, Gute, Bulaki and Kapsyepsye. This chapter findings is presented based on each of the data collection techniques used namely: documents, observations and interviews. As interviews comprise the primary and the main data collection; each section also highlights how each of the different objectives was met. The key finding is that end-users are able to contribute to small/medium hand-pump maintenance but unable to do complex faults and/or hand-pump rehabilitation. The factors which promote end-user hand-pump maintenance include: household end-user labour and financial contributions, training of the local committees and active roles of the local committees. Conversely, factors that limit hand-pump maintenance include lack of sponsor support when pumps are handed over to them as unable to manage complicated faults both financially and technically. The section ends with the overall summary.

### **1.10.5 Chapter Five: Discussion and Recommendations**

A more detailed discussion of the results is given with particular reference to the implications of the results; how the results relate to the existing body of knowledge; as to whether they agree or are contrary to the current drinking water research and findings; and the new insight offered. This chapter also discusses and interprets the findings in relation to the models of rural development, the study adopted. Specifically, the chapter discusses what the results mean and how they fit in the existing hand-pump maintenance literature and project management broadly; as to whether they are consistent with, contradictory or brings new insights in the body of knowledge. Firstly a summary of findings on each hand-pump is presented. Findings are integrated through a cross case analysis and the literature reviewed. Hand-pump maintenance factors and limitations are discussed in terms of how they influence or impact the functionality of hand-pumps.

### **1.10.6 Chapter Six : Conclusion and Implications**

This is the final chapter and explains how the research problem is resolved by the means of answering the research question. This is followed by the claim the study presents in a form of contribution of knowledge to project management scholarly, practice and research. Finally, a discussion on the study limitations is presented. Recommendations for further practice is highlighted. The last section is the final conclusion of the thesis.

## **1.11 Conclusion of the Introductory Chapter**

This introductory chapter defines the research problem and the way it was addressed through the determination of research questions, aims and objectives, and the justification for carrying out the research. The research is justified based on the need to explore the problem. The next chapter examines current thematic issues that dominate research in the management of rural water projects and its relevance in Project Management.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

This first part of the chapter provides an analysis of the Project Management research literature relevant to this study. The intention is to review and convey the contemporary thematic issues that dominate Project Management research, which are applicable in the analysis of the hand-pump maintenance of rural-drinking-water projects and to situate this PhD study within existing research. The literature review also facilitates the determination of variables to consider in the analysis of end-user roles in drinking- water project maintenance. The following section further highlights some of the debates in the analysis of rural drinking-water projects and explores their consequences on the hand-pump maintenance by end-users. The last section but not least, further highlight Malawi situation analysis in terms of demographics, history, politics, geography and trade and how these directly or indirectly informs the hand-pump maintenance in Malawi. Finally, the case study context is also presented.

Selection of literature reviewed is based on credible and reputable articles identified based on an impact factor, which is the number shown at the bottom of each article indicating ranking of the journal. 3-4 star ranked journals are considered as highly credible and very respectable. The main result from the literature review determined the theoretical parameters within which to carry out the research and to position this thesis within the context of another rural drinking-water research. The literature review was conducted in the stages presented in Figure 2 on the next page.

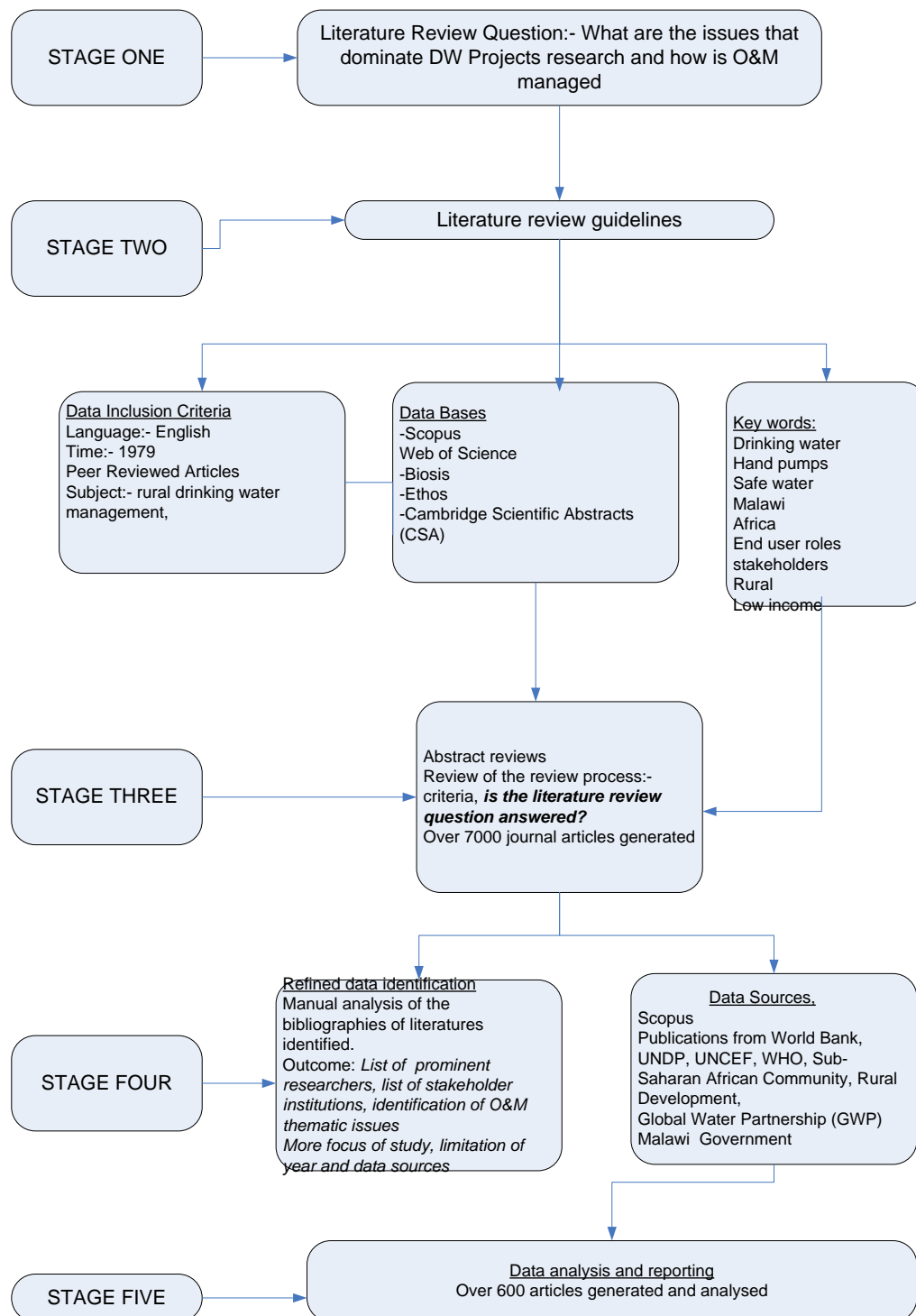


Figure 2: Literature Review Stages

## **2.2 Literature Review Stages**

The first stage was the formulation of review guidelines that outlined the literature review strategy, including: search terms, data sources, data inclusion criteria and data analysis methods. The examination protocol outlined terms for scrutinizing the literature review process, whether the outcome of the literature review did not meet its objective. Initial literature search included research reports and reviews from electronic databases like SCOPUS, Biosis, EBSCO, SAGE, Cambridge Journals and Web of Science. Zetoc database was used to generate international conferences on rural drinking-water issues. The research also stipulated the peer-reviewed articles published in English as a criterion for selection.

The second stage in conducting the literature review entailed the determination of the literature review question, which was done by consulting research work from other researchers in rural projects on trustworthy and respectable articles identified based upon the impact factors, which is the number shown at the bottom of each article indicating ranking of the journal. This analysis was mainly limited to peer-reviewed journals. However, once the researcher started the literature review, another relevant literature on the subject was also considered. These entailed consulting current journals, books, conference reports and grey literature.

## **2.3 Thematic Issues in Project Management Research**

Defining parameters of drinking-water research has its roots in project management research. The Project Management Body of Knowledge (PMBok) have been making several attempts to define and determine the parameters of Project Management in general. The United Kingdom (UK) Association of Project Management (APM) have produced a UK Body of Knowledge, which also provides this definition of Project Management as: *The planning, organisation, monitoring and control of all aspects of*

*a project and the motivation of all involved to achieve the project objectives safely and within agreed time, cost and performance criteria* (PMI, 2008). The British Standard for Project Management, commonly called Prince 2, defines project management as: *The planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance* (DGC, 2008).

Pinto (2000) defines Project Management as *the application of a collection of tools and techniques to direct the use of diverse resources toward the accomplishment of a unique, complex, one-time task within time, cost and quality constraints*. Meredith and Mantel (2006) focus on facets of Project Management, steps needed to successfully manage a project-from planning and resources to budgeting. In 2003, the UK's Engineering and Physical Sciences Research Council (EPSRC) agreed to fund a research study aimed at enriching and extending the subject of project management, with the intent of highlighting the growing critiques of project management *theory* and the need for research in relation to the developing *practice* (Winter et al 2006). Of interest for this research is the fact that these attempts to define and outline the parameters of Project Management have the project manager or managers as the person(s) with the single point of responsibility for ensuring project success (PMI, 2008). However, in rural Africa, once the initial project managers have exited, the task of managing the project is left to the end- users. It is therefore, necessary to investigate whether the new project managers (the end-users), understand the complexities of managing projects.

There are two main categories of Project Management theoretical models. The hard paradigm category has its roots in engineering science and applied mathematics. This paradigm focuses on Project Management planning techniques and methods (Pollack, & Bentry 2006). The soft paradigm category is more social sciences oriented than the

former; it analyses the organisational theory and psychology whilst also focusing on the stakeholders' behavioural aspects to the project (Soderlund, 2004; Pollack & Bentry, 2006). Soft Project Management in this context emphasises on intangible issues such as end-user roles in hand-pump maintenance phase. Consequently, end-user perceptions have their roots in the soft paradigm of Project Management (Pollack & Bentry, 2006). Both the soft and hard paradigm models are reflected in the different stages of the PM life cycle.

### **2.3.1 Project Management Life Cycle**

The Project Management Life Cycle has five stages or processes: The initiation and conception, design and development, execution, commissioning and hand over (Kezner, 2008; APM, 2006). The project concept is instigated during the initiation phase; the solutions are specified during the design and development phase. The implementation or execution stage involves the carrying out of the project plan, and finally; the completed product or deliverable is handed over to the owner in the final stage. Project planning can in simple terms be defined as outlining the scope, schedule and cost (Lock, 2007). Project time-scope-cost are the iron triangle in determining the success of the project. Time is often attributed as the greatest and most common constraint during the project. It has to, mainly because project managers are anxious and concerned with the pressures of impeding deadlines. The other constraints are costs, and scope; costs entail the resources needed to carry out a project while scope focuses on quality, functions and features of the project (Reiss et al., 2006).

Saynisch, (2010) contends that classical definitions and determination of Project Management phases are not wrong, but incomplete. They instead favour a reassessment of the definitions of a project as a temporary organization; viewed as a production function, as an agency for assigning resources to the management of

change within the functional organization, and as an agency for managing uncertainty. The definitions and concepts of project management by Ramaprasad, (2003); PMI, (2008) and APM, (2006) capture the essence and variables of project management which include analysis of initiation, planning, execution, monitoring and control, closing and the determination of project complexity, social processes, value creation, project conceptualization, and practitioner development. These variables facilitate the analysis of project success.

A vast number of researchers concur that a project's success is dependent upon the accomplishment of objectives such as; managing projects within budgeted costs, within schedule and achieving acceptable quality (Papke-shields, 2010; White & Fortune, 2002; and Anderson, 2008). The above variables are, to some extent, tailored for complex projects that have financial deliverables and a Project Manager (PM) or management team foreseeing the success of the project. In the rural areas of developing countries, it is conceivable that the project manager or management team will change during the project. This often occurs when the donors hand over the project to the local communities in the final stages. Ensuring the success of the project is therefore, a task left to the locals or the end-users. This in turn raises interesting issues concerning their competence as project managers in the hand-pump-maintenance phase.

Project Management research literature concludes that the discipline was originally designed to fit industrial projects, which are business or profit oriented (Biedenbach & Muller (2011; Kwak and Anbari 2009; Morris 2011). However, Muriithi & Crawford (2003) and Muriithi, (2003) argue that most projects in rural Africa may not be concerned with profitability or may not have a business orientation. Carden (2008) and Khang (2008) agrees that development projects, which include rural project's effectiveness, is a new area in Project Management research. Muriithi & Crawford



(2003) observe that transferring Project Management issues, which have western ideologies and value system, may contribute to project inefficiency and ineffectiveness in rural projects. Stakeholder end-users in rural projects of growing economies are not absorbed or concerned with economic development but are rather influenced by internal values and socio cultural issues.

Research articles published in Project Management journals have focused on construction and manufacturing sector projects, but rural water projects are less represented, and stakeholder perceptions have not been comprehensively researched (Toor & Ogunlana, 2010; Zwikael, Shimizu, & Globerson, 2005). What is evident from the definitions and research literature is that Project Management is a dynamic and evolving subject. The analysis of its application in rural Africa and other developing countries is more than relevant in Project Management scholarship.

### **2.3.2 Project Management in Rural Projects of Developing Countries**

PMI (2008) and APM (2006), which is the main PM bodies of knowledge, assert that Project Management planning tools are universal; however, research is not conclusive as to whether the Project Management planning and execution approaches are applicable in both developed and developing countries. Kwak & Anbari, (2009), Kloppenborg et. al (2011); Themistocleous & Wearne, (2000) ; Muriithi & Crawford, (2003); Kwak, (2002) concur that there is a relative lack of research in identifying Project Management practices in rural projects in developing countries. Tensaki and Hay (2004) argue that the development projects investigations haven't been undertaken among the Project Management researched topic areas in prominent Project Management journals such as; the International Journal of Project Management (IJPM) and Project Management Journal (PMJ). Winter & Smith (2006) as well as Themistocleous & Wearne (2000) review of Project Management research

topics in publications of IJPM & PMJ concludes that out of forty four Project Management topic areas of publications, stakeholders issues in general are not covered neither is attention paid to the rural water stakeholders' perceptions. Themistocleous & Wearne (2000) and Tensaki and Hay (2004); Winter & Smith (2006) are among the few publications in PM journals explicitly discussing the inclusion of stakeholders' views in Project Management. Kloppenborg, Tesch, & Manolis, (2011) contends that two-thirds of Project Management articles exclude stakeholders' perceptions. However, the stakeholders, who in this context are also the end-users, are vitally important to the sustenance of such rural drinking-water projects.

ODI, (2004); Nwankwolala, (2011); Shanti & Khan, (2010) and Schouten & Mortiarty, (2003) agree that a comprehensive research on development projects is necessary since these projects aim to advance the livelihoods of communities in rural areas. In addition to managing projects within the traditional and often business-oriented prerequisites of scope, cost and schedule, there is a need for a further set of project success factors aimed at the rural projects. This category of projects may require an additional set of success factors due to the complex stakeholder environment in which they operate.

### **2.3.3 Determining Rural Project Management Success**

Every project aspires to have a favourable outcome and achieving success factors is related to accomplishing milestones. Project Management success is codified in standards, tools and techniques, based primarily on experiences of practitioners in developed western economies and relies extensively on assumptions of profit generation (Muriithi and Crawford, 2003). Diallo (2004) and Diallo & Thuillier (2005) argue that universal success factors in PM domain may not be relevant in rural

project management context if they contradict end-user cultural factors. This is because they are different variables to consider in the determination of project success factors. These include; lessons learnt from political, cultural, technical, managerial, economic, and environmental factors (Asthana, 2008). According to Bryde, (2008), there are short as well as long-term success factors and measuring success of projects is often varied depending on the circumstances. Short term factors are those which affect project time, cost, and quality and scope before or during the implementation phase. The long term factors are those which include end-user roles or satisfaction. Bryde & Robinson (2005), White & Fortune (2002) Crawford (2003) and Cooke-Davies (2002) all agree that in the Project Management discipline, different projects are perceived to have completely diverse success factors at different stages in the project life cycle. Bryde & Robinson, (2005); Pinto, (2010); and Cooke Davies, (2002) concur that there has been considerable research on project success factors in developed countries, however, according to Diallo, (2004) ; Diallo & Thuillier, (2005); Ahsan & Gunawan, (2010) there is a need for related research in developing countries.

Project success factors in developed countries mainly focus on cost, schedule and scope, which are the 'hard' issues of Project Management (Soderland, 2004; Smyth & Morris, 2007; Saynisch, 2010; Turner, 2010). For example, Ahsan & Gunawan (2010) asserts that most rural projects exceed budget and therefore, the need for further research in the determination of project success in rural parts of Africa. Even though projects in rural areas of Africa, like most business projects, have success factors based on cost, schedule and scope during or prior to implementation phase. Ashbolt & Barnes, (2010); Diallo & Thuillier (2005) have proposed for additional present-day dimensions of understanding of contextual factors that are unique to development projects, including drinking-water projects in rural Africa. They further argue that universal success factors in Project Management discipline may not work in the rural

African context if cultural issues are not factored into the research. Harvey (2007) argues that lack of clarity at the policy level on the nature of operations, and management has contributed to varied approaches to the determination of drinking – water project success, in the maintenance phase, in many parts of the Africa. By investigating end-users roles, this study aims to develop strategies and recommendations to reduce rural water project failure and contribute to the body of Project Management research.

The analysis of factors that contribute to the success or failures of rural water projects can be assessed at different phases of Project Management, there are; preparation, facilitation, appraisal financing, implementation, monitoring and evaluation (PMI, 2008). DOLG, (2001) specifies the activities within each phase as below:

**Preparation phase:** OECD (2004) states that a rural project preparation phase is when the NGO develops information, and education campaigns to provide key messages to communities and other stakeholders. Key issues include information about the project, technical options, and expert advice to communities on managing construction, recurrent costs and pump-maintenance.

**Facilitation:** The NGO employs teams of field workers who facilitate the local planning process and promote community access to information and resources.

**The sub-project appraisal:** Appraisal of community sub-projects is carried out at two levels commonly referred to as desk and field (DOLG, Malawi, 2001). The desk appraisal involves a basic review of the end-user application to ensure that it is in line with the scope and objectives of the project, and also ensures that it fulfils the guidelines and criteria set out by the NGO and overall funding agency. The field appraisal involves assessing the technical, social, and environmental aspects of the proposed sub-project, as well as the “willingness” of the community to implement it (DOLG, Malawi, 2001). This would also include assessing the community’s ability to account for and report on the sub-project funds. Appraisal of sub-projects is completed using objective and transparent criteria of which the end-users are aware of.

**Financing:** Once a subproject application is approved, the NGO enters into a contract (financing agreement) with the end-users (OECD, 2004; Mansuri & Rao, 2004). Usually the community is responsible for all aspects of subproject implementation, including procuring goods, hiring contractors, overseeing

construction, and, as necessary in the case of erecting a school block or local bridge. In a drinking-water project, communities may be involved in hiring technical experts for drilling the hand-pumps (Malawi, 2005; Laverack, 2001). Funds to the community are released on periodical basis and depend upon the size of the grant, length of implementation period, and capacity within the community.

**Implementation:** DOLG (2001) and OECD (2004) highlights that the NGO trains communities in all aspects of subproject implementation, including accounting and bookkeeping, procuring labour and materials, operation and pump- maintenance, and ensures transparency and support accountability in the activities within the project local committee (Laverack, 2001).

**Monitoring and evaluation:** The NGO develops a monitoring and evaluation plan and completes participatory financial audits of community accounts to ensure proper usage of funds, transparency, and accountability, especially in construction projects (Malawi, 2005).

These phases are outlined within the context of an ideal Project Management Approach which often does not work. DOLG, (2001) and OECD, (2004) asserts that the planned design may be more theoretical than practical due to hazardous stakeholder challenges during the different phases of a drinking water project. The determination of an effective pump- maintenance phase success is dependent on end-user participation in the conceptual, planning and implementing and hand over phases of that project cycle (Gutierrez, 2007), yet challenges exist. According to Gutierrez (2007) and Sonuga & Aliboh et al, (2002) in most developing countries, there is unsatisfactory planning, management of hand-pumps is fragmented and in other areas it is actually non-existent leading to non-operational hand-pumps. Prokopy (2005) and Narayan (1995) contends that reasons for substandard hand-pump- maintenance mainly focuses on end-users roles in terms of whether projects were demand driven and accepted by end-users whilst in project preparation phase or not. According to Ashbolt & Barnes, (2010); UNDP, (2003); Dvir, Raz & Shenhar, (2003) there is a relationship between end-users involvement in planning framework and end-user ability to monitor water project during implementation. However, Diallo & Thuillier (2010), argues that no relationship exists between project planning and project

success, but rather success factors are based on project supervisors capabilities and monitoring mechanisms developed. This argument by Diallo & Thuillier (2010), fails to compliment end-users as supervisors, neither end-user ability to monitor and evaluate the hand-pump project mechanisms nor phases after the installation stage. In the hand-pump projects, there is a considerable focus placed on maintenance of the hand-pumps at the village level using the rural project management design which is 'bottom-up'.

#### **2.3.4 The Rural Project Management Design: 'Bottom-up' Initiatives**

The rural project management design is often referred to as 'bottom-up' rather than 'top-down' approaches. NGOs may adopt a 'top-down' or 'bottom-up' approach to involving end-users in the business of installing and maintaining hand-pumps. Wertz, Odekova & Seaman (2011) defines a 'top down' approach as one where the drinking-water project evolves without involvement of end-users, resources are centralised and pump- maintenance is the responsibility of the district water board or the NGO. In contrast to 'bottom-up' approach, end-users are part of the needs' assessment for the drinking-water project and assume the responsibility to maintain the pump (Weber & Weber, 2010).

The advantage of the 'top-down' approach is that it is centralised, in a sense that the end-user would not be required to carry the monetary demands as the government or NGO would bear responsibility for repairs. The disadvantage to this approach is that it may not be feasible due to the limited life spans of NGOs and the governments' finite resources. On the other hand, the advantage of the 'bottom-up' approach is that end-users are very much part of the process and therefore, proactive in hand-pump maintenance. Woolcock & Narayan (2000) asserts that when end-users are involved from the project inception at the end, they form part of the needs assessments process.

A 'bottom-up' approach also requires the involvement of end-users in the problem identification, solution generation, implementation and evaluation of the project (APM, 2006; PMI 2008). The disadvantage is that engaging end-users can be a complex process and require involvement of resource persons familiar with training the rural programmes (Narayan, 2000). The activities undertaken by NGOs/donors may include assisting end-users to prepare proposals, appraisal and approval, sub projects implementation, monitoring and evaluation and completion of subproject. However, this is also based on donor aid requirements. Laferrara, (2002); Laverack, (2001); Mansuri & Rao, (2004) argue that strategies dealing with managing rural projects from a 'bottom-up' context mainly rely on community or village volunteers.

#### **2.4 The Village Level: Village Volunteers - A Back Bone of Hand-pump Maintenance**

Hand-pumps are a concern for stakeholder end-users; among the ways to operationalise them is by deploying village volunteers. Village volunteers, often selected by the community, are men and women who do the project work without pay (OECD, 2007). The volunteers are generally selected based on their basic numeracy skills. In drinking-water projects, the volunteers assume the roles of a water committee; pump technicians and village pump mechanics. Volunteers also include those in the rural local government development structures at the village level which include the Village Development Committee (VDC) and Area Development Committee (ADC). Project sponsors may train them to manage specific tasks for the rural project. In hand-pump maintenance, training may be tailored as in Table 5 below.

**Table 5: Training Content for Village Volunteers: Local Committees and Hand-pump Mechanics**

<b>Cadre</b>	<b>Training Content</b>
Water Committees	VLOM pump : advantages, construction materials ; faults identification and servicing ; routinely wearing parts like how to remove rods and replace gasket in routine quarterly maintenance (minor maintenance) ;Resource mobilisation ; fund-raising ; hand pump construction; raising standards of sanitation in the village; reporting to health workers and health promotion
Pump Mechanics and Technicians	Identification of routinely replaced parts : bearing bushes, U-seal, bobbins and complicated faults involving the O-ring
VDC/ADC	Identifying local contractors; supervision of work ; group dynamics and governance.

Data Source: Health Surveillance Assistant Training Manual, 2009; Concern Universal Annual Project Report, 2007

Once trained the village volunteers may carry out some routine and adhoc maintenance on hand-pumps. Table 6 below highlights some common faults diagnosed after training and the related remedy the volunteers can operate.

**Table 6: VLOM Hand-pumps Faults Repaired at Village Level**

<b>Problem/fault</b>	<b>Possible cause</b>	<b>Remedy</b>	<b>Repairer</b>
Delayed water flow	Foot valve leaking  Leaking rising main	Checks and replaces bobbin and O-ring on the foot valve Checks and repairers raising main	Pump mechanic /water committee
Weak water flow	U-seal worn out, damaged. Plunger or foot valve bobbin worn out or damaged. O-ring on foot valve out or damaged	Checks and replaces U-seal bobbins and O-ring	Pump technician /mechanic
No water flow	Plunger or foot valve bobbin stuck or damaged. U-seal displaced or damaged	Checks and cleans, replaces if necessary	Pump technician

Data Source: Concern Universal Annual Project Report, 2007



Though village volunteers assist in the bulke of the work, Cooke and Kothari (2001) highlight challenges related to projects relying on volunteers. The main problem is to motivate the volunteers who do the project work without pay. Weber & Weber (2010) highlights motivating volunteers with a monthly honorarium as a token of thanks. However, strategies to motivate the volunteers have also not been sustainable. Another issue to motivate them has been providing them with necessities to help them do their job. For example, a bicycle, soap, and a logo T-shirt are commonly given to volunteers doing health activities. The other example is having packed lunches, drinks and snacks during the monthly meeting of the project coordinator, and volunteers have also increased their morale. Most volunteers are motivated by social status they acquire in the village by the virtue of being a volunteer in the village, and also by the fact that they contribute to the sustenance of their own hand-pump.

Use of volunteers as part of 'bottom-up' participation of end-users has benefits in overcoming local problems. End-user participation has been linked to improving services at the village level than when they are not involved (Labonne & Chase, 2009). Project end-users may be empowered as they participate throughout the process of decision making, manpower, monitoring and evaluating water projects (Prokopy, 2005). However, Weber & Weber (2010) equally show some critique of participation in water issues, which could lead to negative issues other than benefits. For example, it is stated that participation may not operate if local people have no ability to influence the direction of the rural water project (Prokopy, 2005) and that the process places unfair burdens on the shoulders of the poor people (Cooke & Kothari, 2001). Poolman and Van De Giesen (2006) argued that end-user participation is more rhetoric than reality. It is also argued that end-user role in the rural project operation is time consuming, confusing procedures for funding approval when water projects emerged from the bottom up. End-user themselves may lead to a

negative impact of hand-pumps. This happens because stakeholder end-user volunteers may pull out in the operations and management of Village-Level Operations and Maintenance (VLOM) of hand pumps.

#### **2.4.1 Origin of Village-Level Operations and Management of Projects**

End-user roles are believed to be the main determinant to sustain rural projects, including the hand-pumps. The concept of end-users as the main stakeholders of rural projects started across the agriculture field and is now advocated in drinking-water as well. Burkey, (1993) contends that the determination of end-user roles has its origin in the agricultural field in the 1960s, with the main focus on raising awareness of public participation in rural development projects. Chambers (1993) states that in the 1970s, end-users were mainly involved in data collection at the village level; for example, village health volunteers identifying children with malnutrition and referring them to a health facility. In 1980s issues concerning cooperating local knowledge in development projects was considered by donor agencies advocating for use of local knowledge in project development (Chambers. 1993; Burkey, 1993). For example, end- user using local resources of salt and sugar to treat diarrhoea diseases in children, which was commonly called oral rehydration therapy (WHO, 2004).

The Organisation of Economic Co-operation and Development (OECD, 2007) highlights that in the 1990s, the use of stakeholder end-user participation as part of sustainable development agenda for rural projects was encouraged. Apart from the agriculture sector, since 1990s, parallel sectors also used end-user participation as they attempted to sustain operations of different rural programmes (World Bank, 2000). Chilaka (2005) highlight end-user involvement in malaria control in Bukina Faso, Ghana, Nigeria, Tanzania and Uganda though financial resources, competent health staff and health infrastructure were equally relevant. Deliion and Ninan (World

Bank 2008) clarify the concepts of community input in cash or kind in rural projects as there has been debates as to what warrant end-user participation even in VL0M.

End-users are a backbone for efficient VL0M of hand-pumps. The focus on end-users creates a clearer vision of what is expected of them for effective VL0M, thus making it easier to guide and determine pump- maintenance (UNDP, 2006). According to Harvey (2007), VL0M entails determining a framework within which to manage end-users' activities in a manner that it improves their own contributions to drinking-water project management. La Ferrara, (2002) defines operations and management as a sustainable approach in the hand-pump management that recognizes its multidimensional character, which includes technological aspects as well as stakeholders' roles. Effective operations and hand-pump maintenance is based on the premise that there are complex problems, which cannot be tackled without taking into account stakeholders' end-user roles and their governing structures (Laverack, 2001; Haque, 2004). The importance of involving end-user stakeholders is recognized in theory and practice as a central aspect of the hand-pump maintenance (WHO/UNICEF, 2004; Chambers, 1997).

Effective stakeholder end-user notion is based on coordination. Hand-pump-maintenance is an integrated approach based on the notions of coordination, resource mobilisation and ensuring local stakeholder end-users efficiency to repair, replace and rehabilitate the hand-pumps (ODI, 2004; UNDP, 2009). This approach to management of drinking-water projects increases the scope of operations and management because the focus is not only on the pump and fixing the parts but also on development of local capacity in terms of governance for the operations and management process. There are several aspects of VL0M of hand- pumps, including:

- Ensuring that hand pumps provide safe water free of pathogens, which cause disease and deaths.
- Ensuring that operations and management of pumps is based on the effective participation of end-users as these are core beneficiaries.

Several researchers, including Harvey & Reed (2003), Kleemeier (2000), Prokopy (2009), Ashbolt & Barnes (2010), Narayan (1995) contend that VLOM pumps are ideal for developing countries. VLOM has been used in India, Kenya, Uganda, Zambia, Ghana, Cameroon and Botswana (Mbata, 2006). According to the Water Engineering and Development Centre (WEDC) (2010) when VLOM pumps have coordinated maintenance efforts, coupled with local end-user resource mobilisation, it may lead to sustainable water supply for end-users.

Though end-users are encouraged to participate in VLOM, there have been challenges. Kleemeier (2000) contends that about half the rural drinking-water schemes were not functioning properly in Malawi. Kleemeier (2000) analysis is, however, limited to the rural provision of drinking-water through rural piped gravity schemes. Whilst Kleemeier (2000) claims are relevant in localized scenarios, the outcome might be different when the subjects of analysis are hand-pumps where there are many demands for replacement of worn-out parts of the technology. Nevertheless, Kleemeier (2000) work is reliable and valid as used country-wide surveys, producing data, which is more robust (Cresswell, 2007) conversely, the weak area is that end-user views were not represented which this study engages in. In addition, a decade has passed since Kleemeier (2000) work hence there is a need for an up-to-date account of the hand-pump maintenance to determine causes of non-functional hand-pump.

#### **2.4.2 Non-functional Hand-pumps and Ways to Mitigate the Situation**

Hand-pump failure in a form of non-operational state is attributed to several reasons. A non-functional pump is about failure of the pump to deliver or yield clean water. Some pumps are non-functional after construction due to aquifer problems (rock underneath) or technical incapacity of engineers when designing accurate levels of drilling required (Harvey, 2004). Barnes & Ashbolt (2010) argue that the more common cause of non-functional pumps is related to failure to repair the hand-pumps when worn out. According to WHO/UNICEF, (2004) non-functional pumps influence end-users to resort to unclean water, which is harmful for their social-economic wellbeing. Non-operational pumps are not used either because of the poor quality of water yielded or failure of the pump. Non-functional hand-pumps are also related with the quality of water for human consumption.

Pumps may be deemed non-functional if they do not satisfy the safety of water for human consumption in terms of chemical composition as specified by World Health Organisation (WHO, 2004). WHO disqualifies water yielded from the hand-pump as consumable if fluoride levels are higher than the drinking-water guidelines' values of 1.5mg/l (WHO, 2000). Levels beyond this could predispose to dental and skeletal problems (Harvey, 2004). Poor taste of water from some hand-pumps has led end-users to disqualify some pumps, particularly if there is silt, corrosion or acidic water (Kleemier, 2000); however, there are also other factors, which affect whether hand-pumps operate or not as the case of donor-aid and policy issues.

### **2.4.3 External Factors of Hand-pump Maintenance: Donor Aid and Policy Commitment**

Hand-pump- maintenance is done within the framework of donor aid and local government policies (UNDP, 2006; Vaija & White, 2008). Donor or foreign aid in this context is external financial aid, which could be in monetary or non-monetary terms. The significant donor in hand-pumps' projects just like most development projects is IMF/World Bank through UNDP (UNDP, 2006) which dedicated \$23 billion towards funding water related projects that integrate hand-pump installation and maintenance (World Bank, 2008). However, UNICEF and WHO are the main facilitators of drinking-water projects (WHO, 2000). Hand-pump policies, therefore, originate from IMF/ World Bank (World Bank, 2008) as they invest the financial resources through NGOs, governments or private sectors.

Donor aid funding investment is the key to summon end-user requirements or contribution in hand-pump maintenance. According to the World Bank, end-users should partially contribute towards the financing of the hand-pump, particularly in pump- maintenance phase. Traditionally, IMF/ World Bank foreign aid for rural projects had no conditions attached to it until the 1990s. Since then there has been debates on foreign aid effectiveness and economic growth of recipient countries. Economic growth in this context is about improved poverty indicators and well-being (World Bank, 2004). Aid policy reform for most developing countries has attached conditions, particularly for infrastructure projects like schools, hand-pumps, bridges and clinics since the work of Collier & Dollar (2001). Collier & Dollar (2001) propose effective aid as a form of decentralised pool funding and end-user contributions. Collier & Dollar (2001) work influenced IMF/World Bank to initiate end-user contributions in most projects for the poor, particularly infrastructure projects.

Donor aid and end-user policy are part of the strategies encouraging end-users contribution for maintenance. Donor aid policy is a significant variable in hand-pump maintenance because donor aid policy may or may not advocate end-user involvement. IMF and World Bank (World Bank, 2004) are among institutions, which encourage an end-user contribution in overall hand-pump project budget. The United Nations Development Programme (UNDP) requirement is that end-users contribute to hand-pump financing in form of cost sharing (UNDP, 2006; UN Malawi, 2006) either in cash or kind to about 5-10% of the total cost of the asset. Whether recipient local government structures are willing to support end-users to comply to donor aid requirements for hand-pump- maintenance remains unclear. UNDP (2006) further stipulates that IMF/World Bank require local government reorganization of localized structures from centralised to water down their power through decentralised management, which gives more decision-making authority to local stakeholder end-users and their local representatives or committees at village, area, ward and councillor levels; even so, this issue requires contextual investigation.

However, Hansen & Tarp (2000) argue that economic growth in aid recipient countries is not limited by good aid policies. It has been proposed by Dorwick et al (2001) to measure poverty progress by life expectancy other than limiting aid because of poor policies or centralised system in recipient countries. Equally, Collier & Dollar (2001) support the view that aid should be based upon the level of household poverty other than by other political or national income determinants. According to Van Koppen (2007), water in most rural areas in developing countries is still a free commodity that belongs to the public and there are no fees or charges attached. Therefore, the imposition of tariffs within the donor aid policies may be difficult to comply by some end-users in low-income or ultra-poverty regions in developing countries. Furthermore, in relation to rural development approach, questions arise as

to whether the local stakeholders are expected to fund the hand-pump- maintenance, which this research clarifies using a case study in rural areas of Malawi.

End-user contribution is often a requirement that funders attach to their grants offers (UN Malawi, 2006). The idea for end-user contribution is to reduce donor dependency and ‘install’ the concept of self-help, ownership, and empowerment other than passive recipients (UNDP, 2000). Whilst the NGOs role is to cater for total cost of the assets and project administrations, stakeholder end-users are urged to contribute 5-10% of the total cost of an asset as a form of an upfront pump- maintenance cash, materials like sand, bricks, gravel and free labour for digging the wells (UNDP, 2006).

Cost sharing is encouraged because water assets have been poorly managed once international NGOs withdraw funding in Malawi (Malawi, DHS surveys, 2004). Peet (2003) suggests that drinking- water be priced correctly to economize on water use even in developing countries but that many rural water users cannot afford to pay. However, Whittington (2002) argues that even poor rural end-users are willing to pay but that politicians discourage payment to gain votes. Schouten & Moriarty (2003) argue that willingness to pay may differ from the ability to pay as poor users may not have the ability to pay. Though World Bank (ODI, 2004) and other prominent donors have prescribed upfront payments by end-users, Schouten & Moriarty, (2003) argues that upfront contributions can hinder some users to have hand-pumps and also fail to maintain them.

End-user financial contributions aimed at fund-raising for on-going management of water assets is practiced in some developing countries such as India (Prokopy, 2004); Tanzania, (Gine & Prez Foguet, 2008); Swaziland, (Graciana, 2010). According to Prokopy, (2005), End-user fees and participation had a positive impact on drinking



water projects in India as some hand-pumps were maintained by end-users. However, Prokopy, (2007); Vankoppen et al, (2012) argue that cost sharing can discourage end-users if payments are not fairly done and transparent. According to Harvey, (2007) demanding that rural end-users donate to project financing is ‘tyranny’. Non-financial contributions may also be acceptable. Upfront monetary contributions had negative effects on project outcome (Gross et al, 2001). Schouten & Moriarty (2003) argue that research on end-users contributions ought to focus not just on budgetary issues but also on unpaid labour. Prokopy (2007) contends that payments by end-users who are relatively poorer than other villagers are disadvantages because it results in marginalisation of the very poor, which is against human rights.

Marginalised end-user human rights are to be upheld just like any other human being. Human Rights is about the welfare one deserves for virtue of being a human being. Article 8 and 12 of the Human Rights Act states the roles within the government to provide for their citizens. It is therefore, the authorities’ responsibility to devise ways how the basic needs of the inhabitants are met. Although Article 8 and 12 advocate protection of the marginalised groups; governments in developing countries are also often donor dependants (UNDP, 2006).

Hand-pumps are operated within local government policy guidelines. Local government policies have their (DOLG, 2001) origin from the 2000 Millennium Development Summit in which the United Nations mandated its member states to create road maps for achieving drinking-water and sanitation by 2015 (UN, 2000). Political leaders, including those from Malawi at the meeting committed to reforming drinking-water management, which meant that water managers at the national, regional and local levels had to accept and implement the concept of hand-pump maintenance. Despite the commitment there have been challenges some of which are related to local government and decentralisation.

#### **2.4.5 Local Government Committees' and Decentralisation in Drinking-Water**

Local government committees are believed to spearhead good governance. Wertz & Odekova (2011) describe local government committees as a basis for effective rural projects. Local government committees are a form of local leadership in rural projects with the aim to catalyse rural development, including the hand-pumps. Heinrich & Lopez (2009) asserts that the nature of end-user participation in hand-pump projects is shaped by existing power and social relations, and that project identification process is led by a small number of people usually the school head teacher and traditional leaders. In line with this Prokopy, (2007) observed that the economically better off, more educated and the better networked community members were more likely to have their preferred project selected by the higher committees for funding. Prokopy further asserts that as much as most end-users participate actively in making bricks for building hand-pumps they are passively engaged in decision making. However, the difference between Heinrich & Lopez (2009) and Prokopy (2007) is that Heinrich & Lopez (2009) ascribes to the trend of leaders dominating due to the way social fund by donor agents has laid their instructional or policy requirements. This difference in outcome may be critically examined on how end-users perceive their leadership to contribute to mechanisms/causal powers for hand-pump operations or non-operations. Leadership is also linked to whether it functions in a decentralised or centralised system.

Decentralized systems of local government affect pump-maintenance. Decentralization is defined as sharing of power between communities and authorities in the same village, area or ward (Asthana, 2008). Decentralization is done to reduce power of the central local government administration by transferring some of its power to those at the receiving end- thus the structures at ward, area and village

levels. The concept helps centralized governance to access community without actually losing power. Decentralized systems have been recently advocated due to failure of the centralized governance model, proving an opportunity to meet rural development projects. Donor agents, particularly IMF/World Bank policies have also pressurized developing countries and set decentralized management of a condition for some funding- demanding structural adjustment at each level of aid recovery countries (World Bank, 2000). Decentralization has in addition encouraged political and economic issues (Collier & Dollar, 2001). Political reasons encompass better governance as central planning may likely not include the needs of rural end-users in terms of resource allocation. For example, the headquarters officials may not know the site end-users would prefer best to drill a hand-pump. Local end-users have preferences and requirements, which can only be unveiled if they are involved throughout the process where structures accommodate their say. Decentralization also assists with transparency and timely reaction to end-user needs and reduces work load or bottle necks at the central office (Collier & Dollar, 2001). DFID (2002) relates decentralization to poverty alleviation as rural people, local leaderships are involved in decision making.

Though decentralization is associated with some positives, there are also weaknesses as it threatens central administration as goods or services are controlled at the grass root level. Jaglin, Repussard & Belbeoch (2011) argue that decentralized structures on their own are not enough for water projects but to include long-term learning processes and linkage with local government and other sectors. Laverack (2001) asserts that decentralization is also criticized because the few elites may benefit and exploit the marginalized that have no say. Quality of services may also be lowered as local people may not have the necessary or relevant expertise to manage the rural project. Having said that, the work of Rao and Perry (2003) show that end-users were happy with the project despite the 'blame' of the top-down approach of a centralised

system. Decentralized structures also create a medium through which good governance and can lead to empowerment.

#### **2.4.6 Good Governance and Drinking-Water Projects**

Good governance is about transparency, acting in the public good, waving away centralised planning, active civil society and stakeholder participation in rural projects (World Bank, 2001; Putnam, 1993). Putnam further ascribes the concept to development of policies and decision-making process that surrounds economic and social development. The concept of good governance involves interaction among local structures and processes to determine how power is shared, how decisions are made and how the end users' views are taken on board. The concept, therefore, implies power relationships, accountability as to who has influence, who decides and how decision making is made publicly explainable (Jones, 2011). One can deduce that good governance involves getting rid of barriers to transparency and end-user participation, eventually leading to empowerment.

WHO (2000) defines empowerment for rural stakeholder end-users in terms of promoting their choice, having influence and control in the service provision, removing barriers, which hinder their participation in their service provision and government. In other words, empowerment is about eliminating issues, which hinder end-user participation in hand-pump maintenance, ensuring that the water committees and development structures have a voice. However, control over the type of hand-pumps maintenance services they can render, can be critically evaluated using a case study approach as detailed in this study (Cresswell, 2007). Laverack (2001) further advocates community empowerment as a factor that is a key to good governance.

Good governance is relevant in a ‘bottom-up’ initiative. Good governance skills are related to overcoming local problems. Jones, (2011); OECD (2007) and DOLG (2001) concurs that efficient end-user participation process requires the end- to have effective governance supported by adequate resources. Murdock, Wiessner & Sexton, (2005) argue that participation is less effective when there are unclear objectives and lack of independent technical assistance and facilitation. Cleaver (1999) complements that for continued operations of hand-pumps end-users from poor communities may need to be involved in higher decision making and governance (Haque 2004,) other than manual work or labour (Prokopy,2005). Weber & Weber, (2010) suggest more research towards advancing understanding end-user participation at the village level and how it can translate into poverty reduction and collectively shape or change institutional patterns. Social interaction is also influenced or governed by external factors like donor aid requirements.

Good governance in a ‘bottom-up’ initiative is also about the end-user involvement in planning for hand-pump-maintenance and encouraging transparency and accountability of maintenance resources (OECD, 2007; Dasgupta & Beard; 2007). Asthana (2008) further relates good governance in hand-pump maintenance by involving end-user decision making. Bogale & Urgessa (2012) argue that hand-pump maintenance can operate if end-users are willing to pay for pump-maintenance expenses whilst Harvey & Reed (2003) describe good governance as rhetoric. La Ferrara (2002) asserts that pump maintenance is not just about fixing bolts and spanners on a pump, but also about the way rural end-users are involved in the community organisation for the VLOM. There are problems associated with governance. According to the UNDP (2006), most drinking-water-related problems in developing countries are because of poor governance and a lack of adequate leadership at different levels in supporting end-users.

Rural projects have practiced the concept of good-governance in Mali (Jones, 2011), Kenya (Crow, Shallow & Asamba, 2011) and Bangladesh (Hague, 2004). Gibson, Labonte & Laverack (2002) propose good-governance leading to empowerment. Political commitment is therefore, vital in the entire process of implementation because it is not enough to sign treaties at international meetings but question the practicality of the concept at local village levels. Political good-will entail a commitment by those in the highest level of authority to address hand-pump-maintenance concerns and allow stakeholder participation at village (VDC) area (ADC), and counsellor levels (DA). The hand- pump- maintenance acceptability, especially in the Malawian context among local leaders at village and area local level is therefore, a significant research variable to determine institutional mechanisms.

Weber & Weber (2010) assert that institutional mechanisms are effective if all stakeholders accept them as legitimate or if the process, and the organised structure that supports it, is legitimized by local laws and policies. However, this seems more theoretical than practical. This implies that management structures at village, area or district levels may either be established by the stakeholders themselves and/or facilitated by the government. According to Harvey (2003), hand-pump, maintenance should be acknowledged as being an overtly political process at national, regional and local levels. Harvey's assertion is that although hand-pump maintenance is derived from discourses of international donor aid and NGOs as project sponsors, it is, however, reshaped by local political imperatives, which need detailed case study approach to understand hand-pump maintenance processes, including NGO roles.

#### **2.4.7 The Non-Governmental Organisations (NGOs) Roles in Rural Project Management**

NGOs are central to the meeting of rural peoples' needs. However, there are also some mixed reactions of their initiatives. NGOs are international organisations

executing rural programmes in developing countries on the behalf of project sponsors who are global funding organisations (Levine, 2002; Pfeiffer 2003; Smith, 2012). Water problems in developing countries are among the key agenda for implementation. Among the leading universal NGOs in water projects include: World Vision, Concern Universal, GTZ, OXFAM, and the EU just to mention a few. Jemenez & Perez-Foguet (2009) estimate annual NGOs investments in developing countries in water and sanitation at a cost of \$28 000 million during the mid- 1990s. Examples of financial investors working with NGOs to execute their rural projects include: WHO, UNICEF, USAID, DFID, World Bank, UNDP and GTZ. The NGO scope of work in different recipient countries depends on the funding institutions' objectives. In general, NGOs projects in developing countries aim to significantly better end-user livelihoods through the provision of basic needs and /or improving socio-economic status. Provision of clean water through hand-pumps is among the key agenda of NGOs in rural areas of developing countries (WHO/UNICEF, 2004). The NGOs work or agenda aligns with the global UN Millennium Development Goals (WHO/UNICEF, 2000). Smith, (2012) postulates that NGO actions in water projects have focused on safe water supply in a form of construction of new hand-pumps, shallow well upgrading, spring protection and old hand-pump rehabilitation. For details of roles of NGOs see Table 7 below.

**Table 7: Roles of NGOs in Drinking Water Projects**

- Provision of financial and technical resources
- Construction of new pumps, shallow well upgrading, rehabilitation of old hand-pumps and construction of new ones
- Liaise with contractors who drills after conducting a geophysical sitting (private contractor hired to drill); casing with PVC pipes, lining with gravel packs, cleaning, disinfecting, measuring yield, constructing civil works (drainage system), installing PVC riser pipes and fitting hand-pump.
- Upgrading shallow wells; this involves deepening an existing shallow well, lining with bricks and mortar, measuring yield, cleaning and disinfecting, moulding a top slab cover and installing a Malda hand-pump.
- Rehabilitation of hand-pump in the form of removing worn-out hand-pump parts (rising mains, rising rods, cylinder, and plunger) and replacing them with standard Afridev pump parts for deep wells and Malda pumps for shallow wells. Cracked, damaged apron and drainage structures were also replaced with new concrete apron and drainage.
- Training of the water and developmental committees

Data Source: Concern Universal Annual Project Report, 2007

Despite some positive impacts, NGOs work in different projects has been received with mixed reactions. Pfeiffer, (2003) highlights NGOs as project sponsors in rural areas having strengths and weaknesses. One side to the coin believes that village people assistance be channelled through NGOs as some NGOs encourage transparency and good governance. Levine, (2002) and Scherrer, (2009) regard NGOs as making positive impact in developing countries. Areas where NGOs are known to contribute impact include; local financial institutions; advocacy for sectional



committees (Brown, Ebrahim & Batliwala, 2012); fund-raising for sustainable project interventions (Herzer & Nunnenkamp, 2013); bringing project services to beneficiaries (Brass, 2012); micro-finance improvement (Kabeer et al, 2012) and advocacy for rights based approach for rural dwellers (Nelson & Dorsey, 2003).

NGOs are the main development partners in water hand-pumps supply, and when NGOs phase out, some problems may arise (OECD, 2007). NGOs are further criticised for focusing on short term rather than long-term development (Ebrahim, 2003); for unintended empowerment results for the rural (Stiles, 2002); lack of coordination among NGOs distributing projects unevenly/work duplication and implementing activities not related to local people needs (Galway, Corbett & Zeng, 2012); fragmenting local systems (Pfeiffer, 2003). There are also some unethical aspects in their projects execution (Fassin, 2009). The above work had been NGOs work on other projects other than drinking-water, hence a critical examination of end-user roles in hand-pump installed by NGOs would provide a picture of the developments the NGOs had engaged with end-users in preparation for hand-pump maintenance in Malawi and overall project or asset profitability.

#### **2.4.8 Hand-pump Maintenance and Asset Profitability**

From a financial perspective hand-pump, maintenance can be a significant influence on business outcomes related to production costs. Production costs are a total of operations and maintenance costs. Revenues arise as well as volume of the sales increase. There are substantial fixed costs (and variable costs) that must be recorded before a project makes any profit (PMI, 2008). To increase profit margins, there are several ways one of which is increasing the sale revenues. Sale volumes in this case could relate to the volume of water the hand-pump yields per minute. Profit margins

can also be determined by increasing price or volume of service production or reducing fixed and/or variable costs. Therefore, if hand-pump maintenance is done effectively and efficiently, it can reduce both the fixed and variable costs. Even when the asset is idle, it still requires a minimum of maintenance to preserve it from the potential future use, thus fixed costs. If demand is high or low, cost of parts and labour also increase or decrease but costs to manage them do not. Direct pump-maintenance labour and parts costs are variable. There is a direct relationship between the frequencies of maintenance to the increase in labour costs. However, an investment in hand-pump maintenance can reduce the down turn and its associated costs.

Hand-pump- maintenance management is important because it is a major production cost, if too expensive, hand-pump like any plant shuts down, which is called down time. Downtime is unproductive time caused by lack of pump maintenance due to lack of repairers, spare parts or technical know-how. Pump- maintenance, therefore, keeps the pump as an asset performing to the standard that is required by end-users. The aim is to maximize services (clean water supply) and minimize input of resources (financial, human and physical) thus providing the best value to end-users as well as the funders (Campbell & Reyes-Picknell, 2006). The product that maintained hand-pumps delivers is available supply of clean water and indirectly improved state of the hand-pump itself. Therefore, installation of the new pump requires importance of hand-pump maintenance and reliability decisions at the design stage, when there is greatest opportunity to reduce the life-cycle operating and hand-pump maintenance costs.

There is also the issue of value of the asset in business context. Value includes quality of services, which is quick and at a lowest price. To satisfy end-users, hand- pumps must be able to respond quickly to the provision of safe water over the 24-hour period

with a minimum of eight litres per minute throughout the useful life cycle (Harvey, 2007). Hand-pumps as a deliverable, therefore, have a product life cycle which is closely related to the maintenance management but there is also an element of risk exposure (financial or operation) as summarized in the equation below:

$$\text{End-user value} = \frac{\text{Quality (volume)} \times \text{pump service}}{\text{Cost} \times \text{Time} \times \text{Risk}}$$

The above equation gives some insight that the higher the volume of water that the hand-pump can deliver for a given cost and response time, the more the value end-users perceives. It is essential that hand-pump provides clean water when needed and produce at the required rate (8L/min) and at a reasonable maintenance cost, with risks minimized. A well-maintained hand-pump as an asset can meet production commitment more easily and lower the risks, which is something end-users, NGOs and donors are interested in (Campbell & Reyes-Picknell, 2006), in addition to meeting the capital costs of the Afridev or Malda hand-pumps.

Costs incurred for Afridev differs from Malda pumps as these pumps have distinctive installation and maintenance requirements. The Afridev is drilled up to 20-45 meters from the ground to access ground water, which means it is ideal for hilly dry places as well (Harvey, 2004). Installation is calculated according to the water table the Afridev pump provides water throughout in rainy or dry seasons (UNICEF/WHO/2004). Each of Afridev pumps cost up to £3000 as cost of the asset (Harvey, 2007). An Afridev pump in an efficient condition can yield up to 10 litres of water per minute and can be pumped over a 24-hour period supplying water to a population of 250 people requiring 25 litres per person per day- which is the UN drinking-water requirement (Harvey, 2007). UNICEF/WHO (2004), concur that Afridev pumps are commonly used to supply water to dry lands and as such has a low water table. The disadvantage

is that they need technical people to install it , and spare parts may be difficult to find locally in the rural areas of Africa as they are often manufactured in India (Harvey, 2007). To compliment deep wells, each country is encouraged to devise their own shallow wells for areas, which require shallow well access (Malawi, DHS Survey, 2006).

In Malawi, the local shallow wells called Malda pumps, a type of shallow wells, which are man- dug and can access water with a high water table, about 6-10 meters from the ground (Harvey, 2004) The amount of water the pumps yield per pumping depends on the amount of water in the ground such as that volume generated may significantly be reduced in dry seasons (WHO, 2004). The advantage of Malda pump is that they are cheap costing about £1000 per asset and is easy to install, and the spare parts may be locally found. However, the disadvantage of Malda pumps is that the pumps cannot access water in dry hilly areas because they can only be installed in wet land areas with a high water table (Malawi, DHS Survey, 2006). Malda pumps are also less durable than Afridev pumps hence more vulnerable to break down. Malawi has adopted these two types of pumps in order to comply to IMF/World Bank policy, which advises each country to devise no more than two types of pumps so as not to complicate challenges of spare parts (Harvey, 2004). Though Malawi has improved access to drinking-water up to 79.3% of the population with use of the hand-pumps, (NSO, 2012), there is a risk-management issue as some hand-pumps are either non-operational or vulnerable to break down.

#### **2.4.9 Relationship of the Rural End-users' Roles and Risk Management**

Non-operational hand-pumps expose end-users to risk. Rural end-user vulnerability to risk is identified as one of the characteristics of poverty (World Bank, 2000) and this is seen in disruption of basic necessities for rural people, which include rural

drinking-water projects. Hand-pump maintenance, therefore, has an inherent risk of being non-functional. Risk is defined as uncertainty, which could occur and have adverse effects on something (APM, 2006). In a rural development context, risk is further defined as threats to poverty reduction efforts of which include the provision of clean water (Bhattamishra & Barrett, 2010). End-user involvement with pumps involves uncertainties, and these can affect the way end-users take decisions and outcomes (OECD, 2007). Whenever end-users take decisions without prior knowledge or experience of hand-pump maintenance, there is always a chance of risks. Bhattamishra & Barrett, (2010) further argue that anticipating, planning, preventing and managing risks makes rural projects successful. This section will review how end-users manage risk management of other rural projects which Bhattamishra & Barrett, (2010) refer to as Community-Based Risk Management Arrangements.

#### **2.4.10 Community-Based Risk Management Arrangements (CBRMA)**

The aim of reviewing literature on Community-Based Risk Management Arrangements (CBRMA) is to identify the extent to which rural end-users manage other risks, other than hand-pump vulnerability and whether such can be applied in hand-pump maintenance. CBRMA has been encouraged by stakeholder end-users in rural areas of Africa and Asia (Bhattamishra & Barrett, 2010) in a form of: insurance for life events; savings and credit arrangements; social assistance facilities and provision of goods or public facilities. Platteau (1997) highlights insurance of life events existing in some rural areas of Africa. These insurances are organised by community to cater for shocks related to high costs of funeral expenses. They are also called funeral or burial societies. In this approach, community members make monetary contributions on regular basis or when burial occurs to cater for the funeral shocks.

There is also some health insurance available in some rural areas of Africa. Health insurances associations have been known by different names commonly called: health funds, mutual health organisations, rural health insurance, micro finance insurance programmes, drug revolving fund or end- user fee clubs. While some health insurances are introduced by external agents, there are others, which are their own developed initiatives as the end-users. The health insurances are produced in partnership with health workers. Membership is voluntary and is concerned with pooling and revenue collection and provision of basic services. Contributions can be described as ex- ante meaning members receive a pay-out when they require treatment after an illness. Gine & Prez Foguet (2008) highlights evidence of end-user financing improving access to rural health services and monetary protection against costs of illness in rural areas of Tanzania. However, the end-user financed initiatives were inadequate leading to a small size of risk pool and also the poorest were excluded from the schemes. At times, the neediest are included as the basis of subsidy from the external agents like NGOs.

Savings, credit and insurance are also local plans, which help with risk management at the village level. Bhattamishra & Barrett, (2010) describes some savings and credit arrangements to insure end-users against income risks. End-users have used these arrangements in different ways one of which is as a precautionary savings or consumption credit to help them overcome income shocks or anticipated income shortages / expenditures in the case of weddings. Secondly, end-users also use invested credit for assets for their future capacity to self-insure. An example of this one is grain banks at the village level. In the grain bank models, end-user surplus grains are collected post-harvest into a common pool which is controlled by a village headman. Member end-users borrow grains when there is food scarcity, during the agriculture lean season. Loans are returned with interest in a form of grains after the

following harvest period. Hence grain banks help end-users cope with anticipated seasonal food shortages and price fluctuations as the risk. Credit may also be provided as insurance as there could be households that would not be able to return the loan after facing negative shocks – though the repayment period may also be extended. Though grain banks are externally induced by the NGO to take off the ground, eventually they are managed by local end-users. Bhattamishra (2008) found that end-users that participated in grain banks reduced the incidence of borrowing from local money lenders who lent at high interest rates.

End-user micro finance is another area of risk management. In this model, external agents offer loans in little amounts called micro credit; the saving is called micro savings (OECD, 2007). The setup is a form of insurance with a facility of small contributions and pays out with specific conditions called micro insurance. Micro finance loans are individual loans but have joint liability such that if a member of the end-user group fails to repay their own loan, then all members of the group are barred from any future loans from the micro credit institution. The advantage of this is that end-user members cover each other with insurance against shocks. Furthermore, lending is based on peer selection and peer monitoring information – reputational mechanisms to reduce defaulting, and borrower's assets are not at risk of seizure when non-payment occurs hence borrowing risk is reduced because of rationing of the credit (Bhattamishra & Barrett, 2010). There are also low requirements, which further help the poor end-users to access credit and assist them to cope with shocks. The disadvantage is that micro finance is totally induced externally by micro finance institutions.

Community-based provision of public goods and services are also known to reliance the community of shocks, whether through ex-post risk transfer (insurance) mechanisms or through reduced ex-ante risk exposure (prevention). Community-

based provision of public goods and services are assets or services provided to people in rural areas to alleviate poverty. An example of the services is immunization, deworming, and sanitation. These are often provided through the external agent such as the NGOs or governments which deliver goods and services for public well-being and relieve the shocks of poverty. Bhattamishra & Barrett, (2010) highlight services to be more advantageous if they aim to address community other than individuals. The way end-users organise themselves for CBRMA may be related to hand-pump maintenance, in drinking-water projects, which could maximize hand-pump maintenance opportunities. Rural risk management operates within a framework of stakeholder management theory.

## **2.5 Stakeholder Management Theory and Models**

The framework within which end-users operate the hand-pump maintenance can be complex as different stakeholders are involved. Stakeholders are people or organisations that are involved in and have an interest in the project (Bourne, 2005). The following Table 8 below highlights key stakeholders in drinking water projects and their roles.



**Table 8 Key Stakeholders in Drinking Water Projects and their Roles**

<b>Key Stakeholders and Their Roles</b>			
<b>End-Users</b>	<b>Water Committees</b>	<b>Local Government Structures (VDC/ADC/DA)</b>	<b>NGO</b>
Agree on water pump maintenance plan and household fees	Facilitate end users to agree on maintenance plan and household fees. Organise inauguration ceremony. Sign off completed projects with drillers	Ensure implementation of maintenance plan and fees. Certify completed projects. Sign off on completed water pump.	Ensure implementation, maintenance plan and fees by end -users. Certification of installed pumps. Ensure capacity building for water committee, local mechanics and local government structures
Maintain water pump after completion. Ensure funds are in place.	Penalizes defaulters in payments. Develops criteria for payments	Forum to deliberate water pump problems encountered- develops solutions or channels them to higher levels	
Attend inauguration ceremony			

**Data Source: Concern Universal Annual Project Report, 2007**

Although there are key stakeholders in drinking water projects, WHO/UNICEF which coordinates drinking-water project management for developing countries, do not offer a blueprint framework for enhancing stakeholder involvement and their roles. WHO/UNICEF however, encourages national drinking-water policy bodies to develop the frameworks that facilitate the process of incorporating stakeholder end-user views in decision making (WHO/UNICEF, 2000). Equally, the Overseas Development Institute (ODI) (ODI, 2004) which supports institutional arrangement for hand-pump maintenance does not offer a particular model for stakeholder end-user participation or engagement but provide some suggestions on pertinent issues to be considered in hand-pump- maintenance. This study will therefore link the above

stakeholder roles to the Freeman Stakeholder (1984) Model as this model outlines various aspects of stakeholder practices.

### **2.5.1 The Freeman Stakeholder Model**

The Freeman Model (1984), model has some strengths and limitations when applied to drinking-water project practices. The Freeman (1984), model focuses on stakeholder relationship, and classifies internal or external stakeholders (Achterkamp & Vos, 2008). The Freeman Model (1984) also highlights stakeholder relationship and influence (PMI, 2008; & APM, 2006). The model situates stakeholder influence at the centre of the business success. Freeman (1984) proposes a project as a business firm with a nexus of contracts with several stakeholders who form part of the firm's environment-and that, indeed, may have some impact on its activities and its stake in the firm itself (Freeman, 2004). Internal stakeholders are those who have a direct impact upon the project cost, schedule and scope. Examples of internal stakeholders in the drinking water framework include: the project team, sponsors, funders and the project managers.

External stakeholders are those who indirectly affect project operations and examples of these include customers (end-users) and supply chain team (hand-pump spare part vendors). External stakeholders are not part of the direct business operations (Freeman, 1984). Freeman argues that because these stakeholders exist outside the project operations, the project manager had no obligation to consult them although the project managers have to pay close attention to their actions, needs and demands, which may be rare in social projects. Freeman also increases the scope of stakeholder definition to include those who influence the operations within the project by virtue of their interest in its activities even though they are not part of the business environment and might not be directly affected by the operations in the project.

The limitation of Freeman's stakeholder model in hand-pump maintenance is that not all aspects or categories of stakeholders engage with the model because the model is linked to profit-making projects while hand-pump maintenance is linked to non-profit making. For example, end-users that were external stakeholders during hand-pump construction become internal stakeholders and assume the role of hand-pump maintenance managers after the NGO team phases out. Furthermore, end-users as hand-pump maintenance managers operate upon the basis of trust, social cohesion and communication which Freeman's model does not articulate. The model is therefore; dependent on having competent stakeholder end-users, which can establish stakeholder salience because it is only when this is done that there appears to be active involvement with stakeholders through various forms of communication. The model does not indicate whether stakeholder participation is mandatory or out of good will. The model also fails to address the inter-linkages or inter-relationships between the various stakeholder groups or local development committees and how that affects their participation. There is stakeholder characteristic of ambiguity and the vagueness of the boundaries within the stakeholder model operating at rural levels, which could be examined using a case study approach of operational and non-operational hand-pumps.

Stakeholder (SH) identification is among the key issues in Freeman's (1984) model. It is important to identify stakeholders early in the project life cycle to reduce negative impacts on the project. The Project Management Institute (PMI, 2008) shows that the key question in identifying SHs of a project is who/what are considered as stakeholders. The Project Management Body of Knowledge (PMBOK, 2008) further emphasizes the need to ask who is directly affected by the project outcome. Who is involved in the project? Who owns the project? Project ownership may need to be clarified by identifying who is providing the budget, who determines the project

business requirement, or is responsible for project business outcomes and benefits? Stakeholders may claim interest in the project or are simply stakeholders because they are relevant for the project. However, in addition to identification of end-user stakeholders, the power each stakeholder has needed to be clarified to know who has influence in maintenance of drinking-water projects.

### **2.5.2 Power, Legitimacy and Urgency Model**

Mitchell et al., (1997) suggests three core variables of consideration in stakeholder classification as **power, legitimacy and urgency**. According to this model; **power** refers to the ability of a stakeholder to influence an organization; while the **legitimacy** of a stakeholder refers to their interaction within the organization in terms of desirability, properness or appropriateness. **Urgency** relates to the requirements that a stakeholder set within the project (Mitchell et al., (1997). The model further provides a more detailed categorization of stakeholders with the broad variables of consideration, which are power, urgency and legitimacy given to the heterogenic nature of stakeholder groups.

In rural hand-pump maintenance, the heterogenic stakeholder end-users can also be grouped as internal and external. Internal stakeholders include: women /men/children water committees, local government committees, the village headman and the pump technicians. The external stakeholders in this case include: government extension workers, hand-pump spare parts vendors and NGOs. The nature of stakeholder's end-user roles in maintenance is therefore, contingent upon understanding the concept of their roles in terms of influence and power.

### 2.5.3 Stakeholder Power and Influence or the Grid Model

It is also possible to classify hand-pump maintenance stakeholders in a form of power and interest/influence grid. PMBoK (2008) identifies **Power** and **Interest grid** there by classifying end-users groups based on their level of authority (**power**) against their level of **interest** about hand-pump maintenance. The project manager concentrates on stakeholders with high power and high interest as these have most influence over the project outcome. There are also grids of **power and influence** and **influence and impact**. The importance of the classifying according to power/influence grid is that it helps to identify which stakeholders could be concentrated on to achieve successful hand-pump maintenance. For example, in the power and interest grid, most concentration or involvement is based on those groups of stakeholders with high level of authority (**power**) and concern (**interest**). Power, according to this model, means the ability of stakeholders to impose their will on decisions relating to hand-pump maintenance.

The stakeholder model distinguishes between the various groups and types of stakeholders. Even though the stakeholder classifications presented by these models are necessary, they do not capture reality or possibility of different stakeholders belonging to multiple groups. OECD (2007) emphasizes the determination of ‘key stakeholders’ based on power and influence, but this has the potential of leaving out marginalised stakeholders like women and the poor, which could be complimented in using the inclusive rural development model.

### 2.5.4 Inclusive Rural Development Model

*Outsiders (non-rural, educated, government officials, NGO staff and donor agents) under perceive rural poverty as a result, the poor rural people are little seen and even less is the nature of their poverty understood (Chambers, 1993).*

This section will discuss inclusive rural development model and its links to drinking-water. The concept of rural development has changed significantly during the last three decades (UNDP, 2002; Burkey, 1993). Inclusive rural development is about improvement of rural livelihoods and poverty alleviation through participation of end-users themselves. The background for the model started in the 1970s, when rural development was in a form of agricultural development focusing on increasing agronomic production (Chambers, 1993). With the focus on increasing agricultural production, the aim was to promote smallholder agriculture. By the early 1980s, the World Bank defined the model as strategies designed to improve the economic and social life of the rural poor (Chambers, 1993). However, not much change was achieved and there was an increased concern about the persistent and deepening of rural poverty. The meaning or concept of development itself was not clear, eventually it included non-monetary side. The importance of reducing the non-income dimensions of poverty to achieve sustainable improvements in the socioeconomic well-being of the poor was proposed (Burkey, 1993). Today's concept of rural development is fundamentally different from that which was used about three or four decades ago.

The concept now encompasses concerns that include an assessment of changes in the quality of life, broadly defined to include improvement in health and nutrition, water, education, environmentally safe living conditions, and reduction in gender and income inequalities (Cleaver, 1999). This makes it essential to go beyond the income-related factors such as prices, production, and productivity to a range of non-income factors that influence quality of life thus inclusiveness of rural development (UNDP, 2002). The model states that rural development is influenced by these dimensions: three different but interrelated dimensions as seen from the Figure 3 below:

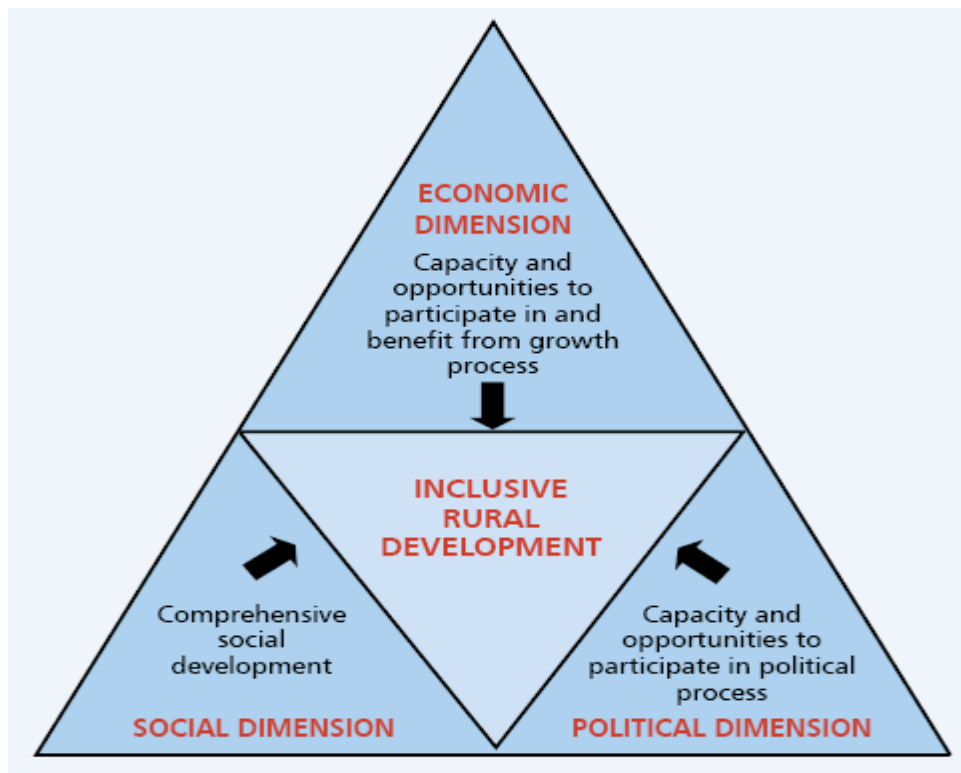


Figure 3 Theoretical Framework: Inclusive Rural Development  
Data Source: Burkey, (1993)

The first is the economic dimension or part that encompasses providing both capacity and opportunities for the poor people and low-income rural households to benefit from the economic growth process in such a way that their mean incomes rise at a higher rate than the growth of average incomes in the sector as a whole (Burkey, 1993; UN 2006). Secondly is the social dimension of supporting social development of the rural poor and low-income households and disadvantaged groups, eliminating inequalities in social indicators, promoting gender equality and women's empowerment, and providing social safety nets for vulnerable groups (UNDP, 2002). Third is the political dimension of improving opportunities for the poor and low-income people of rural areas, including women to effectively and equally participate in the political processes at the village level and beyond, compared with any other categories within the population.

Sustainable rural developments include methodologies to involve stakeholder end-users in identifying their social needs: among such methodologies is Participatory Rural Appraisal (PRA). PRA is defined as a methodological approach which involves rural end-users identifying their development needs or problems using sketch mapping, transects and diagramming (Chambers, 1993). The model emphasises the concept that rural people cannot be developed unless they are part of the process. PRA offers such an opportunity for rural end-users. The approach is less effective if outsiders spearhead the identification of the rural people's needs, instead it is local people themselves who map, develop diagrams representing problems, rank, score, observe, interview, analyse and plan interventions (Chambers, 1993 : 97). PRA is proposed from a social and psychological background.

As much as 85% of the population of Malawi live in rural areas (NSO, 2012). The following last section highlights Malawi situation analysis in terms of demographics, history, politics, geography and trade and how these directly or indirectly informs the hand-pump maintenance in Malawi.

## **2.6 Profile of Malawi and World Bank Case for Human Development: Exploring Poverty Reduction and Rural Drinking Water Status**

Malawi is one of the poorest countries in the world (World Bank, 2006) and is among the countries which are a prime target of poverty alleviation by World Bank (WB) /International Monetary Fund (IMF). Malawi's poverty made it ideal for debt relief under the highly indebted Poor Countries (HIPC) Initiative by the World Bank and International Monetary Fund. The World Bank and IMF, however, demanded a new version of policies relating to national government commitment to specify economic and governance milestones. As part of debt relief and provision of low income loans to poor countries, in December 2000, the IMF and WB approved US\$643 million as



HIPC debt for Malawi. One of the conditions was that Malawi had to prepare and implement the Poverty Reduction Strategy (PRS) with specific economic conditions.

PRS has been processes aligned to reduce poverty. PRS in Malawi like in other Sub-Saharan countries is engineered by the World Bank /IMF. PRS as a poverty reduction strategy emerged in the 1990s. The aim of PRS is to introduce the change from the traditional central government system to local government policies, which include decentralisation. The PRS strategic approach also incorporates rural people participation and ownership in the end-users provision of community-based services at the village level. The PRS provides an evolution of a strategic approach to programme management in Malawi though more rhetoric (Ellis, Kutengule & Nyasulu, 2003). The overall goal of PRS is sustainable development through empowerment of the poor. The key issue in the PRS is to create a conducive environment to enable or initiate the rural poor people to reduce their own poverty (Malawi, 2001). However; the extent to which the poor people can contribute in reducing their poverty is not clearly articulated. To promote rural development, Malawi created local government system consisting of 39 assemblies in 1990. However, the government has still not been fully keen to disseminate central government functions to local government. In addition, local government lacks the technical capacity to handle the complex managerial, technical and financial systems; and there are also challenges of corruption (World Bank, 2002); showing that reducing poverty for the poor is a complex issue particularly in rural areas.

The poor are more disadvantaged in comparison to their rich counterparts who live in urban areas, due to poor socio-economic conditions in Malawi. **Table 9** below highlights some critical indicators about the socio-economic situation of the population based on data from Malawi Demographic and Health Survey of 2000, 2004 and 2011; particularly, those related to rural livelihoods (NSO, 2012).

**Table 9: Malawi Development Indicators**

<b>Characteristics</b>	<b>Value</b>
Total population (millions) (2010)	13.1
Annual population growth rate (%) (1994-2004)	2.4
Life expectancy at birth(years)	42
Infant mortality rate (per 1000 live births)(2004)	76
Under –five mortality rate (per 1000 live births)(2004)	133
Gross National Product (GNP) per capita (2004) (US\$)	160
Per capita total expenditure on health ,2002 at average exchange rate, US\$ (2003)	13
Official development assistance per capita (US\$)(2003)	45.4
Proportion who cannot read at all (2011)(NSO 2011)	16.6 % urban 35.6% rural
Proportion of people using an improved water source (NSO, 2011)	79.3

Data Source: Malawi Demographic and Health Survey of 2000, 2004 and 2011; particularly, those related to rural livelihoods (NSO, 2012).

Malawi is one of the poor countries ranking the Human Development Index (HDI) of 0.404, which is 165<sup>th</sup> of the 177 countries classified as low-income countries by World Bank (World Bank, 2002). The per-capita GDP in 2003 was US\$156 with an annual growth rate of 0.9%. This is much lower than the average values of other low-income countries in sub-Saharan Africa. The commonest disease burden leading to high infant rates include communicable diseases, particularly diarrhoea. This is also linked to poor access of drinking water. The per-capita total expenditure on health is among the lowest in sub-Saharan Africa much shorter of the US\$34 as recommended by WHO, to provide a basic package of services. The health expenditure, which includes drinking water, by the government, constitutes about 41% of the whole government expenditure (NSO, 2004). This contrasts the Abuja resolution by African head of states to allocate 15% of the national budget for health (Zere et al, 2007). The low budget allocation has an implication in such a way that end- users have to

complement with their input in community-based services at the village level as proposed in the PRS among which is drinking water.

One of the aspects defined in the PRS to reduce poverty is the provision of safe drinking water. This is because improved source of drinking water free of faecal contamination is regarded as one of the wealth quintiles determining socio-economic status of households and improvement of their standard of living (NSO, 2012). Based on this, Malawi was one of the 191 United Nations member countries that adopted the Millennium Declaration in September 2000 in which each country was committed to achieve 8 goals to reduce global poverty. The goal 8 and target 7 of Millennium Development Goals (MDGs) focussed on reducing the proportion of people without access to safe drinking water by half by 2015 (DFID, 2004). Malawi had to adopt MDGs because by then 68% of its population had access to safe drinking water of which 95% were in urban areas and 58% in rural areas (NSO, 2002). The 2011 Malawi Demographic Health Survey (DHS) shows that Malawi may meet the 2020 WHO/UNICEF targets as safe drinking water access has improved to 79.3% of the population who use an improved source of drinking water. However, these figures still mask wealth discrepancies as urban areas have 91.1 % while rural have 76.9% as much as 85% of the population live in rural areas (NSO, 2012). Malawi regards an improved source of drinking water in a form of piped water, piped public stand, hand-pumps; a dug-protected well and rain water collection (NSO, 2004). At the same time, issues of maintenance are still unclear as much as uptake is determined by the presence of the improved water sources which could be functional or non- functional.

### **2.6.1 Malawi Background: Demographics, History, Politics, Geography and Trade**

Factors of history, politics, geography and trade effect Malawi to have high social indicators and challenges of chronic poverty. Malawi is one of the 10 poorest

countries based on the World Bank defined poverty line of having per capita of less than one US dollar per day. Malawi has a GNI per capita of US\$170 ranking the sixth from the bottom of World Bank listing (World Bank, , 2002). Poverty in rural Malawi is defined in terms of failure to meet basic needs (NSO, 2002). Malawi estimates 65.3 % of its population to live below the poverty line (NSO, 2004).

The reasons for economic challenges are mainly historical, political and regulatory. Malawi, formally called the British colony of Nyasaland, was among the first countries to seek World Bank-IMF economic rescue in 1981. The scale of poverty has not improved much since the country gained independence from the British colonial rule in 1964. Politically, Dr President Hastings Banda did not advocate Malawians to imagine themselves to be poor, so poverty was not openly addressed as an issue or concern. The introduction of the multi-party system in 1994, under the rule of Dr Bakili Muluzi of United Democratic Front Party started to address the gap of poverty though at a smaller scale and with numerous challenges (NSO, 2011).

Strategies to overcome poverty were clearly defined in the PRS model prepared by the World Bank /IMF and the government. The PRS defined four categories of poverty alleviation in a form of: human capital development (health, education and water); improvement of quality of life for the poor, good governance, and sustainable economic growth. World Bank/IMF believes that Malawi's poverty like in any other sub-Saharan countries has the origin in the bureaucratically and vertical programmes adopted. Such programmes are over centralised leading to decisions and programmes, which are not only unrelated but also often detrimental to the real interest of the people and that there is lacked of genuine representation of stakeholder end-users hence preventing local initiatives (Burke, 1993). The paradigm further state that programmes initiated from the top level either never reach the poor or actually make the situation worse. Even when initiatives have attempted to reach the poor, projects

even create a greater degree of dependency and dominion. People often say '*when is the government coming to give us clean water*' (Burke,1993). In addition to regulatory, geography reasons may also contribute to the Malawian poverty situation and delivery of public sector services.

Geographically, Malawi is divided into three regions for administrative purposes, with the north having 6 districts, the central and southern having 9 and 12 districts respectively (NSO, 2011). The districts are further divided into Traditional Authorities (TAs) who are ruled by chiefs. A TA comprises of several villages presided by a village or group village headman. For representation into parliament, by a member of parliament, villages are grouped into constituencies (NSO, 2004). In the newly formed decentralised policies, 39 district assemblies were formed comprising of three city assemblies one from each region; one municipal assembly, and eight town assemblies. Rural districts are further divided into wards, and each ward is represented by a ward counsellor who is elected in the local government elections (NSO, 2004). Though local government systems may be initiated, the exploitation of the rural poor in Malawi like in another Sub-Saharan Africa may also be affiliated to domination of the poor people by their powerful local elites or leaders. Exploitation of the poor or marginalised groups may take the form of: excluding them from decision making in their projects, gender imbalance where women are considered second-class citizens such that men dominate decisions of women's health and welfare. Marginalised groups like women may enter into a dependency relationship with gate keepers. However, organising to break out of these exploitative behaviours may carry the risk of the public sector or development project being rejected by the local leaders. The challenge of the development project is therefore, to successfully act upon the factors that create dependency without creating a new and unbearable high-risk situation (Burke, 1993). Geographically; Malawi is also an inland country as seen in

Figure 4 below. Figure 4 shows the Map of Malawi highlighting its geographical position in Africa.



**Figure 4 Map of Malawi**

**Data Source of maps: <https://www.google.co.uk/search?q=map+of+malawi&hl>**

Malawi is a land-locked country, 901 KM long, and is 1,500 KM from the sea port. The country is bordered by Mozambique to the east, south and west; Tanzania to the east and Zambia to the west. It lies in the East African lift Valley. The in-land geographical positioning affects Malawi's fragile economy due to increased transport costs and logistical problems. Transport costs, incurred due to use of land transport and long times in Malawi like other countries may be up to 40% of total costs (Christ & Ferrantino, 2011). There are also problems related to poor quality of land transport

infrastructure, in terms of poor road conditions, in addition to administrative hiccups at border crossings at ports and border crossing with Tanzania, Mozambique or Namibia (Raballand and Macchi, 2008). Supply chain problems exist due to being land locked country. Malawi like other sub-Saharan lands locked country countries experience increasing frequency of trading costs and time associated with imported goods in comparison to coastal sub-Saharan countries (Christ & Ferrantino, 2011).

Malawi has also problems of service access due to the physical feature's limitations. Many rural areas in Malawi are inaccessible to modern health services due to floods and poor road's infrastructure (NSO, 2002). Service access problems lead to new barriers of development leading to conditions like malnutrition, lack of clean water, poor sanitation, which also weaken the people and make it hard for them to break the vicious cycle. For example, poor access to clinics leads to high rates of child birth among the women who in the long run prevent them to participate in development activities. The implication of the geographical positioning is that there are transport and policy barriers, including high tariffs and export taxes (Christ & Ferrantino, 2011). Apart from that, Malawi is also poorly participating at global trade and there is uncertainty associated with imported and exported goods, long lead times and lengthy transport processes, all further weakening the economy (World, Bank, 2008). Investors are also not keen on do trade in the country due to massive logistical problems leading to high prices of commodities, which may also compromise quality measures, particularly agricultural products.

Malawi's base of the economy is agriculture yet agricultural products have a weak and negative impact on trade. The chief food group grown is maize. However, there is maize insecurity in lean season such as that inhabitants are seasonally hungry (NSO, 2000). Shortage of labour in farms which grow maize for commercial crop has an advantage of providing short term wage opportunities for farm seasonal workers in

the rural areas. In addition to maize, other food crops encouraged include cultivation of cassava, sweet potatoes, beans and groundnuts. The main commercial crop for farmers is tobacco, though small holder farmers were not allowed on the market until 1990. Tobacco has not effectively attracted trade because prices are unstable, poor quality often rejected, market is not always available. Other cash crops are also encouraged in a form of cotton, paprika and soybeans for export. In general, there is insecurity of food or cash crops due to drought. Though agriculture is main economy, the country is unable to meet the food requirements of the inhabitants. Three-fifth of the population is unable to meet their basic needs, including daily food requirement (NSO, 2002) hence the dependence on external aid for livelihoods.

Malawi like the most Sub-Saharan Africa hence depends on developed countries for aid in a form of capital, technology and markets. The rich countries of the west set the interest rates, terms of trade tariffs, import barriers and through their economic power, drain off the surpluses produced in poor countries. Capitalism in a form of all powerful transitional corporations has monopolised the production and extraction of raw materials, production of manufactured goods, commerce, marketing, and information (Burke, 1993). The impact of this on development projects is that external aid projects are exported by project sponsors of rich countries hence promoting stakeholder attitude of inferiority and dependency on the outside for rural projects. The rich countries determine conditions for the grants one of which is the formation of a local government system.

## **2.6.2 Malawi and the System of Local Government**

Malawi system of local government affects the way projects are managed. Malawi was colonised by Britain until 1964 when it gained independence. During that time, the government followed centralised administration model of top down, based on the



constitution (LDA, 2003). In a centralised administrative top-down approach model, the government makes the main decisions pertaining to peoples' welfare. However, there were policy reforms in 1998 when the government introduced decentralisation and the Local Government Act. This meant district level administration had to change from following the centralized model to a decentralised system. Decentralised system is believed to promote better governance (OECD, 2007). In a decentralised system stakeholder, end-users are involved in planning for their projects where transparency and accountability are encouraged. Decentralised system in Malawi was adopted mainly because of donor pressure and conditions attached to donor aid (UNDP, 2005). Donors perceived that a decentralized government is better in improving people's livelihoods than a centralised system because people contribute to decisions about their welfare. However, there are debates as to how effective and appropriate it is in Malawi. Gutierrez, (2007) highlights that decentralised systems are complicated and local communities are not able to manage complex technical processes.

The impact of decentralisation reform in 1998 was that a single structure was established at the district level to manage development projects in Malawi. The aim was to deal with poor socio-economic situation or alleviate poverty in each district. This was done by encouraging different development actors to work together and find solutions to problems related to poverty in the various districts. The main development actors are the government, NGOs, churches, private sectors and civil society.

District Assemblies (DAs) were formed in each district following the local government act in 1999. District Assembly terms of reference entailed policy making, coordination, supervision of district activities (Malawi, DHS, 2004). It also reviewed, approved, rejected proposals of projects from stakeholder end-users. There are five main committees at each district level that oversee finances, development, health,

environment and education. Each area comprises; counsellors from the Traditional Authority (TA), faith organisations, youth, women representatives, business community and extension workers in the TA (LDA, 2003). Examples of extension workers include health personnel, agriculture field assistants, community development assistants and primary school teachers as members of Area Development Committees (ADCs) and Village Development Committee (VDC). VDC is a representative body of stakeholders at the village level. It is a representative body for planning and development at the village level. It is composed of elected members from each ward and four women representatives and extension workers in the village.

Despite the decentralised local government structures, Gutierrez, (2007) highlights chronic poverty related problems in Malawi. The National Statistics office (NSO) in Malawi (2000) claims that the local government structures are more of a rhetoric than reality. Lack of accountability at the local and district level is reported, and districts often use centralised plans. There has also been a lack of coordination at grassroots level leading to too many village action committees duplicating their roles (LDA, 2003). Examples of such committees include village forestry committee, health committee, natural resource committee, water committee, the development committee just to mention some. Some of the ADCs and VDCs have also not been as effective due to lack of accountability. Poor people may also be hindered by local elites who may divert resources for their own gain.

Malawi has particular social and economic characteristics, which can provide a rich and unique dimension in hand-pump- maintenance literature. There is still little knowledge about hand-pump- maintenance in rural areas of Malawi in comparison to urban areas (Mbata, 2006). Another reason for focusing on Malawi is that, as a resident of the country, the researcher has established a number of contacts with

drinking-water projects sponsors and community that would provide easy access for the research hence the study was conducted in Lilongwe and Thyolo Districts.

### 2.6.3 Characteristics of Lilongwe District and the State of Drinking Water

Lilongwe is located in the central region and is the capital of Malawi. According to the 1998 Housing and population census the district, had a high population of 1,346,360 (NSO, 2000). This represents 13.6 % of the total population of the country. Chewa is the dominant tribe and makes up to 99%. Christianity is the main religion. Literacy rate is at 59.6 % that is higher than the national figures of 58% (Malawi, DHS, 2004). In Lilongwe Districts, just like most districts in Malawi, the District Assembly is the key decision making and policy development body. Lilongwe has 18 members of parliament and 17 Traditional Authorities (TAs). The Lilongwe district assembly is required to promote peoples' participation through District Development Plans (DDP), and action committees at area, ward and village levels. Roles of local government action committees at ward and village level are as delineated in the Table 10 below.

**Table 10: Local Government Structures and Roles**

<b>Structure</b>	<b>Roles</b>
District assembly (DA)	Implements policies of the assembly. It coordinates development from all sectors and manages resources.
District Executive Committee(DEC)	Facilitate the formation of structures training and capacity building for DEC, ADC and VDCs. It aligns national policies with district activities. ADC represents each VDC in the TA. It identifies, prepares and village needs. It supervises monitors and evaluates projects at TA level.
Village Development Committee (VDC)	VDC Identifies prepares and prioritizes community-based projects and submits to ADC. It mobilizes local resources in a form of self-help projects. It supervises monitors and evaluates development projects' implementation.

**Data Source: Lilongwe District Assembly, 2003**

### 2.6.3.1 District Development Actors in Lilongwe District

Development actors in the district include the government sectors, multilateral organisations and NGOs (LDA, 2003). However, they need to coordinate with each other. NGOs are the leading development actors. Table 11 below highlights some of the foremost NGOs operating in Lilongwe District and areas of their operation in promoting rural livelihoods.

**Table 11: A Catalogue of NGOs as Development Actors in Lilongwe District**

NGO Name	Area of Operation
Action Aid	Agriculture
Save the children	Community-based HIV/AIDS
AIDs Kumudzi Association of Malawi	Community-based HIV/AIDS
Malawi Red Cross society	Relief
CADECOM	Relief
Plan International Malawi	Environment, agriculture, food security, health
Christian Association of Malawi (CHAM)	Health
CPAR	Relief, agriculture, food security, health
World Vision International (WVI)	Drinking-water, health, education
CCAP Nkhoma Synod	Food and nutrition
Evangelical Lutheran Development Project	Environment, agriculture, education
ADRA Malawi	Relief
Inter aid	Water, sanitation
Care Malawi	Agriculture, public works' health and relief

**Data Source Lilongwe District Assembly, 2003**

### 2.6.3.2 Decision-Making Process at the District Levels

In both Lilongwe and Thyolo districts, planning starts at village level using decentralised local structures (Malawi, DHS, 2004). Local-level planning starts at

VDC, then ADC with the help of Area Executive Committees, which comprise of extension workers. Problems like drinking-water are identified, analysed and prioritised by VDC after that submitted to the ADC for approval before submitting to the DA for review and approval. The DA submits all development projects to DEC, which is the technical arm of development. DEC approves the projects before submitting to DA for approval. Implementation starts after approval of DA. The District Development Plan process in each of the districts starts with production of a Socio-Economic Profile (SEP) compiled for each district (Lilongwe District Assembly, (LDA) 2003). The SEP is a policy direction and guidance of the district for development projects or needs. Lilongwe district SEP ranks drinking-water as their main priority problem, however, non-functional hand-pumps are also common despite the initiatives as seen in Table 12 below.

**Table 12: Functional and Non-functional Pumps in Lilongwe District**

<b>TA</b>	<b>Functional Pumps</b>	<b>Non-functional Pumps</b>	<b>Grand Total</b>	<b>% of Functional</b>	<b>% of non-Functional</b>
Chadza	174	45	219	79	21
Chimutu	197	105	302	65	35
Chiseka	257	204	461	56	64
Chitekwere	76	33	109	70	30
Chitukula	101	165	266	38	62
Kabudula	76	108	184	41	59
Kalolo	198	134	332	60	40
Kalumba	45	16	61	74	26
Kalumbu	168	34	202	83	17
Khongoni	59	82	141	42	58
Malili	137	98	235	58	42
<b>Mazengera-Nkhoma area</b>	<b>253</b>	<b>82</b>	<b>335</b>	<b>76</b>	<b>24</b>
Mtema	42	112	154	27	73
Njewa	69	80	149	46	54
Tsabango	140	73	213	66	34
<b>Grand total</b>	<b>1992</b>	<b>1371</b>	<b>3363</b>	<b>59</b>	<b>41</b>

**Source: Lilongwe District Assembly, 2003: The District Socio-Economic Profile**

Table 12 above shows TA Chiseka has the highest number of hand-pumps (461) but only 56% are functional while TA Kalumbu has 202 hand-pumps yet 83% are functional. Frequent break downs of hand-pumps incapacitate provision of clean water to stakeholder end-users in rural areas of Lilongwe, hence the need to examine factors, which influence the stakeholder ability to maintain hand-pumps in Lilongwe compared with Thyolo District in the southern region.

#### **2.6.4 Characteristics of Thyolo District and the State of Drinking Water**

Thyolo District is one of the densely populated Districts in the Southern Region of Malawi (Malawi, DHS Survey, 2004). Thyolo District is situated boarded by Mozambique to the south, Blantyre on the north, Mulanje and Chiradzulu on the east and Nsanje and Chikwawa on the west. Thyolo District has a population of 587 455. The district has the highest population density of 250 persons per square kilometer. Thyolo District, according to NSO (2000), has 54% of the population living below the poverty line. Literacy rate is at 42.4. Thyolo District just like Lilongwe has local government structures in place to facilitate development (DHS, 2006). The district has 65 VDCs. Table 13 below shows how social problems are prioritized in the district with the drinking-water problem being ranked as the priority problem.

**Table 13: Ranking Social Problems in Thyolo District**

<b>Rank</b>	<b>Social Problem</b>
1	Inadequate access to portable water
2	Poor social service infrastructure
3	Food security
4	HIV/AIDS
5	Low household income
6	Inadequate access to education
7	Lack of public markets
8	Insecurity
9	Environmental degradation

**Data Source: Thyolo District Development Plan 2010-2013**

Thyolo District like most Malawian districts mainly depends on the central government and donor-aid for their projects. Funds are also generated locally. Table 14 below summarises the amounts of investment from different sectors.

**Table 14: Thyolo District Financial Investment**

<b>Thyolo District Public</b>	<b>2008-2009 Investment</b>
Locally generated revenue	K18,365,156.00
Donor aid	K218,207,825.27
Government investment	K557,272,769.00
<b>Breakdown of sectors</b>	
Agriculture sector	K20,998,702.00
Education	K39,911,098.00
Health	K417,657,630.00
Social and gender	K1,368,447.00
Rural housing	K1,254,650.00
Labour	K820,992.00
Forestry	K984,291.00
Drinking-water	K1,396,275.00
Environment	K1,034,187.00
Fisheries	K2,325,980.00
OPC	K1,672,966.00

**Data Source: Thyolo District Assembly (exchange rate 1£ = K250) ( Jan, 2012)**

The above Table 14 shows that Thyolo District like most districts in Malawi depend on foreign aid for almost half of the development budgets including drinking water.

#### **2.6.4.1 Drinking-water Strategic Plans for Thyolo District**

Thyolo District Development Plans aims to improve access of portable water and provide technologies suitable for the district's rural areas. In their three-year plan, according to the District Assembly Plan, the district target is to install 140 Afridev, 120 shallow wells, 140 shallow wells or Afridev and 18 gravity fed pipes for water schemes. These targets are set based on the national drinking-water Millennium Development Goals, and the MDGs vision set for 2020. The Millennium

Development Goals aim at reducing the proportion of people without access to drinking-water by half in 2020 (UNICEF/WHO 2012). Vision 2020 is about mitigating household poverty (UNDP, 2004). The next section outlines the specific study areas namely Bvumbwe in Thyolo and Nkhoma in Lilongwe Districts.

### 2.6.5 Bvumbwe and Nkhoma Study Areas

The study areas involved Bvumbwe area in Thyolo District and Nkhoma area in Lilongwe District. Figure 5 shows position of Bvumbwe area in Thyolo District.



**Figure 5: Bvumbwe Area in Thyolo District**

Sources of maps <http://www.athirstfortea.com/products/satemwa-bvumbwe-html>

Bvumbwe area in Thyolo District is in the southern region of Malawi. Drinking water projects in Bvumbwe area were mainly constructed by NGOs, particularly Concern Universal (CU). In this area, CU an international NGO constructed 27 new Afridev and 22 Malda pumps in the period between the years 2004 to 2007. Prior to Concern



Universal drinking water projects, OXFAM also installed hand-pumps though on a small scale. Bvumbwe area has a population of about 58 000 people. The area has people who are predominantly farmers, some work as tenants in tea estates; few are casual labours, in adjacent city of Blantyre. Bvumbwe trading centre is a rural-urban centre.

The second case study area involved the Nkhoma World Visio International (WVI) Project, implemented in Lilongwe District, Central Region of Malawi. The WVI has several projects in the area, but the drinking- water project under M-WASH project started 2011 ending 2015. At the time of the study, the project has rehabilitated 19 hand-pumps, which were constructed by previous partners. Figure 6 below shows the position of Nkhoma area.



Figure 6: Nkhoma Area in Lilongwe District

Sources of maps <http://www.maplandia.com/malawi/central/nkhoma/>

The two case study areas were chosen to allow comparisons to be made between these regions of the country and different project sponsors. In addition, the Bvumbwe

Concern Universal water project had been phased out in 2007 whilst the Nkhoma had just started in 2011. The variation in implementation periods allows comparisons of what has transpired with or without project sponsors/funding and if end-user roles in hand- maintenance is similar. The two water projects sites can provide end-users' perceptions of hand-pump-maintenance roles and any links to project success or failure because they both handed over the projects to stakeholder end-users to maintain them. Besides, there is no study of hand-pumps so far that has demonstrated the link between the hand-pump maintenance and on-going end-user roles.

This study's focus on Bvumbwe and Nkhoma areas in Malawi also provides some insights that inform research and practice in the wider hand-pump- maintenance in developing countries. Since hand-pump technology changes and different end-users are engaged to be part of the solution, there is a need to understand how end-users cope with technological developments and what factors affect their contribution in hand-pump maintenance processes. This gap in knowledge, as discussed above, is one of the motivations for this study, especially in Sub- Saharan Africa where there is inadequate representation in scholarly journal publications. There is a need to understand the contextual end-user roles' perspectives of the challenges of hand-pump maintenance in Malawi that can take representation of the nature of the hand-pump maintenance in Africa.

## **2.7 Application of Stakeholder Models in the Research**

From a realist philosophical stance, concepts from the stakeholder and inclusive rural development model will be applied by developing or formulating a framework that will guide data collection and testing of the results. Even so, since realism approach for this study is skewed towards qualitative research, the two models will hence be used to explain the findings of operations and maintenance of hand-pumps in the

selected case study areas of Bvumbwe and Nkhoma drinking-water projects of Malawi. The next section highlights how research questions were formed from the literature review.

## **2.8 The Research Focus, Variables of Analysis and the Research Questions**

The research focus refers to the unit of analysis, which is defined as the focal point where the variables, phenomena and the research problem convene. The research focus determines data collection and analysis (Yin, 1994). Not all aspects of water project management can be over elaborate within this single study. The research, therefore, limits itself to establishing factors that contribute to the successful maintenance of hand-pumps. Table 15 below illustrates the variables for initial analysis that were established during the literature review, particularly in the few research papers on rural water projects and lessons learnt (Gutierrez, 2007; Harvey, 2004; Kleemeier, 2000; Njoh, 2002; Sonuga et al., 2002). The main factors identified in literature review could be summarised as monetary and material factors, technical factors and organisational factors. Literatures showed that these factors are diverse however are similar to what the PMBoK (2008) identifies as external environmental factors of a project. Burkey (1993) categorise them as development factors in rural projects.

Table 15 section gives a summary of some relevant insights from literature about end-user roles in drinking water projects, which formed variables of analysis.

**Table 15: Hand-pump Maintenance and Variables of Analysis**

<b>Insight from literature</b>	<b>Description</b>
Monetary and Material Factors	End-users resources may develop means to sustain (Harvey, 2007; Ashbolt & Barnes, 2010; Jones, 2011; Prokopy, 2004)
Technical Factors	Presence of knowledge and skill at the village level may facilitate hand-pump operations (Dvir, 2005; Vajja & White, 2008)
Organisational Factors	Drinking water had challenges, which may call for active local committees with the ability to locally organise end-users and resources for pump-maintenance (Gutierrez, 2007; van Koppen & Rojas, 2012; Jaglin & Repussard, 2011)

Data Source: Chisenga 2014

End-user contributions in hand-pump maintenance have received mixed reactions. Although there is evidence that maintained hand-pumps have benefits but data is inconclusive about the extent and type of resources end-users engage in hand-pump maintenance. Furthermore, the reviews on the work of Prokopy (2007), Khang & Moe (2008), and Barnes & Ashbolt (2010) are justified by evidence as results emerged from reviews, which were mainly descriptive based on macro-level country data. The advantages of such use of data are that it is structural and scientifically proven with objective empirical evidence. However, a realist philosopher would disagree with data generalization in a drinking-water project because the context in which hand-pumps operate, is consistently changing making generalised data to be null and void. Furthermore, we get the impression that donors, NGOs and governments' efforts in initiating end-user roles for their drinking-water projects are fragmented, uncoordinated and unpredicted hence a critical review using a case study would be ideal to get a detailed picture on issues of the main research question as follows:

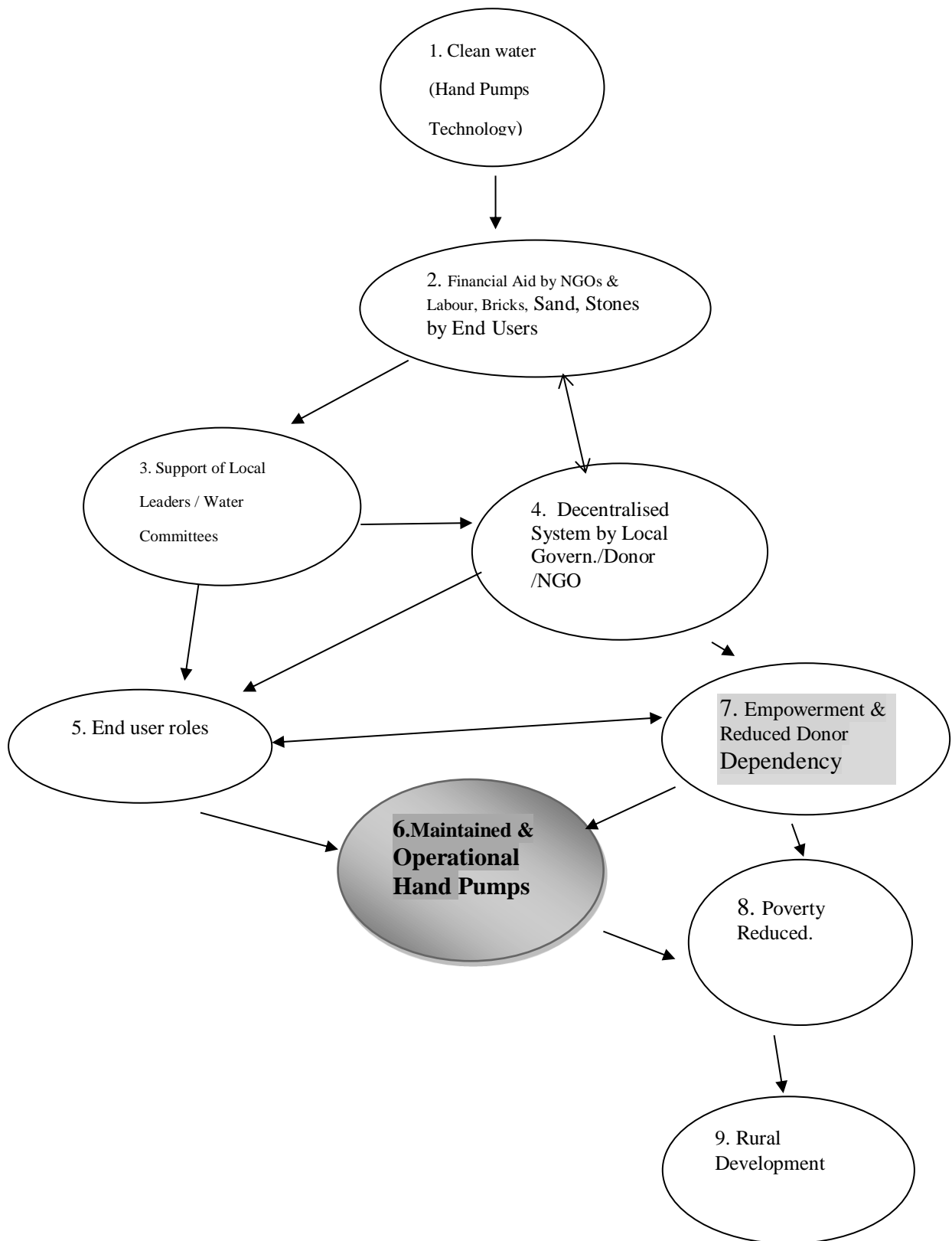
‘What factors facilitate or hinder effective end-user participation in the successful operation and maintenance of drinking-water projects in rural areas of Malawi?’

Also the subsidiary questions as follows:

- a) How do the end-user in-put or contributions influence the outcome of the hand-pump maintenance?
- b) What should end-users do to better understand their roles in hand-pump-maintenance?
- c) How do end-users perceive hand-pump- maintenance success factors? and
- d) What are the key challenges affecting the end-user ability to maintain hand-pumps?

The insights from literature about issues to be in place to promote hand-pump maintenance is further analysed in a form of a conceptual framework as detailed in Figure 7 on the following page 89. The above Figure 7 presents the issues to be put in place or possible models to prevail to achieve successful hand-pump management. Figure 7 also shows that end user roles have some potential to contribute to the operations and maintenance of hand-pumps. However, empowerment, broader poverty alleviation and rural development are ultimate goals. The figure further shows that the aim of the hand-pump is to supply safe drinking water free of faecal contamination so as to reduce diseases. However, this may not be done without provision of financial grants from NGOs, who are project sponsors and funders for capital equipment of hand-pumps technology. There is also need for end user contributions of sand, stone and query for building the hand-pumps other than being passive recipients. Individual end users are unable to dig the well or provide the materials on their own right hence it means some collective management, and institutional support is a necessary part of the machinery for community action (Smith, Bough & Thomson, 2001). Collective management of common-pool resources through local political structures has become a new thinking in drinking water projects. Research on common-pool resources shows that these resources can be sustained by its end- users and their local structures; hence the study focus is shaded circle 6 and 7. The notion of common property of managing resources has been successful in forestry management (Yirenkyl- Boateng, 2001).

**Figure 7: Conceptual Framework & Variables of Analysis (Chisenga 2014)**



However, this line of thinking (research on common-pool resources) has not been without criticism as there are hand-pumps, which are not repaired. The reasons for hand-pump failure varies one of which is inactive or lack of local government structures to support operations. Local government Institutional structures like District Assembly (DA), Area Development Committees, and Village Development Committees (VDC) would not have power without local government/NGO decentralisation policies (Haque, 2004). In summary, the figure shows that a solution to successful management of hand-pumps affiliates to rural development in a form of reducing poverty in rural areas.

The developed conceptual framework emerges from literature (Prokopy, 2005, 2009; Harvey, 2004, 2008; Harvey & Reed, 2002; Njoh, 2002; Crow & Shallow, 2012; Briscoe & Charkraborty, 1981; Breetz & Urgessa, 2012) and the hand-pump factors are diverse. However, the factors are similar to what Burkey (1993) broadly categorises as development factors in rural projects namely: social, economic, personal and political factors. In business or profit oriented projects such factors are viewed as environmental factors affecting strategic performance of a project (PMI, 2008; Johnson, Scholes, & Whittington, 2008).

Concepts from the above models will be applied by developing or formulating a framework that will guide data collection and testing of the results. However, since the study realism approach is skewed towards qualitative research, hence sustainable development model extracted from literature review will also be used to explain the findings of hand-pump maintenance in selected areas of Bvumbwe and Nkhoma drinking water project areas, Malawi

## **2.9 Conclusion of the Literature Review Chapter**

To summarise, the chapter has explored circumstances surrounding the rural drinking-water projects' management and particularly why exploring and understanding end-users' roles in hand-pump maintenance form the main objective of the study. The section has also outlined the stakeholder and inclusive rural development models, which form the basis for the conceptual framework from which research questions are developed including the study unit of analysis. In a nut shell, this chapter has outlined the research problem that needs to be addressed to resolve maintenance of drinking-water problems in Malawi. The last part of the section has elaborated the geographical, political, economic background of Malawi and how the situation directly or indirectly aligns hand-pump maintenance in Malawi. The section also included a presentation of the case study context. The next chapter details the philosophical and methodological approach to accomplish the research objective.



## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter explains the basis for the methodology adopted in the thesis to answer the research questions. The chapter also provides a discussion of the key features of the methodology used to answer the research questions in order to meet the research aims and objectives. The research concepts that are relevant for this research are analysed in order to provide reasons that justify the selection of a realist philosophy, qualitative research, case study research approach, sampling and data collection techniques. The aim of the chapter is therefore, to demonstrate the basis upon which the relevant research decisions were arrived at in order to address validity and reliability issues in a realist qualitative research.

Firstly, the methodology is aligned with the literature review (the problem, research question and aims) and then the flow of work is highlighted in a diagrammatic format to show the relationship of the methodology on other research phases. The background of philosophical choice is given to highlight the suitability of overall philosophical choice. Alternative methods are also discussed and shown why they have not been the best to answer the research question; and why the chosen methods engage with sorting problems of hand-pump maintenance. By employing secondary data (literature review) and primary data collection (using documents, observation, interviews and focus groups), to establish factors facilitating or inhibiting hand-pump maintenance, the research question is explored and answered with valid data triangulated from different sources.

### **3.2 The Research Question, Aims and Objectives**

The author was inspired to undertake the research because there is an investment of hand-pump technology to improve provision of safe drinking water for rural stakeholder end-users in Sub-Saharan Africa, which include Malawi. The author had come to a conclusion that maintenance of the hand-pumps posed a challenge for continued supply of safe drinking water for end-users (WHO/UNICEF, 2004). In

addition, despite increased donor aid grants and thousands of hand-pumps installed in Malawi, nearly 35% were deemed non-functional in the first few years of completing such projects in Malawi. This leads to a concern that unless strategies are put in place to maintain the hand –pumps, stakeholder end-user health will continue to deteriorate and projects value for money will not be achieved. Therefore, the general research question being asked is:

***What factors facilitate or hinder end-user participation in the successful maintenance of drinking-water projects in rural areas of Malawi?***

This research question also has in mind the specific aim and objectives as follows:

**Research Aim:** The research aims is to develop strategies and recommendations to reduce rural water project failure and contribute to the body of Project Management research.

**Research Objectives:** There are several objectives that are targeted in order to ensure that the researcher can achieve the study aim. These objectives were to:

- 1 Critically review, examine and analyse existing literature relevant to the study topic.
- 2 Examine the project maintenance plans at hand.
- 3 Explore and describe the end-user roles in different project phase.
- 4 Explore and describe the challenges end-users face in the hand-pump maintenance of drinking water projects in rural areas of Malawi.
- 5 Make suggestions for changes in drinking-water project maintenance approaches to improve hand-pump sustainability.

Clearly, studying the thousands of hand-pumps in Malawi in details to gain meaningful results was not practical. The solution to this was to select a sample that was small enough to study in sufficient detail, yet one, which is large enough to contribute sufficiently to a spectrum of activities providing with enough data for consideration of suggestions to improve the hand-pump maintenance (theoretical replication).The first step was therefore, to gain an insight of relevant factors from the

literature review or data mining (secondary data) before beginning the data collection (primary data)

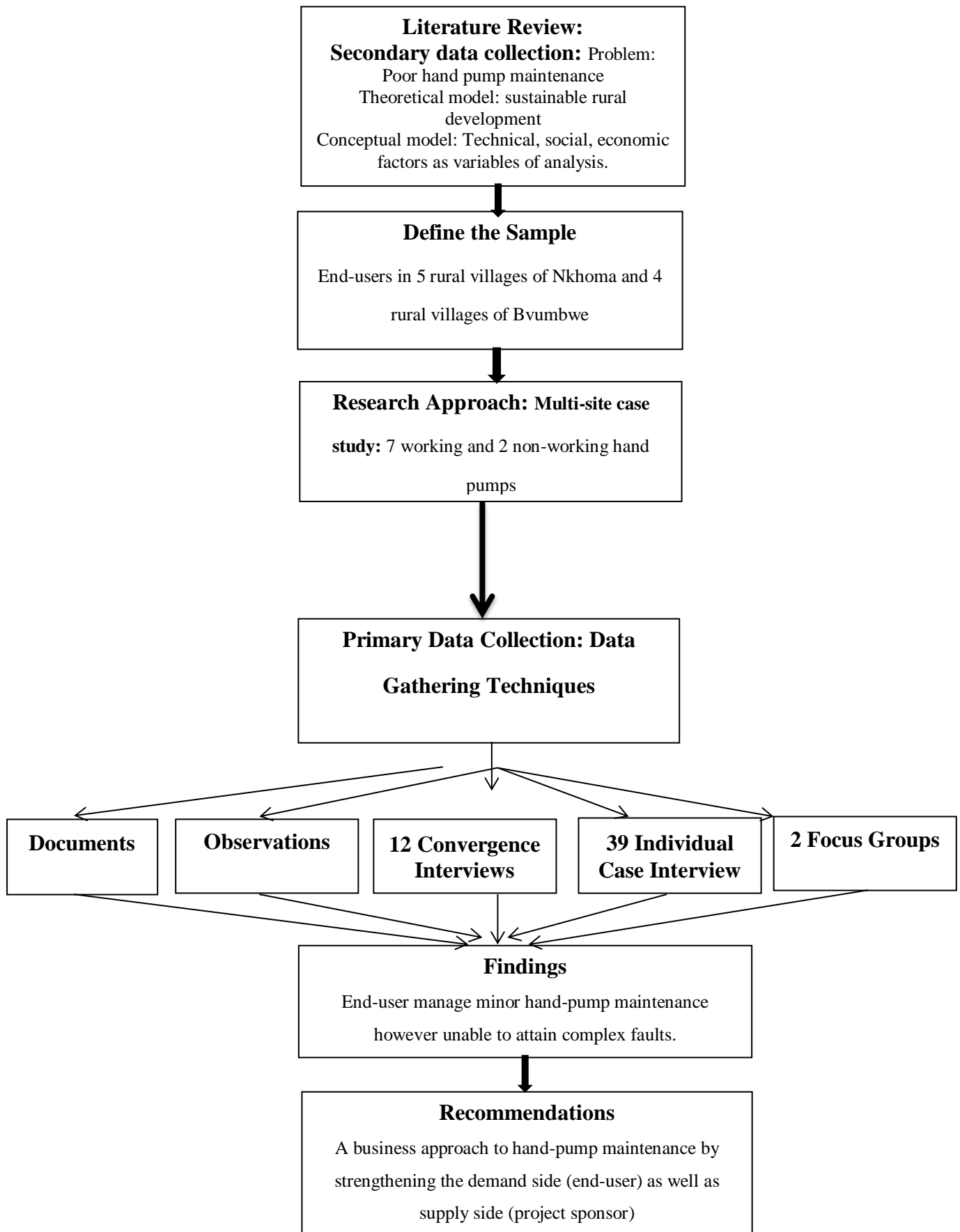
### **3.3 Phase One – Literature Review and Data Mining (Secondary Data Collection).**

Hand-pump technology has been recognised as an appropriate technology to improve the state of drinking water in rural areas of Africa. International investors or funders, NGO, governments and parastatal organisations, including churches have in the past three decades aligned strategies to install hand-pump . The main international donors and investors for rural development include Africa Development Bank (ADB), DFID, WHO, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), World Bank, Swedish International Development Agency (SIDA), Danish International Development Agency (DANIDA), church groups, and NGOs. The existing literature on rural projects in general shows that sustainability of hand-pump maintenance after external aid is phased out is a major concern (WHO/UNICEF, 2012; NSO, 2012) and that end-users are handed over the assets to maintain them despite the challenges. End users operate in an environment which has organisational, cultural, economic and technical challenges which in turn have constraints on hand-pump maintenance.

However, literature does not provide an answer as to the efficacy of stakeholder end users roles in their maintenance, nor does it explain how and why end users maintain or fail to maintain the assets. Hence the overall area of this research can be refined to the study of factors, which facilitate or hinder hand-pump maintenance from the perspectives of stakeholder end-users. In order to obtain data for this research it was necessary to undertake a detailed case study in two different regions of Malawi where such projects had been done.

### **3.3.1 The Method of Data Collection and Analysis**

In order to achieve the level of details required, this study employed nine hand-pumps from two different districts, which had hand-pump projects by different project sponsors, in two different regions of the country. However, by selecting different data sources and subjecting them to analysis using different data collection techniques for triangulation, the problem is approached from different angles thereby incorporating a more valid conclusion. The different methods to identify factors affecting hand-pump maintenance were compiled from insights of literature, documents, observation, and interviews. These are summarised in a form of a flow chart or research outline below in Figure 8.



**Figure 8: Outline of Research Structure (Chisenga, 2014)**

The research outline encompassed the accomplishment of objectives at different stages as summarised in Table 16 below.

**Table 16: Objectives and Research Stages**

Objective	Stage of Research
1. Critically review, examine and analyse existing literature relevant to the study topic.	Literature Review and Stage A Documentary Analysis (Chapters 1 &2)
2. Examine the project maintenance plans at hand.	Case Study Design and Data Collection and Analysis : Stage B (Observations); Stage C, D and E using Interviews (Chapters 3&4)
3. Explore and describe the end-user roles in different project phase	Case Study Design and Data Collection and Analysis : Stage B (Observations); Stage C, D and E using Interviews (Chapters 3&4)
4. Explore and describe the challenges end-users face	Case Study Design and Data Collection and Analysis : Stage B (Observations); Stage C, D and E using Interviews (Chapters 3&4)
5. Make suggestions for changes in drinking-water project maintenance approaches	Chapters 5 & 6

The following section provides details of how the philosophical stance chosen which directed the research process. The main philosophical stances include objectivism and subjectivism (Robson, 2006; Saunders, et al. 2009) however realism has also been recently considered.

### **3.4 Research philosophy: Realism Versus Objective and Subjective Research**

Positivism is the most common philosophical view or stance based on the tradition of empirical scientists focusing on observable social reality, mainly in the physical and

natural science (Pawson, 2006). The origin of physical and natural science has its roots in the work of Plato and later advocated by other scientists, including Aristotle, and others (Bhaskar, 1980). Natural scientists claim that only observable phenomenon leads to credible data. Positivism is based on existing theory and hypothesis testing (Saunders, et al. 2009). Hypotheses are tested and confirmed in whole or part or refuted leading to further development of theory. Hypotheses are approved if based on central tendency theorem, which calculates robustness based at 95% confidence interval and 5 % margin of error (Saunders, Lewis & Thornhill (2009: 147). Positivism uses high structured methodology to facilitate replication and emphasis is on quantifiable observations using statistical analysis (Cresswell, 2008).

Positivism assumes that an objective reality exists independent of human behaviour and is not a creation of human minds. Natural science depends upon the observer/researcher having an objective account with the world as a concrete entity separated from human intention and purpose (Saunders, et al. 2009). The senses are used to determine data that are objective and measurable thus methods are chosen to obtain estimates of truths, using data and estimators that are both unbiased and precise (Saunders, et al, 2009). It is this characteristic of the world view and its value of external validity (the degree to which the conclusions would be the same for other people at other places and at other times) and reliability (the consistency of results gained) that drive natural scientists in their choice of methods.

In rural drinking-water research, objectivism stanza maintains that social entities exist, in reality, independent of social actors concerned with their existence. This view focuses on the structural aspects of hand-pump maintenance and assumes that the structure of maintenance for hand-pumps is similar in all villages. Aspects of maintenance may differ, but pumps are managed within the same system or structure. This philosophical view focuses on management of hand-pumps (whether operational

or non- operational) which has a separate reality from end-users who inhibit them. Data would produce facts on formal maintenance structure at the hand-pump even if some end-users are not using it. Structure in this context could be NGOs, donor funds, local government structures or committees, local leadership and end-users themselves. However, positivist view is inadequate in this study because structure on its own is not enough to base end-user views in the maintenance of hand-pumps but also their meanings, values and intentions. This makes the study view to be skewed towards subjectivism.

Subjectivism philosophy claims that social phenomenon is created from perceptions and consequent actions of social actors through the process of interaction (Denzin & Lincoln, 2005). Two forms of subjectivism philosophy include interpretivism and social constructionism. Interpretivism focuses on a phenomenon purely created from peoples' perceptions of reality. However, if perceptions are created from reality, which is socially constructed based upon the environment; it then becomes social constructionism (Denzin & Lincoln, 2005). As hand-pump operations and maintenance research is done within the environmental context with political, social and economic factors, the phenomenon (hand-pump maintenance) is hence created with influence from the environment. Subjectivism interpretivism considers that hand-pump operations management is not constant, so there are no definite hand-pump maintenance structures in this context. This view looks at subjective views that end-users perceive to play in hand-pump maintenance. End-users under study may perceive different ways of hand-pump maintenance as a consequence of their own view about the world, which affect their roles and level of actions they do. Furthermore, this view attempts to make sense of the environment in which the hand-pumps are managed. The researcher attempts to understand the subjective reality of end-users in order to be able to make sense and understand motives of actions and intentions leading to hand-pump operations or non-operations. However,



interpretivists world view is inadequate because it denies the existence of objects, which are real in hand-pump maintenance research. The next section will argue how this study blends some concepts from positivists and social constructionists' world view, in a form of a realist stance, to engage with answering the research question. This study situates its research question by merging concepts from both subjectivism and objectivism, which bring a philosophical approach called realism. In realism, Bhaskar (1980) synthesises both the reality of objects and their knowledge.

### **3.4.1 Realism Philosophy**

Realism as a philosophical stance was developed in the United Kingdom in the 1970s (Benton 1981; Harre 1972; Harrre & Madden, 1975). Realism is defined as 'the view that objects or entities exist independent of our knowledge or theories of their existence (Saunders et al, 2009: 114). Carolan (2004) furthermore defines realism as the view that entities exist autonomous of being perceived or independent of our theories about them. Bhasker (1980) further expands that scientific realism is the view that theories refer to the real features of the world. 'Reality' refers to anything in the universe like forces, structures that cause the phenomena we can perceive through our senses. Such views were not accepted by both positivists and constructionist and post-positivists. In the 20th century, realism, particularly critical realism has emerged as a philosophical discussion in business management (Devitt, 2005). Realism retains ontological realism (that there is a real world that exists independent of our perceptions, theories and constructions) while accepting a form of epistemological constructivism/ interpretivism and relativism (our understanding of the world is inevitably a construction from our own perspectives and stand point). Realism denies the possibility of attaining a single 'correct' understanding of the world as perceived by positivists. The 'real' in realism is classified in the domain of the actual and comprises events or phenomena that happen irrespective of whether they are observed

or not (Pawson, 2006; Pawson & Tilley, 1997). If an object or phenomenon is observed, then it becomes an empirical fact (Hartwig, 2007; Bhaskar, 2000).

Realism accommodates both extreme ends of positivism and social constructionism and has become one of the popular research philosophies used to investigate various disciplines, including marketing (Eston, 2010; Fleetwood, 2006); natural resource management (Evely et al, 2008; Yirenkyi-Boateng, 2001); media (Lau, 2004); information science (Wikreg, 2005), education (Hatch, 2002) and economics (Lawson, 1997). This paradigm shift support signs of Kuhn's structure of scientific knowledge revolution. Although realism is becoming popular, it is criticised for being unclear and (Hartwig, 2007) argues that it is only a minority of researchers that use it.

There are also various forms and different terms which have been applied to realism, including 'direct' and 'vital' (Saunders, 2009 :115) 'critical' (Archer et al 1998); 'experiential' realism (Lakoff & Johnson 1999); constructive realism, 'subtle realist' (Hammersley, 2002); 'natural' realism (Putnam, 1999), 'innocent' realism (Haack 2003), 'agential' realism (Barad,2007), 'multiperspectival' realism (Wimsatt, 2007). In general, all the categories of realism have a distinct feature which denies that we can have any objective or certain knowledge of the world and accept the possibility of alternative valid accounts of any phenomenon based on context (Eston, 2009). This study is skewed towards critical realism because it encompasses most concepts of the above-mentioned variations of realism because of its 'emancipatory' nature (Bhaskar, 1989; Archer, 1995, Seelo & Mair, 2010).

### **3.4.2 Differences Between Realism, Positivism and Interpretivism**

Firstly, Realism rejects the view of abstract concepts and terms or logical constructions based on predictions of observable data making, which has no claim on

reality. In realism philosophy, theoretical terms refer to actual features and properties of a 'real' world. Critical realism holds the view that mental states and attributes, including meanings, intentions though not directly observable are part of the real world; which is denied by both positivists and interpretevists. Realists consider mental and physical entities like hand-pumps as real though conceptualized by means of different concepts and framework. Secondly, critical realism endorses the concept of 'cause' and 'effect' in both the natural and social science and views it as real phenomena. 'Cause' and 'effect' is viewed as an 'explanatory' concept intrinsic to either the nature into the world or understanding of it. Nevertheless, realists deny the view of causation by positivists in quantitative research, which states that regular causation or association between events or variables form a pattern in data. Realist argues against predicting causation as having patterns because the context constantly changes (Maxwell, 2004).

Ontological realism can have be useful for qualitative methodology, practice and implications as it can provide a new and useful way of approaching problems and generate important insights into the social phenomena of the hand-pump maintenance. Realism claims that verbal expressions are as valid for a claim. Statements about entities that belong to the mental framework are also as testable by scientific methods as statements about any hypothesis. Putnam (1999) argues that 'mental' statements about one's beliefs, reasons, or motives for doing something can be as valid explanation of the person's actions. Mental phenomena in the study context are the causes of behaviour related to whether end-users maintain pumps or not. Individual intentions have consequences of how people act, think and make sense of what is going on and why they maintain the hand-pumps or not. Neglect of mental phenomena is what qualitative researchers identify as a main flaw in quantitative research. However, in realism, both physical phenomena and mental aspects are

considered real. Realist supports interpretive about the social phenomena though interpretivists denies the existence of causal effect on the mind of the physical world.

Realism hence provides a clear argument to accept the causal role for values of what is hand-pump maintenance success or failure. From a realist point of view, both end-user values or perspectives and the state of hand-pumps, whether working or not working are 'real' phenomena and casually interacting with one another. The realist perspective can provide a framework for better understanding the relationship between the actors' perspectives (end-users) and their actual situations of the hand-pump maintenance state thus integrating a realist ontology and interpretivists epistemology.

### **3.4.3 A Realist Ontology and an Interpretivist Epistemology**

This section provides a discussion of the fundamental epistemological and ontological issues that informed the methodological nature of this study. Critical realism combines realist ontology and an interpretivists epistemology which makes it different from positivism and interpretivism. Ontology refers to what actually exists or the nature of reality. Realist ontology refers to the belief that there is a real world that exists independent of our belief and constructions. In rural drinking-water projects, ontology is about what was the evidence of social reality about hand-pump-maintenance and the nature of relationships between the knower, who are end-user and the researcher (Driedger, Gallois, Sanders, Santesso, & Group, 2006). Epistemology refers to how we gain knowledge of what exists or how to know anything. A constructivist epistemology relates realism to the belief that our knowledge of the world is inevitably our own Constructions created from specific point. Realism also claims that individuals have no possibility of achieving a purely or 'objective' account that is independent of their particular perspectives.

Epistemology in this study is about priority areas on what represents knowledge of rural water projects' maintenance.

According to Acher (1995), Carolan, (2005), realism in contrast to the concept of idealism, borrows concepts from positivism as it assumes a scientific approach for the development of knowledge whilst also considers the changing environment in which features operate (Bammer, 2005; Maxwell, 2012). Realism acknowledges that knowledge producing actions only make sense when an assumption about the existence of related structures is granted (Benton, 2001; Corolan, 2005). Critical realism makes important distinctions between the way things are and our knowledge claims about objects of knowledge as it fuses epistemology (*what we think is knowledge*) and ontology (*what is*).

To engage with day to day life with hand-pumps as a new innovative technology qualitative methods, therefore, need to go beyond interpretivism because knowledge is connected to the real world it refers to, and it is not complete or infallible but partial and subject to revision (Bhaskar, 1980). This is because end-users are daily adapting to the new technology based upon their values, beliefs and intentions, which is seen through their practices in maintaining their hand-pumps or not. A realist view in social science treats the ideas or intentions held by end-users in this context about hand-pump maintenance as equally real as physical objects as the case of maintained or non- operational pumps. Maxwell (2008) identifies realism views to have aspects of reality not as independent or separate but interacting in social life and influencing each other. Barad, (2007) and Lent, (2003) are among scientists who have integrated ontological realism and epistemological interpretivism as acceptable philosophy from the physical as well as social science.

In every-day hand-pump maintenance life, realist views the ideas, intentions; meanings end-users attach to maintenance to have consequences for their actions or their roles. For example, changing end-user understanding of dangers of drinking polluted water can help to change their attitude to seek ways to repair pumps and improve their livelihoods. Realism also views that physical events such as a non-functional hand-pump can influence end-users' beliefs or intentions of what they can or cannot do about them. Critical Realism meets both above criteria and can therefore help to solve philosophical, theoretical, methodological and political problems related to non-functional pumps in rural areas of Malawi. A realist approach was consequently used to provide insights into end-user experiences in the operations and hand-pump maintenance of rural water projects.

#### **3.4.4 Realist Causal Power in Hand-pump Maintenance**

Bhaskar's reality is differentiated from others as it comprise of the three domains: *'the real', 'the actual' and 'the empirical'* (Bhaskar, 1978; Hartwing, 2009) and these will be a guide for this research. The 'empirical dimension' consists of experiences, observed events and outcomes due to mechanisms operating in parallel (Tao, 2013; Sayer, 2000) while the 'actual dimension' involves the flow of events produced either by experiments or as uncontrolled conjunctures. The 'real' world of causal powers and structures are about the links between powers, mechanisms and empirical observed events. If powers are humans, then they represent the way people act to show mechanisms when stimulated externally or intrinsically (Bhaskar, 1980).

A realist causal claim is about what objects can do or what it is conditioned to do or what it will do in any particular situation (Sayer, 2000). Eston (2010) further explains that a causal claim is what makes things happen...what generates or influences it. The process starts with social objects, which could be end-users or social relations that

have causal powers. Causal powers exist based on the internal structure of the objects irrespective of being exercised or not (Sayer, 2000; Tao, 2013). For example, end-users may have the causal power of being self-reliant, though they may not use it, in particular, circumstances. These circumstances vary as social reality is an open system. Particular objects or end-users with their causal powers always co-exists with other objects/ events that have causal powers (Evelly et al. 2008). To be causally efficient social structures need to have properties that cannot be reduced below the sum of individuals making up the group, which realist calls emergence (Evelly et al. 2008).

Critical realist understanding of causality is based on multiple determinations, several causally efficacious mechanisms operating at the same time. Even so, individual end-users also still hold their causal powers as they may choose some actions not others (Archer, 1988). According to the realist, theoretical framework, there is a need to identify mechanisms or new guidelines and knowledge systems to emancipate end-users from problems of hand-pump failure and donor dependency. In applying Bhaskar (1999) variables in realism, this researcher argues that if there are non-operational hand-pumps, because of a particular causal power X, it does not necessarily mean that it's the causal power did not work. There are possibilities that an opposing causal power Y was operating at the same time leading to non-operational hand-pump (abandonment or discontinuation). It, therefore, follows that the exercised causal power X and exercised causal power Y operate in the opposite direction at the same time. The relationship between causal power X and causal power Y is internal. XY relationship may be defined as internal if and only if X would not be what it essentially is unless Y is related to it in the way that it is (Bhaskar (1999; Hartwig, 2007). However, the relationship between X and its effect on Y is contingent on other causal powers operating or not at the same time. Within realism, causality, (other causal powers that coexist within a given causal power), and its

influences on the actual events are called conditions (Eston, 2010). Figure 9 below presents a realist theoretical framework and illustrates how the elements of causation could be structured to constitute of the ‘real’ level (context) in the management of hand-pumps.

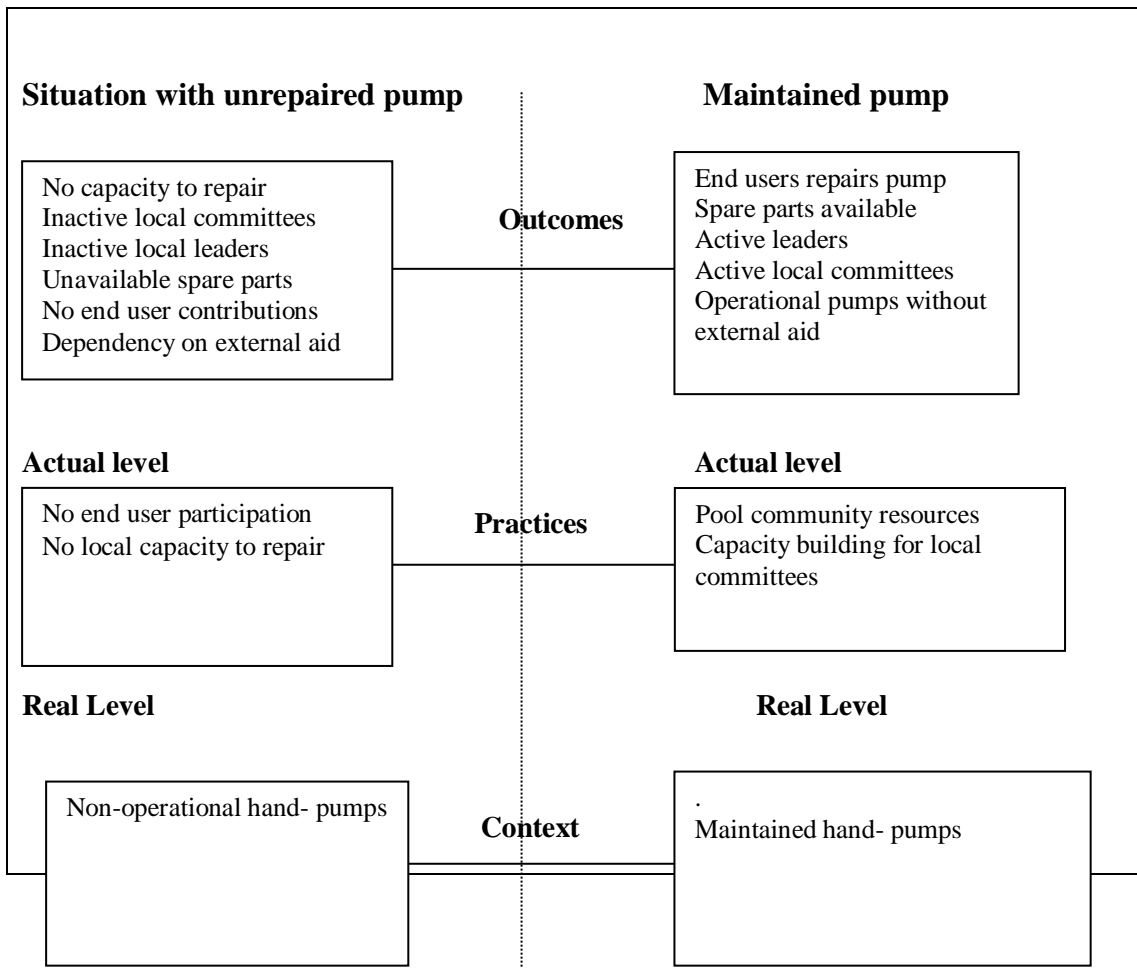


Figure 9 Critical Realist and Drinking Water (Chisenga 2014)

Figure 9 implies that if end-users have causal powers in their interactions, it can lead to effective hand-pump operations and management. However, it does not imply that structures (end-users) as a collective entity are independent of actors, who are individual end-users (Archer, 2007). Although structures have causal properties, and causal powers do not mean that they determine the behaviour of individual end-users. In this context, structure refers to the social entities that are groups of end-users and



the communal relationship between them (Elder-Vass 2007). The realists' view is that structures are pre-existent- we are born or conditioned into social relations that are not of our choosing as individuals. In other words, people do and make selections from structurally and cultural generated options which they do not choose (Archer, 2007). Realism claims that complex systems are greater than the sum of their parts (Bhaskar, 1979). It therefore, follows that social institutions influence actors' habits and how actors reflect, which eventually leads to formulation of courses of actions.

#### **3.4.5 Research Design Based on Realistic Premises**

Realism acknowledges mental processes as existent phenomena just that they are not observed. Maxwell, (2008) further argues that a realist design represents what is actually happening, on the context other than what was initially planned. The researcher is guided by what is happening on the ground and shapes the proceedings accordingly so it becomes an iterative routine. However, design decisions are initially shaped by the researcher's prior experiences, beliefs and goals as well (Maxwell, 2012). Research design is also a 'real' phenomenon because it represents the actual nature and components in terms of 'real' setting, end-user roles and relationship within hand-pump premises (setting). The setting may alter the direction over the conduct of the research making the existent design implemented to differ from the planned design. So the design finally is the outcome of what was planned, interactions with the physical and social which are external to the initial design, which the researcher may not have been aware of at the beginning. In other words, the design did not only pay attention to what was planned but also what was happening within the study context.

This study did not stick to 'fixed' deductive designs as in quantitative research, which aims to compare data and maintain design features to self-guard against some validity

threats. In normal approaches, quantitative research designs follow a linear, sequential and comprise of a series of stages or tasks in planning in the study. Often quantitative research designs start with problem formulation then conclusion and theory; however, in a realist qualitative research approaches such designs are incompatible because the research follows an inductive strategy. In a realist, qualitative research, the research process is constantly changing according to new information or transformation in contextual circumstances. To therefore avoid a deductive research design this study adopted a flexible research design (Robson, 2011) using Convergence Interviewing (CI) as the first stage to develop categories related to hand-pump- maintenance. CI allowed re -constructing the design other than follow a prescribed pattern. Realism has insights and strategies or implications how to conceptualize values, causations and diverse ways' end-users associate with hand-pump maintenance; which are regarded as 'real'.

Maxwell (2012) describes a realist informed design to be related to the first three components (goals, conceptual framework and research questions) as these are 'real' phenomena existing in researcher's mind but also have observable behavioural manifestations and consequences of the research. In this context, the researcher has in mind about drinking-water maintenance as a phenomenon studied, and intentions. The method represents actual behaviours and ideas surrounding the process of selecting settings, respondents, relationship established with respondents and methods used to collect and analyse data. Maxwell (2012) identifies validity as the last component focussing on concerns about the relationship of the conclusions and inferences drawn from the analysis as an actual phenomenon studied. The research design components are 'real' phenomena with complex aspects and consequences on the study. The

implication is that it is critical to understand how the researcher goals, beliefs and questions influenced the actions and how it eventually affected research setting and selection of end-users who were respondents. End-users describe their interaction with each other and their experiences in the maintenance of hand-pumps, presenting these stories as facts (Silverman, 2011). The research established facts by comparing diverse end-user stories. Realism also considers characteristics of predetermined concepts or prior knowledge. Prior knowledge in this context are the hand-pump maintenance insights established in the literature review (secondary data mining) (Robson, 2011) and lessons learnt from previous rural water projects. This prior knowledge, therefore, introduced elements of objectivism or deductive research. Realism, as a result, merged deductive and inductive perspectives of end-users (Hatch, 2002; Marshall & Rossman, 2006) facilitating the development of a common understanding on what constitutes knowledge in rural hand-pump maintenance, based on case study research strategy.

### **3.5 Choice of Case Study as a Research Strategy**

This section justifies why the study opted to use a case study as the research strategy. Research strategies are defined as research processes and there are five main research strategies used in social research, which include: experiment, survey, archival, history and case study (Saunders et al, 2009; Yin, 2009). Each of these has advantages and disadvantages, and their appropriate use depends on the research question being addressed. Table 17, on the following page, summarises application of relevant situations for different research strategies

**Table 17: Issues to Consider for Different Research Strategies**

<b>Strategy</b>	<b>Form of Research Questions</b>	<b>Control of Behaviour Events</b>	<b>Focus on Contemporary Events</b>
Experiment	How? Why ?	Yes	Yes
Survey	Who? What? Where? How many? How much?	No	Yes
Archival Analysis	Who? What? Where? How many? How much?	No	No
Case Study	How? Why?	No	Yes

**(Source, Yin, 2009)**

The survey was also not appropriate for this study strategy as well because the study does not aim to explore and understand context limited by specific variables by which data can be collected (Eston, 2010). Furthermore, this study does not adopt experiment strategy because we may not be able to undertake hand-pump maintenance phenomenon within a highly controlled context as required in experiment.

In hand-pump maintenance research, the experiment was not an appropriate option because drinking water maintenance as phenomena did not require to study using controls. In other words, this study does not adopt experiment strategy because we may not be able to undertake hand-pump- maintenance phenomenon within a highly controlled context as required in experiment. Archival was equally not suitable because the hand-pump maintenance is a contemporary phenomenon. A survey could have been fitting depending on feasibility and availability of resources, which were constrained. A survey was also not appropriate for this study strategy as well because the study does not aim to explore and understand context limited by specific variables by which data can be collected (Eston, 2010). The option was to do a case study. This was a best option, firstly, because hand-pump maintenance is a contemporary

phenomena. Secondly, a case study was more advantageous than any other research strategy because it allowed to study the phenomena at a smaller scale in a detailed way whilst applying the results at a larger scale (theoretical replication)( Yin, 2009).

Yin (2009) proposed that when 'a how and why' question is asked about contemporary set of events, over which the researcher has little or no control, a case study has a more distinct advantage. Yin (2009) further states that a case study is more ideal because it considers examining hand-pump operations and maintenance as a phenomenon within a real-life context, when the boundaries between the phenomenon and context are not clearly defined. In support of the case study approach, Robson (2011) argues that, a case study is viewed as having its own right and not as an extract from a sample in the study population. Yin (2009) also states that the importance of a case study is that it focuses on specific boundaries of the phenomenon being studied. Yin's (2009) view is that the phenomenon (such as hand-pump maintenance), and contexts (end-user roles) are not easily distinguishable in real-life situations hence data collection and data analysis become significant. Therefore, the study results rely on multiple sources of evidence. Data is triangulated or cross checked to produce justifiable conclusions.

The case study is also advantageous in this study because as it helps to answer the 'what' and 'why' questions related to hand-pump maintenance. Sunders et al. (2009:146) and Yin (2009) concur that a case study is appropriate when the study aims to understand more of 'what' events or facts about the phenomenon as the case of hand-pump maintenance. This engages with this study research question as the literature review clearly identifies hand-pumps, which have failed to operate as well as those which are repaired (boundary). Hence the main focus is to explore the strategy that hand-pumps are perceived as operational and maintained (the case) and the reasons behind such end-user perceptions, which would best be understood by

examining representative cases using multiple sources of data. Yin (2009) recommends six types of information to collect data in the form of documents, interviews, observation and physical artefacts. Such data could be practical in case study but may not be feasible in experiment or survey (Cresswell, 2007).

### **3.5.1 Choice of Representative Cases in the Study of Hand-pump Maintenance**

Choice of appropriate illustrative or representative cases is a complex issue in case study research (Yin, 2009). Representative cases in case study researchers are those isolated from the population of hand-pumps in Malawi to study the phenomenon. Yin (2009) and Cresswell (2007) proposed the criteria of choosing cases or hand-pumps to depend upon the one which mostly represents the phenomenon but may also consider others, which may show different perspectives about the problem (repaired or abandoned hand-pumps) or phenomenon. Yin (2009) proposes the choice of cases to be bounded by:

- Exploratory and explanatory type of study
- Multisite vs. single case site
- Multiple sources of information

The exploratory case study has been chosen because the variables or criteria for assessing end-user perceptions for underlying hand-pump maintenance factors in rural drinking-water is not available (Cresswell, 2007: 242) hence the use of Stage C, Convergence Interviews.

Exploratory study is an emerging design study, where the context depends on enquiry and data collection, and analysis is largely inductive (Patton, 1990). Exploratory case study is appropriate because we seek to have an in-depth understanding of the perspectives or views of the rural hand-pump maintenance (phenomenon) by project end-users in different hand-pump locations and compare with each other (embedded cases). However, the second phase is an explanatory purpose of the case study. This is built from a realist perspective and was carried out as data was gathered from known variables using semi-structured interviews. The aim was to establish causal

relationships of variables to explain why hand-pumps are not maintained (Saunders et al., 2009).

Yin (2009) also proposes either multisite or single case site study. The researcher used several cases, other than a particular case or holistic case to determine how hand-pump maintenance is perceived in different projects. A multiple case study is defined as one, which involves the study of more than one case, while a single v single case is defined as a case study where it represents a critical case or an extreme unique case examination – to provide an opportunity to observe and analyse the phenomenon that few have considered before (Yin, 2009). There are no rare cases of drinking-water projects hence this type does not engage in this study. The holistic case v embedded case dimension, on the other hand, refers to the study of units of analysis that is, different hand-pumps in each NGO area of Nkhoma and Bvumbwe (Yin, 2004). This was adopted in this research as the research focussed on Nkhoma and Bvumbwe drinking-water project areas as the whole, including logical subunits in terms of how end-users relate in each pump-pump and also the whole system in support of maintenance practices. The rationale for using two NGO- drinking-water project areas helped to establish whether water operations and hand-pump maintenance system (which is the case) occurred in other areas as well. The use of multiple and embedded cases led to a consequence of the need to generalise from these findings (theoretical generalisation).

### **3. 5. 2 Choice for Case Study Representative Sampling**

Sampling is about taking a smaller chunk of the larger universe (Miles & Huberman, 1984).). In this study, sampling is about which people to interview and which hand-pump events and social processes relating to maintenance (Miles & Huberman, 1984) to be explored. Positivists differ from a realist because they focus on random sampling while the realist tends to be skewed towards purpose driven sampling. In addition, sampling was also driven by the conceptual framework and the research question. The chosen hand-pumps were from a large pool of over hundreds in each district. Therefore, the working and non-working hand-pumps were samples. The study was investigating the process of managing hand-pump maintenance, so as to make sense of the social phenomena.

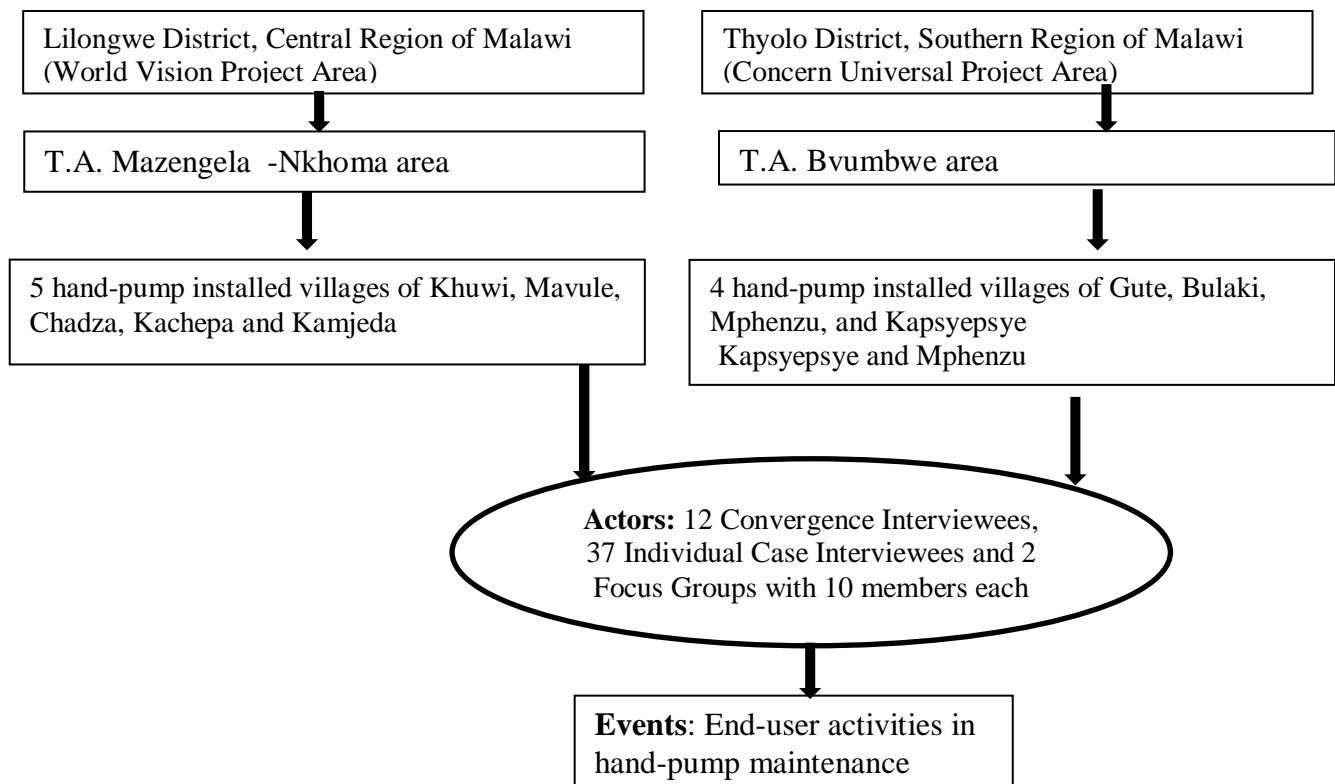
Samples were also tied to issues of generalizability (Miles & Huberman, 1984). To promote generalizability, multiple sites were more appealing than a single hand-pump site. Multiple sites were encouraged because they can make claims about a large population of hand-pumps, settings, maintenance events, processes than a single site. So nine hand-pump sites were chosen from two different Traditional Authorities of the two districts which are in different regions of the country. There are 24 districts in Malawi, divided into Traditional Authorities (TAs) and wards (sub-TAs or group village heads). A TA is presided over by the chief. Each TA comprises of villages, the smallest administrative units presided over by the village or group village headman (NSO, 2000). Each TA may have hundreds of hand-pumps depending on investment by the government, churches or NGOs. Selection of Lilongwe and Thyolo were systematically chosen because they had NGOs implemented and engaged in hand-pump projects. Hence it followed that in each district where NGOs who implemented water projects, were chosen namely, TA Bvumbwe in Thyolo District and TA Mazengela or (Nkhoma area) in Lilongwe District. In other words, when it came to sampling the district and TA where to conduct the study, systematic sampling was used (Saunders et al, 2009).

There was also the selection of systematic selection of sub-settings, which were villages, which had hand-pumps in the TAs. Sub-selection of villages was systematic based on whether villages in the TA had operational or non-operational hand-pumps as the interest of the study events surrounding each of these. Five random villages were chosen in Nkhoma of which one village had a non-operational hand-pump. In Bvumbwe 4, villages were randomly chosen of which 1 had a non-operational hand-pump. While the researcher chose the districts and the TAs, choice of the villages and the 9 pumps was guided by the local extension workers and/or the chiefs or gate keepers. As the research had to concentrate on those who were familiar with the water projects so the gate keepers used snow-ball sampling. In this, the respondents sampled and interviewed passed the researcher to another (Yin, 2009). Respondents included those responsible to repair at different levels, including end-users, water committees, local development committee members, village chiefs, local government workers and local NGO workers.



It may not have been possible to observe all the hand-pumps so selection of samples to base analysis and conclusions from data was done. Observing 9 pumps as a sample was much less time-consuming, and as a result it was likely to collect more detailed and accurate data (Yin, 2009). Though the 9 pumps in a survey would be regarded erroneous by positivists because maintenance activities observed sampled and observed are unrepresentative of the general population of the hand-pumps, villages, and maintenance events with which the researcher is concerned about (Robinson, 2011). In other words, positivists would not legitimately generalise from the 9 hand-pumps as a sample (Saunders, et al, 2009). Positivists view is a flaw in this case study because researchers can also select a representative sample of events within the case to make generalisation to the relevant population of hand-pumps or establish general patterns in of hand-pump maintenance (Yin, 2009). This was done by random or systematic sampling, which involves selecting a random or systematic sampling of hand-pumps as in the Figure 10 below.

**Figure 10: Sampling Parameters: Settings, Actors and Events (Chisenga, 2014)**



Choices of actors alternatively called respondents or interviewees were based on whether they:

1. Used the hand-pump
2. Had knowledge about hand-pump developments
3. Were village representatives with roles on the hand- pump
4. Were committees which had a role in hand-pumps and/or
5. Were Local hand-pump repairers.

End-users were therefore: a) any water user who were either men/women or school children b) those involved from a technical point as of local extension workers (NGO or government community workers) at ward/councillor levels- who had a concern for the hand-pumps in the local area they were working. Details of the number of interviewees are presented in Table 18 below.

**Table 18 Numbers of Interviews-Sample Size**

No. of Interviews with End-users in Each of the 2 Study Areas	Number of Interviews
Key end-users: in each of 9 hand-pumps - using CIs to generate themes	12
ICI : 5 in each of 7 hand-pumps	35
4 NGO community workers (NGO or government) using ICI	4
2 Focus groups in each NGO area with 10 end-users in each group	20
<b>Total</b>	<b>71</b>

### 3.5.3 Sampling and Generalisability

This section justifies why the maintenance characteristics observed in the nine hand-pumps under study can be generalised to hundreds or thousands of hand-pumps in Malawi and sub-Saharan Africa, in contrast to generalisation by sampling distribution using statistical inferences. Generalization is about narrowing down to a few cases to study the characteristics yet applying the concept to a wider population (Creswell 2007:341). In contrast empirical researchers argue that if population characteristics are known, generalization can be represented by the degree of a representative sample; based on central tendency theorem, which calculates robustness to generalize results if based at 95% confidence interval and 5 % margin of error (Saunders, Lewis

& Thornhill (2009: 147). The realism model of causality questions the possibility of generalization. This is because realists consider the context or other causal powers may be operating hence what causes an event has nothing to do with the number of times it has been observed to occur and nothing with whether we happen to predict it as stated in positivism (Sayer, 2000).

Furthermore, case study research fails to meet the generalization requirements of statistical inferences due to a small sample hence criticised as unscientific because of inadequate representative sample (Yin, 2009). However social researchers argue that a case study strategy can be a worthwhile way of exploring more of the existing issue of hand-pump maintenance as perceived by end-users. The 9 cases if well-constructed could enable the researcher to provide knowledge of rural water project maintenance and provide a source of new research questions. Ghauri & Gronhaug (2005:88) argue that a single case could still be used because within a case study is a wide range of different initiatives of maintaining hand-pumps, which may represent a wider picture of the way end-users manage hand-pumps. This could help to develop a broader theoretical significance than the case work because it exhibits the applicability of existing systems relating to end-user maintenance roles in drinking-water projects. The study sampling led to theoretical generalisation using multiple sources of information in a case study design which is consistent with Creswell (2007) and Robinsons (2011) using multiple sources of data. Multiple data sources include; interviews, documents and observations as shown in Table 19 below.

Table 19: Data Collection Methods/Tools Matrix: Primary and Secondary Data

<b>Information Source</b>	<b>Interview</b>	<b>Observation</b>	<b>Documents</b>
End-users for CI			
End-users for ICI, FGDs			
Physical Infrastructure of a Functional and Non-functional Hand-Pump			
Water Committees Reports			
Concern Universal and World Vision Annual Project Reports			

(Source: Developed for this thesis by Chisenga 2014)

### **3.6 Data Collection: Primary and Secondary Data**

Primary and secondary data was collected for the research in two different phases. Phase one involved secondary data collection using literature, which is also called data mining (Robinsons, 2011) using documents, also called stage A of primary data collection in this study. The second phase or stage involved primary data collection used in different stages. Stage B which used observations while Stage C used Convergence Interviews, and Stage D, Individual Case Interviews and finally Stage E used Focus Group Discussions. The following sections present details of Phase Two including Stages A, B, C, D, and E of data collection.

### **3.7 Stage A of Primary Data Collection: Documentary Analysis**

#### **3.7.1 Advantages of Using Documents as a Method of Data Collection**

Documentary sources were used to confirm the interviews. Documentary sources refer to sources in a form of written textual data which were in a form of annual project reports and water committee's documents. There are primary and secondary sources of documents. Primary sources are those which are in use at contemporarily times and close to the origin of the project (Finnegan in Sapsford & Jupp, 2006). The section will further narrate how textual documents, which were in a form of written words were evaluated to determine the extent. they supported the interviews' data. Firstly, the section explains the: advantages of documentary analysis, nature of documents used, how they were compiled, and how they came into being (Robson, 2011). The main concern about use of documents is to determine the purpose for which they were written and link with the research objectives.

The disadvantage of documents used in the study, as part of data collection technique, is that the end-users way of maintaining hand-pumps may not be easily or clearly articulated in the document. In addition, end-user roles quoted in the documents on maintenance may just reflect a proportion of gate keepers and not everyone else who is a concerned stakeholder. Links between cause and effects of hand-pump maintenance may be influenced by other factors, which may not be highlighted in the documents. However, documents have more advantages because they are unobstructed and non-reactive (Foster in Sapsford & Jump, 2006). The researcher does not need to be in direct contact with end-users maintaining the hand –pumps hence there is no reason why end-users behaviour would influence the research outcome. Documents in this case can provide valuable cross-validation of maintenance measures either in support or disconfirming the research outcome (Robson, 2011). Above all, documents promote the study validity and reliability as the researcher is not the author of the documents.

### **3.7.2 Characteristics of the Documents Used**

This study analysed documents, which were in a form of annual project reports, training manuals and basic water committees' reports. The origin of annual reports was that they were written by project managers of the organisation Concern Universal and World Vision International. The source was directed to stakeholders, including donors as audience. The reports were prepared to stir up support from the stakeholders and also directed to project executives and donors as part of the requirement to make further decisions about the project. However, the reports presented also considered the audience; the authors that are the project managers had in mind (Robson, 2011). The styles of annual reports documents followed the NGO templates, namely Concern Universal and World Vision International. How the researcher made use of reports or documents appropriate for the research topic. Though the reports were directed for the

attention of stakeholders and project sponsors, the researcher had to make a kind of selection in the sources and used some thematic principles based on the study conceptual framework (Finnegan in Sapsford & Jupp, 2006). The sources of data were project documents produced by managers and stakeholders. Annual Reports were official reports at macro-level hence pertinent to conceptualise of the extent of hand-pump maintenance in the social system. Table 20 below summarises the thematic issues explored, and relevant questions designed and used to examine the documents.

**Table 20: Thematic Areas and Guiding Questions for Document Analysis (Chisenga 2014 adopted from Robson, 2011)**

<b>Thematic Area</b>	<b>Guiding Questions</b>
Relationship to the Research	What research questions are presented in the report/ documents?
Relevance of the Reports	How were records compiled by whom and for what purpose? How detailed and truthful is the report?
	How official are documents and how truthful?.
Link to Hand-pump Maintenance	How accurately are issues of hand-pump maintenance reported?
Aim of the Source	The aim and parameters of the research how far the sources describe end-user roles in hand- pump maintenance
Stakeholder End-user Roles	What is project sponsor and end user roles in the reports?
Evaluate Process in the Report	How far has project plans guided roles or practice of end-users?
	What is the reasonable meaning of hand-pump maintenance in the report?

The next section includes a discussion on the observational method.

### **3.8 Stage B of the Primary Data Collection: Observational Analysis**

*'Saying is one thing doing is another'*, Robson (2011) hence to avoid this flaw; this study used observation to support or compliment the data. Foster in Sapsford & Jump (2006) highlights that observation as a data collection method can be used for production of public knowledge about specific issues. There is a difference between observation in everyday life, which occurs spontaneously and one in the research, which is systematically recorded, interpreted and used. The research observations are subject to checks to determine validity.

#### **3.8.1 Observation of the Hand Pumps as a Method of Data Collection Method**

This study employed observation as a preliminary stage in determining hand-pump maintenance- as a way to determine hand- pumps, which can be studied more fully by using other methods like Convergence Interviews, Individual Case Interviews and Focus Groups. Observation was used towards the end to provide a check on data collected in CI, ICIs and FGs. In natural research, observation is the main research method and in this case is used to obtain descriptive data about the phenomena. However, in this study observation was used as part of the broad approach to the research data gathering techniques. The approach of observation in the study contrasts Glaser & Strauss (1967) in which cases were deliberately selected for observation to develop and test particularly theories. Conversely, in this study, the guiding principle was the sustainable development model as stated in literature review (Robson, 2011)

#### **3.8.2 Advantages of Observational Method**

The advantage of using observation of hand-pumps maintenance research in the study is that hand-pumps which were operational or non-operational were recorded directly

by the researcher without relying on interviewees; so the issue of inaccurate information is out of context (Foster in Sapsford & Jump, 2006).). However, the disadvantage of observation at times is that it can be time-consuming and some hand-pumps, which are in very remote areas may not be easily accessed. Since the researcher noted down what she saw or occurred, of the state of hand pumps it follows that observation was more accurate (Robinson, 2011). In other words, interview data could have discrepancies of what end-users say of what they have done to maintain the assets or what they did not do. Such data was also supplemented with observation. For example, as an illustration, if the end-users mentioned that they contributed funds to repair the hand-pumps, the effect of the funds was evaluated on observation of whether the hand-pumps were functional or not. Observation as a data collection method, therefore, helped the researcher to get a ‘**real life**’ in the real world of what hand –pump maintenance is all about (Robson, 2011).

### **3.8.3 Gaining Access for Observation of the Hand-pump Setting**

Hand-pumps are part of the public goods in the community which eased access. The researcher simply became one of the villagers hence used the village to observe sources of water and mechanisms pertaining to it in each village. Observing, working or non-working hand-pumps did not require covert observation, which is done when participants do not know that they are being observed. Covert observation is done so that participants do not change their mode of behaviour when they know they are observed (Homan 1980). However, since the research was conducted openly, the researcher sought formal permission from the local leaders or gate keepers and participants in order to observe the hand-pump settings. Information for gate keepers involved explaining the aim of the research. The methods adopted including observations of the potential knowledge gains for the community as the whole for drinking water. Furthermore, the researcher dressed like the villagers, spoke the local



language and observed the local cultures. Such actions helped to gain access and enabled the researcher to ‘fit in’ to daily life as it formed a kind of familiar identity in the eyes of the interviewees. The next section highlights how observations were recorded.

### **3.8.4 Using Photography to Record Observations**

This study used photography to record observations of operational and non-operational hand-pumps. The advantage of photography is that it helps to provide a more complete and accurate record of the status of the hand-pumps at that time, which supplements the data from interviewees.

The researcher observed the hand-pumps whilst they are operational or non-operational. Observations also included how the villagers/end-users engaged with such assets. The researcher moreover observed how the end –users operated and handled the hand-pumps and also listened to their conversations. The researcher used informal observation. Informal observations are less structured (Robinsons, 2011) and allow the researcher to determine what information should be gathered and how it should be recorded. The information included note taking and also recording some of the data in the form of photography. Observations were followed by actual interviews, starting with convergence interviews to determine the state of hand-pumps and its maintenance.

### **3.9 Stages C of Primary Data Collection: Convergence Interviews**

The study interviews were in three sequences namely: Convergent Interviewing (CI), Individual Case Interviews (ICIs) and Focus Group Interviews (FGIs). Details of each of these are presented. Stage C, Convergent Interviews (CIs) was aimed at developing a list of success factors-categories or themes as perceived by end-users. In Stage D,

which was ICIs, used the list developed during CI to further confirm if the list of items developed were also perceived as maintenance success factors by other respondents. In Stage D, ICI, semi structured interviewing was used based on themes developed in CI or Stage C. The ICIs was followed by FGIs in which small groups of end-users discussed maintenance success or failure categories, identified in CI, and confirmed in ICIs. These sequences of processes were chosen because they promoted validity of study results. More detailed information of each data collection is presented, starting with CI.

### **3.9.1 Process of Selection of Participants for CI**

CI is distinguished from the other interview methods, by the way; participants are chosen. CI deploys interviewing participants (end-users and local committee members, leaders, local NGO/government workers) as these varieties have diversity of characteristics with some differences between them (Jepsen & Rodwell, 2008). Having known that the characteristics of end-users and water committees play a role during the process of hand-pump maintenance, this determined selecting the respondent as it was important to tap their knowledge of hand-pump maintenance. Interviewees chosen were those who were willing to share their views about the research topic. The scrutiny of participants with expert knowledge were based on those who were familiar with hand-pumps projects and how they were introduced, implemented and how maintenance plans were carried out, if any. The researcher asked the project team, the village chief, and the health staff for a list of knowledgeable women and men and water committees capable of sharing their opinions on main issues that influence hand-pump in the villages. Compilation of this list also ensured the nominated represented those from areas where hand-pump projects were discontinued, operational or failed. The researcher aimed to ensure the compiled list of potential participants who were likely to know most about rural water projects management (Rao & Perry 2003). The persons identified to be most

knowledgeable were interviewed first and then the next most knowledgeable but with different demographic characteristics or opposite project outcome (operational or non-operational). Only a few people were selected initially who were then asked to recommend others. This process was vital in ensuring that the sample grew as the study went on as seen in snow ball sampling.

A snowball sampling technique is important or appropriate when the study is about a small specialized population of people who are knowledgeable about the topic (Patton, 1990, Rao & Perry, 2003). Yin (2009) refers to purposive or snowballs sampling as a type of non-probability sampling, whereby a researcher deliberately decides who to include in the study on the basis that, those selected are able to provide the necessary data required for answering the research question. Another part of sampling process is the careful selection of the first interviewee as first snow –ball. In this case, the first interviewees directed the researcher to others who were familiar with the hand-pump maintenance. The researcher did this with support of Health Surveillance Assistants, who are the lowest cadres of government health personnel in the villages.

Once interviewees were identified, the researcher explained the nature of the research, process and interview schedule. Explanation was made why they were going to be interviewed, the nature of interview, selection process, confidentiality, and contact details of the researcher(see Appendix 3 and 4 pages 291-293 ). It was also explained that the interviews could take an hour or two to reach the level of detail required to identify maintenance key issues. The process consisted of rounds of interviews, with each round of three interviews in order to maximize the obvious difference in the opinions of three participants. The subsequent interviews were scheduled so the participants come from variable project outcomes (operational or non-operational). .

The aim of conducting CI was to explore the respondent's knowledge about understanding of project operations, reasons behind hand-pump maintenance or failures, what they perceived as different levels of success or failures and what could have been a better way to manage rural hand-pumps. The aim was to reduce bias hence the key study respondents (end-users or health committees) were asked a general question which was later modified. Prior to conducting CI, the study planned specific steps to be taken as summarized in Table 21 below:

Table 21: Convergent Interviews Steps

	<b>Activity</b>	<b>Explanation of Roles</b>
<b>Step 1</b>	Train Co- researcher	The researcher and co- researcher worked parallel to each other then met to compare results so as to reduce bias
<b>Step 2</b>	Conduct Pilot Study	
<b>Step 3</b>	Define the Target Population	Included other internal and external stakeholders such as: pump end-users, local committees, health centre staff, project staff, chiefs, and community project staff. These gave advice on sampling and choice of cases and also gave feedback to the researcher on study pitfalls
<b>Step 4</b>	Conduct CI Interviews	Probed, asked to tell more, content free interviews done
<b>Step 5</b>	Interpret CI Interview	Similar to Glaser (1994) used coding process : respondents words or phrases or clarifications to form pump- maintenance categories
<b>Step 6</b>	Compare CI Interviews	Compared notes with other co-researcher. Noted areas of similarities, disagreements in data collected. Weighed agreement against the disagreements.
<b>Step 7</b>	Recycle until Saturation	Returned back to step 5 to recycle till two successive interviews did not provide any more new information then moved to next stage
<b>Step 8</b>	Report	Compiled report on the findings from the interview in terms of pump- maintenance themes or categories identified

Source: Chisenga, 2014 (adopted from Rao & Perry, 2003 )

There are advantages associated with following the CI steps in the above Table 21. The main advantage of CI is that it is easier for end-users and the local committees to initiate them discuss without bias (Rao & Perry, 2003). Imagining the researcher used leading question like, *'tell us the project success or failure factors of water projects*

*in this village?*' Such questions would probably make the end-users to state more of the negatives things because they could be expecting something better. In the same way, the local committees are likely to state more positive because they do not want to be associated with any failure in their water roles in the village. Hence to reduce such bias a neutral, non-leading content free question was ideal including the question design and wording.

### **3.9.2 Convergent Interview (CI): Question Design and Wording**

CI is an in-depth method and methodological approach to qualitative research. CI has a special characteristic; in a sense that the content is unstructured, but the process is semi- structured. CI was more ideals in this study because CI as a data collection process starts with a broad question, followed by constant comparative process and prompts developed to explore subsequent interviews (Dick, 1990; Kane, 2007). The process allows data to encompass both inductive as well as deductive approaches which is also compatible with a realist stance. Imagining if users were asked directly, *'tell me your views about hand-pump success and failures factors'*, the chances are that such a question would initiate data contamination or bias. To develop a list of hand-pump maintenance success and failures factors, CI approach was used. By funnelling the analysis to clarify general categories, bias was reduced. CI started with open ended questions like:

*'What do you think about the operation status of the hand-pump constructed in this village? What makes things different since the hand-pump was constructed and handed-over to you as users?'*

The above CI open-ended questions helped end-users to state responses while keeping the central theme throughout the study. Answers were probed to help determine what they considered as positive or negative issues of the hand-pump- maintenance. If the respondent mentioned an issue that can be categorised as a hand-pump maintenance

factor, it was noted and at the end of each interview, the respondent was cross checked if the classification were indeed what they considered as well. If the answer was positive, the category was used for subsequent interviews. So when respondent EU1 suggested a category, it fed into interview EU 2 as a search for agreement or disagreement and fed forward until the point of saturation was reached. EU2 was also asked to emerge new categories, which were further searched for agreement or disagreement in subsequent respondents (Rao & Perry, 2003; Kane, 2007). If balance of agreements outweighed disagreements at the end of the CI process, then such a category was accepted to go forward to the next stage of ICIs using semi-structured interviews.

### **3.9.3 Convergent Interview (CI) Technique and Bias**

Despite that, CI was a more suitable initial data-collection tool for this study, there was a potential problem of bias as in other qualitative methods (Rao & Perry, 2003; Dick, 1990). Bias is about compromise of study results due to in appropriate procedure or researcher subjective influence. To prevent bias, the precise participants were identified and the right method of selection was followed. For example, CI techniques required respondents to be knowledgeable about rural hand-pump management to make meaningful contributions. A total of 12 respondents, end-users from nine water points were selected based on their active interactions with the hand-pumps, whether operational or non-operational. The respondents were also chosen purposefully using snow ball technique (Saunders, Lewis, & Thornhill, 2009). Key end-users were chosen to provide relevant information about hand-pumps usage, condition and how they are managed or maintained. The respondents were also oriented to the process and the researcher ensured they were familiar with what they were required to do, and were willing to share experiences. Hence the researcher asked NGO community workers or village health worker for a list of knowledgeable end-users capable of sharing their opinions on main issues that influence hand-pump successful or unsuccessful utilisation in the villages. Rao & Perry (2003) further advise to refer respondents to different interviewers to ensure they are not focussed in

'one mind set' of the interviewer. This concept was accomplished as research had two interviewers, the principal researcher and the co-researcher and the developed categories from each were compared. The down side of CI like other qualitative research is that it the criticism by positivists is that it involves bias. However, Dick (1990:11) claims that if the process of establishing areas of convergence or divergence is done clearly, or systematically, it will provide the study with objectivity when refining subjective data. The CI strengths outweighed the weakness hence findings were further crosschecked in ICI using semi-structured interviews.

### **3.10 Stage D of Primary Data Collection: Individual Case Interviews (ICIs)**

Individual Case Interviews were used to confirm hand-pump maintenance factors developed in the initial CI process. Likert-type scales were then used to measure the level of success or failure of the factors in terms of influence of hand-pump maintenance (Silverman, 2011). Likert-type scales are used where a number of responses are required in a form of a range for each category in question. Some scales attached value to each influence on the hand-pump maintenance factor to aid comparison (Kane, 2007). Divisions in each category had 1- 3 while others were 1- 4 levels. 4 represented that the interviewee did not consider the category as a hand-pump maintenance factor and score of 1 showed it had high influence. Score of 3 showed it was influential but not much. However, most category scales had to be based on each category other than comparison with other categories. For example, on the category of the type of hand-pump most preferred; 1=borehole, 2=Malda pump and 3=unprotected well. Furthermore, on the amount of household contributions made as a category; 1=0-£1.50, 2=communal fund raising while 3= no contributions made. So most categories for this study used Likert-type scales to numerically code categories and aid analysis. The first section was to pilot ICIs by administering semi-structured questions and ranking them on likert-type scales.

### **3.10.1 Pilot Stage: Piloting the Individual Case Interviews (ICIs)**

A pilot can be called a trail run of the research instruments (Robson 2011).

van Teijlingen & Hundley (2002) further compliments that a pilot study is a mini-versions of a full scale study conducted with the aim of pretesting the question guide. The advantage of doing a pilot study is that it can depict in advance the problems which could be encountered when carrying out the research. For example, the question guide may be too complicated or inappropriate. The pilot study may also help to unearth thematic issues which may need to be addressed in the main study. This study piloted individual case interviews to avoid pit falls in the main study and identify issues which were critical in hand-pump maintenance.

#### **3.10.1.1 Piloting Individual Case Interviews (ICIs): Process of Selection of Participants**

The interviewees' names were replaced with the acronym PR (Pilot Respondent) to conform to the ethical requirement that the respondents' identities (anonymity). The pilot study sort to identify respondents who could provide knowledge aimed to advance understanding whether interviewees:

- Used the hand-pumps and were involved in maintenance of their pumps.
- Considered their in- put or activities to have any relevance and
- Considered themselves as main contributors to maintenance of their pumps.

Through snow-ball sampling, 8 respondents were identified and interviewed during the pilot study. Out of the eight respondents, 2 were water committee members; the other 2 were general end-users; 1 was a project or government community worker; 1 was a pump repairer. Respondent (PR) 8 a World Vision field coordinator was included to get an account of the role of World Vision International (project sponsor) about how end-users were involved before hand-pumps were constructed, during and in the maintenance phase. Though she did not live in project area but was,



nevertheless, relevant for the study and indeed, the management of hand-pumps because she was one of the keys the trainers and supervisor of WVI, government field workers and water committees that advocated hand-pump maintenance in the project area. A summary of pilot respondents are as delineated in the table below.

<b>Pilot Respondent (PR)</b>	<b>Role</b>
PR1	HSA-government worker
PR2	Hand-pump user
PR3	Water committee
PR4	Water committee
PR5	Hand-pump user
PR6	Hand-pump user
PR7	Hand-pump repair or mechanic-village level
PR 8	Hand-pump user

Purposive sampling and snow-ball sampling guided the selection of pilot participants who could provide relevant knowledge. The pilot study was particularly looking for information to compliment guidelines for data collection in areas of: end-user roles for hand pump maintenance; water committee roles; end-user contributions as highlighted in literature.

### **3.10.1.2 Piloting Individual Case Interviews (ICIs): Question Design and Wording**

Pilot study was conducted to try out different styles of questioning prior to the main ICIs phase of the study (Silverman, 2011:199). Piloting was done to learn from mistakes thereby improving interviewing skills. To maintain or improve internal

validity of the semi-structured questions, the pilot observed these procedures as adopted from Teijlingen & Hundley (2002) :

- Questions administered to pilot respondents were administered in the same way to the main study
- PR were asked to give feedback on the questions that were not clear
- Time taken was taken note if it was within acceptable ranges
- All difficult questions were discarded
- Assessed if each question gave enough answers
- Determined if responses could be interpreted in terms of factors affecting or limiting hand-pump maintenance.
- Determined that all questions were answered
- Restructured questions accordingly

Data collected from pilot study led to data description in terms of:

- Details of categories and definitions
- Quotes from respondents
- Researcher interpreted ICI within the hand-pump maintenance or non-maintenance framework
- Descriptions, interpretations and definitions were verified by taking a preliminary draft back to the sources for feedback and incorporating their comments in the final version. For example, to obtain feedback after interviews, respondents were asked: *‘Is the description of hand-pump maintenance success issues accurate? Are themes and constructs I identify consistent with your experience? Are there themes and constructs I have missed’?*

The researcher particularly looked for descriptions, interpretations and definitions relating to: *‘What constructs helped to understand perceptions of maintenance factors? ‘What hand-pump maintenance constructs were unique in under study’?*

After learning lessons, the pilot was followed by the main ICIs section.

### **3.10.2 Main Stage of the Individual Case Interviews (ICIs)**

The respondents were asked to score or rank the factors influencing maintenance of their hand-pumps: whether they perceived the factor had influence or not, and if it did to what degree or influence did it affect their hand-pump operations and maintenance?

The respondents were given the opportunity to add to the factors or simply make

comments. Each response was tallied on each scale of the questions in terms of the level the factor had in affecting maintenance of the hand-pump. A summary of comments on each question as to why that scale or level of influence was chosen was written underneath. This was read back to the interviewee to validate that the response given represented the hand- pump maintenance factor they had in mind.

### **3.10.2.1 Main Stage of the Individual Case Interviews (ICIs): Process of Selection of Participants**

A snowball sampling technique was used to identify respondents in ICIs. The researcher was assisted by the village health government workers to identify initial respondents for ICIs who were the first interviewee as first snow –ball. In this case, the first interviewees directed the researcher to others who were familiar with the hand-pump maintenance. Participants included end-users and local committee members, leaders, local NGO/government workers as these were key drinking water project stakeholders hence it was important to tap their knowledge of hand-pump maintenance. For details of the list of participants and their roles, please refer to appendix 5, page 294. Interviewees chosen were those who were willing to share their views about the research topic. The scrutiny of participants with expert knowledge were based on those who were familiar with hand-pumps projects and how they were introduced, implemented and how maintenance plans were carried out, if any. Compilation of this list also ensured the nominated represented those from areas where hand-pump projects were discontinued, operational or failed. The researcher aimed to ensure the compiled list of potential participants who were likely to know most about rural water projects management (Rao & Perry 2003). The persons identified to be most knowledgeable were interviewed first and then the next most knowledgeable but with different demographic characteristics or opposite project outcome (operational or non- operational). Only a few people were selected initially

who were then asked to recommend others. This process was vital in ensuring that the sample grew as the study went as described in snow ball sampling.

Once interviewees were identified, the researcher explained the nature of the research, process and interview schedule. Explanation was made why they were going to be interviewed, the nature of interview, selection process, confidentiality, and contact details of the researcher. It was also explained that the interviews could take an hour or two to reach the level of detail required to identify maintenance key issues. The process consisted of rounds of interviews, with each round of three interviews in order to maximize the differences in the opinions of three participants.

### **3.10.2.2 Main Stage Individual Case Interviews (ICIs): Question Design and Wording**

This section explains the process of ICIs using semi -structured interview technique. The common categories or themes were identified or developed from Stage C, during CI from the researcher and the assistant. In Stage D, ICI, semi-structured interviews were used. Respondents scored the level of influence each pump- maintenance factor had on each category. The aim was to get more understanding about the perceptions of end-users on each category. Prior to scoring ICIs respondents were asked to agree or disagree to each of the hand-pump maintenance categories proposed by end-users in CI process. In other words, the interviewees at this level were asked if they identified the categories developed by respondents in Stage C to be relevant to them as well. Each category had a specific definition to clarify the concept as proposed by the respondents in CI process. The gaining of agreement at this stage was part in the process of ensuring categories developed in CI were being confirmed as valid by those in ICI stage.

Stage D, ICIs used semi-structured interviewing. Question design and wording was as highlighted below in Table 22 below.

**Table 22: Individual Case Interview Questions**

1	2	3	Questions about contributions	Comment
No cash/labour contributions	Labor contributions	Monthly cash contributions	I think 1 or 2 or 3 has the effect of maintenance of pumps	

1	2	3	Questions about committee roles	Comment
No local support	Water & Village head man support	Local government. committee support	I think 1 or 2 or 3 has support for pumps	

1	2	3	4	5	Questions about description of a maintained hand-pump	Comment
Don't know	Spare part access	NGO Rehabilitates	Water Bank account	Active water committees	I think 1 or 2 or 3 or 4 or 5 mainly determines a maintained hand-pump	

				Questions about barriers to pump maintenance	Comment
Spare part problem	Pump vandalism	Inadequate local funds	Lack capacity to rehabilitate pump	I think 1 or 2 or 3 or 4 is our main challenge to maintain the pumps	

Categories of maintenance identified in CI, ICI were further confirmed in stage E of primary data collection which involved Focus Groups (FGs).

### 3.11 Stages E of Primary Data Collection: Focus Group Discussion

This section explains the process of Focus Group Discussions (FGDs) as a third step to confirm categories developed in CI, cross checked in ICIs using semi-structured Interviews. The advantage of conducting group discussions in this study is that it helped to address the balance of power in their favour. Focus groups were adopted because they are more exploratory and described as more flexible research method with very elastic boundaries. One member may start, and others follow the snowball contributions also called ‘synergy group effect’ (Robinson, 2011). FGs involved those who draw water from the same hand-pump throughout, as these have similar relationships. Hence discussions in FGs became group themes other than individual. The researcher moderated FGs, and a group of 10 end-users were used for FGs one from a maintained hand-pump and the other from a non-operational hand-pump. 10 people are considered ideal to shift the position of power from being skewed towards a group other than the moderator; and help to create an atmosphere conducive to narrating reliable information as the researcher was a minority among peer participants. Table 23 below highlights thematic issues or guides for the focus groups conducted.

**Table 23: Thematic Issues/Interview Guide for Focus Group Discussions**

**Thematic Issue 1: Labour and Household Finances**

1. What are your views about labour/household finances for the hand-pump maintenance? How relevant are the contributions?
2. How have the contributions affected the maintenance of the hand-pump/ has the hand-pump changed since you did the contributions ?
3. What are the local laws and policies about the contributions? Do the people feel forced to make contributions?
4. What could hinder contributions?
5. Any suggestions to improve the contributions?

**Thematic Issue 2: Local Committees Roles**

1. What committees are linked with hand-pumps in this village
2. What are their roles? How do they link with end-users and other partners?
3. How do water committees link with the development committees like VDC/ADC?
4. How do you perceive commitment of water committees? How do they share information about hand-pump maintenance? How satisfied are the people with water committees?

5. What changes have local committees brought on maintenance of hand-pumps?
6. How do committees link with pump local pump technicians? How effective are pump technicians?

### **Thematic Issue 3: Spare Part and Inadequate Funds Challenges**

1. How are challenges identified? Any experience of specific challenges and how they impinge on hand-pump- maintenance?
2. How could we overcome the challenges of spare parts and inadequate funds for pump- maintenance?
3. Who do you perceive to have responsibility to sort the challenges impinging on maintenance?

#### **3.11.1 Focus Groups: Sample and Descriptions of Participants**

Details of respondents who participated in focus groups were coded as in Table 24 below.

**Table 24: Focus Group Participants**

Acronym	Name	Village
EU 63	M. Kayenka	Khuwi Village (Nkhoma)
EU 64	M. Chekwea	
EU 65	L. Mukunba	
EU 6	R. Nkajinala	
EU 67	R. Timbeneto	
EU 68	R. Master	
EU 69	M. Planuel	
EU 70	B. Esow	
EU 71	R. Khuwi	
EU 72	S. Banda	
EU 53	M. Jana	Kapsyepsye village (Bvumbwe)
EU 54	A.Ndalama	
EU 55	P.Chogwira	
EU 56	MA.Kazembe	
EU 57	E.Nchacha	
EU 58	V. Kamulange	
EU 59	M.Lipenga	
EU 60	F.Maulidi	
EU 61	M.Watilasa	
EU 62		

#### **3.11.2 Procedure for Conducting the Focus Group Discussions**

The next section explains the procedure for conducting the focus groups and analysing focus groups data using thematic coding-content analysis. One focus group

was conducted in Nkhoma and the other in Bvumbwe. Out of the two, one hand-pump was non-functional while the other had been successfully maintained. Two meetings were done using focus groups to identify the group experiences of a hand-pump maintenance. The focus groups for Stage E followed a protocol delineated in Appendix 6 on page 296. The groups were asked to comment on the maintenance or hindrance factors they perceived about their hand-pumps.

Focus group participants were men and women comprising of end-users, village chiefs and some members of water committees, VDCs and pump mechanics. In all focus groups, participants were active in narrating their experiences. Explanations were detailed and at most gave practical examples of what as individual or household they had done or not done about hand-pump issues. At times when one explained the others agreed and added more to what was said. There were very few examples where viewpoints differed though they meant the same thing. For example, some explained their contributions in a monetary form while others made their contribution in a form of manual labour or making themselves available to do any work they were required to at the hand-pump premises like sweeping or clearing the place. In each group, there were one or two who did not refuse or hesitate to talk but rather felt shy to talk before the village leaders. At times, the group expected the village leader or committee to initiate the process. The village chiefs and the water committee were informed by the researcher to give opportunity as much as possible to end-users to ventilate their minds and make appropriate comments or clarification as would be deemed necessary. The next section explains the procedure the study followed in analysing focus groups.



### **3.11.3 Procedure for Analysing the Data Collected from the Focus Group Discussions**

This section will detail how the researcher analysed focus group discussions using content analysis. Content analysis involved identifying, coding and categorising the primary patterns. Field notes were taken. The first step was to make comments on the margin of the papers used. Data was organised into topics and files. Chunks of data were given a name and a label. Since the study involved an assistant, both of us were involved in analysis and coding of data.

Data collection and analysis occurred the same day before leaving the villages in order to promote awareness of the emerging themes and identify areas which needed further exploration or interview. The advantage of manual data analysis was that we were capable of the intellectual and conceptualising processes required to transform data into meaningful category findings (Saunders, Lewis & Thornhill, and 2009:26). Transcription was used to arrive at meaningful categories.

Transcription involved listening, categorising and summarising data. Categorizing data involved developing and attaching these categories to meaningful chunks of data. An example of meaningful chunks of data was training of water committees. Categories were initially derived from hand-pump maintenance factors generated from literature. Codes or labels were used for grouping the categories. Grouping involved identifying key words in the contexts. Those key words with similar meaning were grouped together into piles of similar meaning. Summarizing data involved identifying key points emerging and compressing (condensing) long statements to brief statements in which the main sense of what was said could be rephrased in a few words. The researcher also looked for missing words related to maintenance issues as identified in literature. Missing words indicated that the respondents may not have been familiar with the themes or if it did not happen at all

in the process of their hand-pump maintenance. After this process the researcher then returned the transcribed description to the respondent end-users for validation of findings. The presentation of data followed thematic coding of the data analysis ; for the purpose of theme emphasis, clarity and easy understanding, some exact words stated by respondents have been included.

### **3.11.3.1 Advantages of Thematic Coding Approach of Data Analysis in Comparison to Other Qualitative Forms/Approaches**

Three main approaches to qualitative data analysis include quasi-statistical approaches, thematic coding and grounded theory (Saunders et al, 2009). Quasi-statically approaches involve content analysis, which uses words or phrase frequencies and inter-connections as key methods of determining the relative importance of terms and concepts (Robinson, 2011). This study adopted some form of Quasi-statically approaches in analysing Individual Case Interviews using Likert-type scales. Likert-type scales allowed identifying the mode-the most frequent factor attributing to hand-pumping maintenance. The advantage of analysing ICI using Likert's scales was that it allowed identifying the mode-that is the most frequent maintenance factor respondents identified.

The other form could have been grounded theory as this can also be applicable to qualitative studies. In a grounded theory data analysis, codes arise from the interaction with the data. These codes are based on the researcher's interpretation of the meanings or patterns in the texts; used to develop a theory grounded in the texts (Saunders et al, 2009). In this approach, different types of coding acquire different specialised terminology. This form was not ideal in analysing CI or focus groups because the CI and focus group data did not aim to form a theory but to confirm the Inclusive Sustainable Development and Stakeholder Management Models identified in the literature review, chapter 2.

This study used thematic coding to analyse focus groups, documents and observational data. Robinson (2011) states that a thematic coding approach is a generic approach not associated with any particular theory. The data analysis is based on categorisation, which is subject to the re-analysis, allowing reliability checks and replication studies. Data is coded to represent something of interest and labelled. Codes with the same theme are grouped under one heading. Codes and themes emerging in the data are determined inductively by reviewing the data and/or concepts of the research question or previous research, including the theoretical framework. Such themes serve as a background for further analysis and data interpretation. Themes are summarised in matrices; Network maps flow charts or diagrams. Thematic coding approach can be used in descriptive data analysis or exploratory form or based on a certain theoretical framework, as done in this study. This study also used manual data analysis as opposed to computerised methods.

### **3.11.3.2 Advantages of Manual Data Coding Versus NVivo Analysis**

Qualitative data, particularly the focus groups can be analysed using computer processor or manually. This study chose manual data analysis over other forms of qualitative data analysis, which are computerised. The advantage of Computer packages is that they can help to store large quantities of data, organise and keep in user friendly files (Robinson, 2011). Data codes can also be easily accessed using ‘copy’ and ‘paste’ functions. Data can as well be connected against categorising simplifying and reduction (Robinson, 2011). One of the common soft wares is the NVivo. The disadvantages of using NVivo are that:

- Efficiency in their use may take time
- Categories may be hardly changed one established
- Different programmes may pose different ways to categorise data

- Dependency on technical coding functions may give less emphasis during interpretation

Manual data analysis has been the traditional way of analysing qualitative data. Though it is complex to deal with large volumes, however, this was not applicable as CI data had converged into categories through the iterative process. The manual analysis was used in this study because it allowed the researcher to engage with the data (Strauss & Corbin, 1990) hence opted over the computer generated analysis. Methodological rigour was maintained in different sections of the qualitative data.

### **3.12 Methodological Rigour in a Realist Qualitative Research**

Methodological rigour is one of the critical aspects to be addresses in a research. Rigour is about research quality. Qualitative research is at stake without verification steps to improve credibility and objectivity (Silverman, 2011). Qualitative research is often criticised for lacking scientific rigour, and one of the disapprovals is that it is strongly subject to researcher bias and therefore, may not be objective (Ghuri & Gronhaug, 2005:58). The researcher’s interest introduces an element of subjectivity at the outset of the study. Objectivity is also hindered because the “self” is viewed as a potential contaminant. In a qualitative study, the researcher is a central figure, who actively constructs the collection and interpretation of data, and contamination can occur during these stages within the research process (Ghuri & Gronhaug, 2005:60). In addition, approaching a research project with an open mind is crucial for maintaining objectivity. The problems mentioned above demonstrate the need for some strategies to be put in place in order to promote rigour for a qualitative inquiry. Saunders, Lewis & Thornhill, (2009:326) reflect that rigour from the perspective of qualitative research involves engaging in efforts, which increase the confidence that research findings represent the meanings presented by stakeholder end-users. Literature indicates that within qualitative research, rigour can be achieved in various

ways. In this study, rigour was achieved through a form of adopting validity, reliability and trustworthiness.

### **3.13 Establishing Validity**

Validity in qualitative research can be achieved through different forms of cross checking. Validity is a form of in-built checks and controls within a form of four tests of: construct, internal, external validity (Saunders et al., 2009). Validity is about truth hence in this study it is defined as the extent to which an account accurately represents the hand-pump maintenance to which they refer to (Silverman, 2011: 275). Validity is also about how accurate the developed categories stated by end-users represent issues, which really drive hand-pumps maintenance. Internal validity is about causal relationships and the validity of the influence of one variable on the other variables (Silverman, 2004). In this research this was achieved by purposeful sampling which was employed during CI, ICIs and FGs to determine project end-users knowledge about the hand-pumps management (Patton, 1990).

Construct validity is about the extent to which this study measures the hand-pump maintenance factors which influence hand-pumps survival. Construct validity was achieved through triangulating CI with ICIs. Construct validity was also incorporated within the research design by ensuring the research questions were worded in two or more questions during the interview. These two or more questions focused on looking at project success constructs from different angles (Rao & Perry 2003). In addition, the CI had an in built negative case analysis in which in each interview and before the next one, the technique demanded to approve or disapprove emerging hand-pump maintenance factors and the explanations interpreted in the data (Dick, 1990; Rao & Perry, 2003). The process also required flexibility to allow the interviewer to re-

evaluate, re-design both the content and process during the interview, hence establishing content validity.

External validity concern is whether the study results can be generalised to other relevant hand-pumps in Malawi and in the other sub-Saharan Africa (Saunders, Lewis & Thornhill, and 2012:194). External validity is described as the ability of the research findings to be described beyond the immediate case studies (Cresswell, 2007). This study achieved this as it followed a realist perspective and case study which allow theoretical or literal replication. Literal replication is about cases producing results that are similar for predictable reasons however if cases produce contrary results for predictable reasons, it is theoretical replication. As this study employs a realism paradigm, the context is influenced by other factors like political, social; economic hence selection of cases is based on contextual replication. As the study is based on contextual replication, multiple cases or sites were employed to improve external validity.

Validity verification was further followed by using other strategies like: refutable principle for anecdotalism, constant comparative method, comprehensive data treatment, deviant case analysis and using appropriate tabulations (Silverman, (2010 278). Each of these is explained how they were employed in the study. Anecdotalism, which is about the researcher setting assumptions and jumping on easy conclusions (Kirk & Miller, 1986) which was refuted at every stage. For example, interviewee X stated '*the village chief blocks to repair hand-pump because he is not interested*'. Though this was an interesting factor, the researcher refuted and instead the next respondent was subjected to be tested by stating, '*the chief is there to support your hand-pump repair explain more about this...*' Constant comparative method is about finding another case to liken (Charmaz, 2006) how the cases of the pump maintenance factors are perceived (Silverman, 2011: 282). This was achieved as the study looked

at end-users perception of the hand-pump maintenance success factors from nine hand-pumps, 2 of which were not operational. A comparison of the outcome on what end-users were doing on welfare of each of different categories of hand-pumps allowed to examine what is considered as a successful or non-successful hand-pump-maintenance.

Deviant case analysis (Silverman, 2011: 282) is about looking at anomalies precisely to learn more of the concept. For example, when the interviewee in hand-pump X stated '*the village chief blocks to repair hand-pump because he is not interested*' it was noted Y hand-pump interviewee stated '*the chief was the first to give money to buy spares parts for hand-pump to be repaired and encourages us all*'. Such contrasting data sets called for repeated inspection to arrive at generalization of a maintenance category. The outcome of such generalization was often contextual as after data was comprehensively reviewed, it was noted that hand-pump X village chief was not active because he had not been trained by the NGO while hand-pump Y had been trained, so training or capacity building for the village chiefs was concluded as a desirable category or success factor to drive maintained hand-pumps.

Appropriate tabulations may aid to identify the mode in qualitative data. Mode is about the most frequent variable. The mode improves or confirms validity of data results. Charmaz, (2000) used tabulations of hospital qualitative data and Kane (2007) tabulated qualitative data about the micro-business perspectives in food-safety research. This study used simple tabulations in a form of likert scales in analysing ICI interview data to determine the mode, as highlighted in the next chapter. Mode showed what was the most frequently hand-pump maintenance category. Reliability just like validity needs to be well outlined in qualitative research to improve study credibility.

### **3.14 Establishing Reliability**

This section outlines how this study reliability was incorporated. Reliability refers to whether the data collection techniques and analytic procedures would produce consistent findings if they were repeated on another occasion or replicated by a different investigator (Saunders, et al 2009 : 192; Guba & Lincoln, 1989; Rao & Perry, 2003). Charmaz, (2000) defines reliability as the degree to which the findings are independent of the accidental circumstances of the research...or whether the researcher would expect to obtain the same findings if he tried again in the same way (Silverman 2011: 275). In the quantitative study this is achieved by pretested measures and scales but in a qualitative it depends on what was going on to explain the preciousness about reliability of researchers own interpretation of the interview (Silverman, 2010 : 287). One of the ways to achieve reliability was by recording and using field notes in developing categories during CI. CI as an initial data collection tool to develop categories was initially broad and the respondents directed the flow of the interview till it became structured with subsequent interviewing.

In CI, reliability was accomplished by:-maintaining a structured process in data collection, writing and interpreting data. Writing of categories was based on whether the respondent agreed or disagreed to the previous answered data collection matrix (Table 27 page 166), in the findings' chapter, which consolidates final categories developed from respondents. Interpretation of categories also emerged from respondents as they gave the definition of each category, and next respondents were asked if the category represented the proposed definition. A summary of definitions proposed by respondents and confirmed by succeeding respondents (Table 28 page 172). Respondent agreement and disagreement concept is similar to Guba & Lincoln (1989) concept of utilising a steering committee to assist in designing and administration of the research process in accommodating reliability. This concept



attributes to reliability as pump- maintenance factors were only taken on board if a reasonable number of respondents agreed about the specific factors, and the collective judgement based upon the objectives. Reliability was also accommodated as information was gathered freely from volunteering of interviewees (Rodwell, Noblet, Stean, Osbourne, & Allisey, 2010). The CI process allowed the respondents to talk of categories they regarded as most important in influencing project success of hand-pumps rather than just answering the pre-planned questions in convergence interviews.

The study also improved reliability as two interviewers (co-researcher recruited for this study) worked individually parallel to each other in collecting data. Moreover, reliability was achieved as there was a comparison of researcher's results with those in literature about rural projects' success factors identified. In the two focus groups conducted, reliability was achieved by producing the data extracts which included the question, interviewee response, and the investigator continues like (ehh...Hmm) this encouraged group of end-users to state more information (Silverman 2004). Apart from field notes, reliability was strengthened by inter-coder agreement. Field notes were transcribed straight away. Pauses and overlaps though trivial were also transcribed. Talk verbatim was transcribed without tidying up, but as a focus group discussed. Material was coded by researcher and assistant separately. There were few inconsistencies between two outcomes may be due to ambiguity in data or overlap in coding categories.

### **3.15 Trustworthiness**

Trustworthiness is about relationship building between the researcher and interviewees. To employ this, the researcher identified information, which was

obvious or may not exist in interviews; there was need for the respondents to trust the researcher for them to expose their internal feelings and facts about hand-pump maintenance factors. This was possible because the researcher had lived in rural areas and was familiar with the local language and customs which helped to establish the concept. However, the researcher may have appeared authoritative due to a difference in social-economic status, which may make respondents to be unwilling to show true feelings about the phenomenon. Being from urban areas may also be perceived to have some power connotations by users. To adjust to this, the researcher and the assistant adjusted to the village systems in a form of dressing code, and followed local protocols in communicating to them. Issues of negating access and ethical considerations were also employed.

### **3.16 Negotiating Access and Ethical Consideration**

Access is about formal agreements to carry out the research from different levels. Formal agreements were made to gain access for the research using the following channels:

- Formal agreement from the University of Salford Ethical Committee was granted (See Appendix 1, page 282 )
- Connections were made with friends to contact Project Managers working for WVI and CU as these were seen as the gate keepers of the relevant project/s information

After formal contacts with project managers responsible for the drinking water projects who had operated in Nkhoma and Bvumbwe, an outline of the study was presented to them. The ‘Outline Information Sheet for the Prospective Project Managers Working for the NGOs’ included a careful explanation of the research, the outline of the main issue was to explain the reason for the research (See Appendix 2, page 289). Another ‘Outline Information Sheet for Prospective Participants’ (See

Appendix 3, page 291) was developed for the village-level gate keepers, and including ‘Consent Forms for Participants’ (See Appendix.4, page 293).

Interviewees were prepared with assistance via contacts through the WVI project community health workers in Nkhoma. However, in Bvumbwe the government health workers were used. Relevant information was supplied to the participants before the interview. A list of themes was sent by e-mail relating to information sheet and consent form as detailed in Appendix 3 and Appendix 4. These information sheets were explained to the end-users by the community project staff. Sending the participants information sheets to project managers helped to promote validity and reliability by enabling project managers to consider information being requested and allowing them the opportunity to assemble supporting project documents from their files (Saunders, Lewis & Thornhill, 2009: 326). Establishing interview themes were also part of these preparations, and this was done from the literature review analysed, drinking-water PM, experiences and discussions with colleagues familiar to the subject.

### **3.16.1 Access to Respondents**

This section outlines how ethical research issues were employed for the study namely: access to respondents, informed consent, privacy and protection of the vulnerable groups. Seeking permission to conduct a study from responsible authorities at the place where the study took place was ethically imperative. Access is about following the right procedures before conducting the study. This study accomplished access issues by submitting the study proposal to Salford University Ethics Committees for moral approval (Appendix 1 page 282). At the field study hand-pumps level, letters were sent to local gate keepers (Appendix 3, page 291) and to seek consent of the project end users ( Appendix 4 page 293). Letters were also sent to the two

prospective NGOs seeking permission to conduct a study in the project areas who were recipients of the hand-pumps they had sponsored (see Appendix 2, page 289).

### **3.16.2 Informed Consent**

Informed consent is a prerequisite in order to safeguard the end-users/participants and protect their rights. Informed consent is about voluntary decision making to participate in the study. End-users had adequate information about the research, and understood the information which enables them to make an informed/versed decision to participate or decline. The information was about: why the study was conducted; what we wanted to achieve; the type of data; participant selection; procedures and contact information. Considering the low literacy levels of end-users in rural areas (Malawi, DHS, 2005), explanations were simple without long scientific jargon, in local language, which includes the meaning of the original version (Henderson, Cornel, Mahoney, Nelson, & Mwansambo, 2007). The researcher also obtained both verbal and written consent from the participants and also explained the voluntary nature of the consent and the right to withdraw (See Appendix 4, page 293).

### **3.16.3 Privacy and Confidentiality**

Privacy and confidentiality were ensured throughout the research period. Polit and Beck (2008) reflect that all research with humans involves intrusion into the personal lives of participants, and participants have the right to expect that the data they provide be kept in strictest confidence. Anonymity is the most secure means of protecting confidentiality, and this was demonstrated when the researcher could not link a particular participant with the information given. However, as a researcher, it was also suggested that there would be a link between each field note and each participant to be able to return the transcript for participant validation. Anonymity was maintained through use of designated codes instead of participants' names. Notes

of individual participants were coded and not participants' named. Participants were assured that confidentiality would be observed throughout the study period. All research materials, including notes were taken during the interview are kept in a locked filing cabinet, and the key is kept by the researcher. However, the information produced during this research may be used for presentations during research dissemination conferences. When the research is completed, the raw data will be destroyed.

#### **3.16.4 Protection of Vulnerable Rural Populations**

Vulnerability is about exposure to unnecessary trauma. In rural projects, participants could be at risk due to poverty or the nature of interviewing. Illiteracy and poverty predispose end-users vulnerable as they do not have options or alternatives to take decisions. It may also be hard to engage some autonomy issues, which are stated in Nuremberg code and the Social Research Association (SRA) Code of Ethics, as these may be mostly geared for the western world. For example, if a village chief authorizes the study of the village, the end-users may not disagree due to illiteracy (Henderson et al., 2007). This study specified to the end-users whom it would be alright for them to turn against the chief decisions should they want to disagree. Sinding and Aronson (2003) also suggest that vulnerability occur because interviewers are deeply occupied with making meanings that reside within respondents. It is worth mentioning that the power differences may not be as evident throughout this study because the first series of interviewing was CI. CI process involved initiating the respondents themselves to generate the categories. The use of an aide memoir and not a fully structured interview schedule also helped to reduce dominance on the part of the interviewers. This implies that the interviews were mostly guided by what the participants determined.

#### **3.17 The Involvement of a Co-researcher/Assistant: Role and Responsibilities**

The key researchers were the principle or chief researcher and the co-researcher or assistant. The chief researcher had a background in project management while the co-researcher had a background in humanities and social science. The aim for recruiting an assistant was to verify the quality of research work to overcome ‘fiddling’. As much as the assistant researcher was familiar with conducting qualitative research, she was trained in the process of data collection and analysis using documents, observation and interviews. The research assistant was also ideal because she was familiar with the local language, had lived in the rural village so was aware of the target population. In addition, she had positional relationship to the hand-pump maintenance research as had used hand-pumps at one time or another. The role of the assistant researcher was therefore to bring in a cross-disciplinary research understanding as belonged to a different discipline from the chief researcher. Both the principal researcher and the assistant were involved in data collection and coding. Comparisons of data were made at different levels to compare the analysis and agree on the way forward. For example, the coded data was classified into categories individually which was followed by comparison of the data. This was important as two different researchers developed insights individually; thereby promoting validity.

### **3.18 Conclusion: Data Collection and the Realist Perspective**

As a realist study, data collection focussed on meanings and mechanisms behind hand-pump operations and maintenance. The intensive realist approach sought to understand the type of necessary relations, causal structures and the social context of practices or institutions that exist and bear upon hand-pump maintenance (Hartwig, 2007; Eston, 2010). Data were collected based on links between end-user practices and repairing of the hand-pumps. The next chapter details how the results were analysed and presented.

## CHAPTER FOUR: STUDY FINDINGS AND ANALYSIS

### 4.1 Introduction

This chapter presents data gathered using secondary and primary data. Stage A and B involved secondary data analysis using documents and observations whilst Stage C,D and E involved primary data analysis. Secondary data complimented the primary data hence the bulk of the chapter focusses on primary data. Secondary data involved analysis of Documents and Descriptive Observations while primary data focussed on analysis of Convergence Interviews (CIs), Individual Case Interviews (ICIs) and Focus Group Discussions (GFDs). Multiple data analysis is used to answer the research question, ‘What factors facilitate or hinder effective end-user participation in the successful maintenance of drinking-water projects in rural areas of Malawi?’ The first phase also called Stage A of data collection and analysis presents findings of Documents constructed maintenance categories based on content analysis. Stage B, of the data presents findings of Observations using descriptive observational analysis, supporting findings in the form of photography. Stage C of the data analysis and findings is a summary of the Pilot and main Phases of the Convergent Interviews data analysed in a form of a Matrix form 12 respondents. The aim of collecting data using CI was to develop categories related to maintenance of hand-pumps. The collected data or hand-pump maintenance categories were further cross checked in ICIs with 39 respondents and in FGs with 20 respondents. CI data was tabulated to compare the answers received from the 12 respondents.

Stage D, involved ICIs. The aim of conducting ICIs was to cross check the various maintenance categories of answers provided by the interviewees in CI. To explore

and understand data in Stage D using ICIs, charts are presented to aid in identifying the mode- thus the most frequent category facilitating or hindering maintenance of hand-pumps in likert-type scales. Lastly, findings from Stage C and D are confirmed in Stage E, which used 2 focus groups with ten members in each group, and data was analysed using content analysis.

#### **4.2 Stages A of Primary Data Findings: Results and Analysis of the Documents**

This section explains the methodological approach and findings of the stage of the study related to the examination of the documents used in the study. Documents used in the study involved annual project documents for Bvumbwe drinking water project, produced by Concern Universal the project sponsor, training manual used in Bvumbwe and Nkhoma for the WASH Project by World Vision International and the water committees reports. Document analysis approach uses deconstruction (Robsons, 2011) so as to: define maintenance, problems of maintenance and solutions, which emerge from the reports about how to maintain hand-pumps. The preferred solution does not stand on its own but flows directly from active participation of end-user stakeholders. Thirdly, the annual reports of NGOs and water committee reports had some aspects which could be underpinned in the inclusive rural development model. These aspects focussed on end-user being the centre of sorting their maintenance problems and solutions .

The documentary analysis did not involve categorising, coding and counting but a critical reading of the text to uncover these issues :

- How the hand-pump problems are defined,
- What reasons are put forward to maintain the assets and
- What is seen as preferred solutions (Foster, in Sapsford & Jump, 2006).

Documentary analysis was also used with the aim to surface what was not in the report, what was not seen as problematic in repairing the hand pumps, what



maintenance issues are not considered and/or what are not preferred as hand-pump maintenance solutions? In other words, the analyses focussed on how the reports frame end-user roles in hand-pump maintenance (Miles & Habernum, 1987).

The analysis also suggested alternative view points in hand-pump maintenance hence not just methodological reading but also challenging the texts. Though the reports are a form of communication at macro and micro level, it also evaluated the response of the audience or recipients. For example, the annual reports, commented about household contributions for hand-pump maintenance however the ‘meaning’ of household contributions as part of end-user empowerment was not clearly articulated in the projects annual report of both Nkhoma and Bvumbwe. The following Table 25 summarises hand-pump maintenance constructs from documentary analysis of project annual reports, training manuals and water committees reports.

**Table 25: Hand-pump Maintenance Category Constructs from Documentary Analysis of Documents**

<b>Hand-pump Maintenance Construct Category</b>	<b>Details</b>
<b>Subject in the Document</b>	End –user roles appeared as one of the common constructs
<b>Direction</b>	End-user roles treated as a sign of favourable hand-pump maintenance
<b>Values</b>	Values attached to end-user roles involved their contributions in cash or kind
<b>Goals</b>	The goal of end-user roles was to have hand-pumps survive when handed over to them
<b>Methods</b>	Methods used is training and end-user contributions
<b>Actors</b>	Documents refer to as end-users or beneficiaries
<b>Location</b>	The actions or activities at village level was the main concern than sponsor or funder activities in the reports
<b>Conflict</b>	The WVI and CU training themes vary in length and intensity

(Chisenga, 2014 adopted from Miles & Habernum, 1987).

### **4.3 Stages B of Primary Data Findings: Results and Analysis of the Descriptive Observation**

Descriptive observational analysis was used to analyse data collected through the observation method. Dimensions of descriptive observational analysis (Robson, 2011) focussed on the following:

- Hand-pump status, and whether they were in a maintained state or not and whether they were in use or not.
- Actors, who are end-users: names and relevant details of their roles.
- Activities related to maintenance incurred like clean premises.
- Specific individual actions on the hand-pumps, including equipment used by local mechanics.
- Particular events occurring like meetings in terms of minutes of discussed items at the village level.
- What end-users are attempting to accomplish on each hand-pump in terms of short term and long term plans.

#### **4.3.1 Findings and Analysis of Descriptive Observations**

Small and medium maintenance of hand-pumps depends on roles of end-users at large. However, hand-pump maintenance was also seen as a non-starter if it was beyond local capacity. This hypothesis fitted with all observed hand-pumps and end-user roles noted in hand-pumps, which were maintained and those which were not. This information was unambiguously and as faithfully as possible using the camera to document observed evidence. A camera was used to show visual evidence of a maintained hand-pump in Figure 11 and Figure 12 below. A non-maintained hand-pump is presented in Figure 13 below and use of unprotected spring/open well because the hand-pump was non-functional; as seen in the Figure 14 below.

**Figure 11: A Maintained Afridev Hand-pump in the Khuwi Village**



**Source: Chisenga 2012**

**Figure 12: A Maintained Malda Hand-pump in the Mavule Village**



**Source: Chisenga 2012**

**Figure 13: Non-operational Afridev Hand-pump in the Chadza Village**



**Source: Chisenga 2012.**

**Figure 14: Use of an Unprotected Spring in The Kamejeda Village**



**Source: Chisenga 2012**

#### **4.4 Stage C of Primary Data Findings: Convergent Interviews : Determining Maintenance Factors**

This section presents the findings from the interviews conducted with 12 respondents using CI. Table 26 shows respondents recruited for CI and maintenance categories created from each interviewee.

Table 26: End-user Maintenance Categories: CI in Bvumbwe and Nkhoma

<b>Respondent Classification</b>	<b>Relevance Significance in the study</b>	<b>End-user has noticed changes in the hand-pump in the last 2-10 years</b>	<b>Is the pump affected by your actions/ role</b>	<b>Concern for the pump repairs</b>	<b>What you consider as a factor for maintenance - category</b>
EU 3 Community WVI worker lived Over 5 years in the area	Among the trainers for locals pump repairers	Yes	Yes	To be repaired by users	Labour, financial contributions
EU 4 pump Technician.	Repairers simple faults	Yes	Yes	Great	Spare parts, good training
EU10 Group tech	Repairers complicated faults	Yes	Yes	Great	Active water committee
EU11	Uses open well due to broken pump	Yes	No	NGO to repair	Government/NGO role to repair
EU 17	HS A –govt. worker in village	Yes	Yes	Advocates to use & repair pump	VDC/ADC roles
EU 23	Village headman	Yes	Yes	Pump technology	Pump technology, leadership
EU 34	Uses water	Yes	Yes	Great	Working pump
EU 37	Uses hand- pump	Yes	Yes	Great	Working pump
EU 38	Uses hand- pump	Yes	Yes	Defaulters	defaulters
EU 50	Uses hand- pump	Yes	Yes	Repair by users	Household contributions
EU 51	Uses open well due to broken pump	Yes	No	Chief roles	The chief to be active and tell people to fund raise
EU 43 ADC/VDC member	Makes local laws	Yes	Yes	Repair by users	Working pump

The interviewees' names (See Appendix ) have been replaced with the acronym EU (End -User) to conform to the requirement that the respondents' identities to be safeguarded. The numbers under the category column represent the number of maintenance categories emerging in each interview. Choices of respondents were based on:

1. Whether they used the hand-pump
2. Knowledge about hand-pump developments

3. Village representatives with roles on the hand- pump
4. Committees which had a role in hand-pumps and
5. Local hand-pump repairers.

End-users were therefore: a) any water user who were either men/women or school children b) those involved from a technical point as of local extension workers (NGO or government community workers) at ward/councillor levels- who had a concern for the hand-pumps in the local area they were working. As seen from the above table respondents perceived different categories. The analysis involved identifying how respondents viewed categories developed by others, whether they agreed or not, which is further described in the next section.

#### **4.4.1 Results and analysis of Convergence Interviews (CIs)**

The results from the Convergence Interviews (Respondents EU 3,4,10,11,17,23,34,37,38,43,50 and 51) suggests nine categories of the hand-pump maintenances, which were perceived by end users of drinking-water projects from nine different hand-pumps in Nkhoma (Lilongwe, Central Region) and Bvumbwe (Thyolo Districts, Southern Region) of Malawi. Among the nine, hand-pumps 7 were operational while 2 were non-operational (refer to definitions of operational/non-operational pumps). In both areas CI developed, categories in Stage C were carried forward with none rejected as all had support from interviewees. The Table 26 below consolidates and summarizes CI results from 12 respondents of Nkhoma and Bvumbwe drinking-hand-pumps. CIs involved individual interviews with drinking-water end-users with the aim of allowing the end-users to articulate their views and generate maintenance factors and associated drivers or challenges (Rao & Perry, 2003). Secondly, it was to identify the different hand-pump maintenance categories and develop a definition of each of them. To determine the

operational maintenance category through CI required refinement of agreement or disagreement with both the category and its definition (Dick, 1990; Driedger, et al, 2006).

Each interviewee was asked to define the maintenance category they proposed. Such a category and its definition were then either agreed or disagreed by each of the subsequent interviewees. Each subsequent interviewee was also asked to generate new maintenance categories. When no new maintenance categories were being proposed, a point called saturation level, the final vote was counted. The votes determined each category if it was 'agreed' or 'disagreed' as a maintenance category by the majority of the respondents. When the number of disagreed were more than the agrees, such a maintenance category was disregarded or rejected. This process, therefore, depended on opinions of the end-users as it is their vote, which determined whether to include or exclude the category. Respondents' opinions also helped the researcher to decide when a saturation point was reached. Categories emerging from the first eight interviewees suggested the interviews had reached saturation point, as no more new categories emerged (Saunders et al. 2009). This suggests also that the emerging themes were the ones of importance as they emerged early in the process and were presumably on the minds of the interviewees. However, it did not imply that pump - maintenances which emerged later were less important than the early ones. This section hence suggests that the 12 respondents recruited in the CI were familiar with their roles in hand-pump-maintenance and developed nine maintenance categories. The categories were in general supported by subsequent interviewees as seen in the Table 26 below.

Table 27: Convergence Interviews Analysis

<b>Respondent</b>	<b>Labour &amp; finance. Contrib</b>	<b>Training WCs/pump Repairers</b>	<b>Spare parts issues</b>	<b>Water Comm.. roles.</b>	<b>NGO roles</b>	<b>VDC/ADC /DA roles</b>	<b>Village leader roles</b>	<b>Defaulters tracing</b>
EU3	yes	yes						
EU4	Agree	Agree	yes					
EU10	Agree	Agree	Disagree	yes				
EU11	Disagree	Disagree	Disagree	Disagree	yes			
EU17	Agree	Agree	Agree	Agree	Agree	yes	yes	
EU23	Agree	Agree	Agree	Agree	Agree	Disagree	agree	
EU34	Agree	Agree	Agree	Agree	Agree	Agree	agree	
EU37	Agree	Agree	Agree	Agree	Agree	Disagree	agree	
EU38	Agree	Agree	Agree	Agree	Agree	Agree	agree	yes
EU43	Agree	Disagree	Agree	Disagree	Disagree	Agree	agree	agree



EU50	Agree	Agree	Agree	Agree	Agree	Agree	agree	agree
EU51	Agree	Agree	Agree	Agree	Agree	Agree	agree	agree
<b>Category</b>	<b>accepted</b>	<b>accepted</b>	<b>accepted</b>	<b>accepted</b>	<b>accepted</b>	<b>accepted</b>	<b>accepted</b>	<b>accepted</b>

Table 27 above is a tabulation of the CI process. The definition of each category is achieved through perceptions of 12 respondents. 12 respondents (EU 3,4,10,11,17,23,34,37,38,43,50 and 51) developed or defined eight categories relating to hand-pump- maintenance categories. It was necessary to help the end-users to clarify their thinking by seeking to define the specific maintenance categories they were mentioning- to help to clarify to subsequent interviewees when asked whether to agree/disagree with the category and its explanations. The definitions of each category were developed from respondents who first mentioned the category and were subsequently refined to ensure ideas were all further elaborated or captured in the definition. Maintenance categories which had similar definitions or were related were consolidated or grouped under a common heading of category. For example, interviewee, EU 3, mentioned household monetary contribution, which was defined as revenue collection whilst the interviewee EU2 it meant communal-gardening for fund-raising to repair hand-pumps. Collection and communal-gardening were married together as household financial contributions by Interviewee EU1 because both explanations meant to generate finances to buy spare parts for the hand-pumps. Subsequent interviewees were hence given explanations of the category, so they knew whether to agree or disagree. The process to develop categories involved asking respondents to share their understanding about their roles in hand-pump-maintenance. The experiences were further probed in terms of: whether they were familiar with changes in the pump (operational and non-operational state) since construction, how they considered themselves relevant for pump- maintenance, whether they linked their actions to pump operations, whether they had a concern for the pump and finally what they considered as factors to facilitate pump - maintenance. The following section links respondents' categories to study objectives.

The 8 categories developed through the Stage C using CIs linked to the study objectives 2, 3 and 4 which are delineated below:

- Objective 2 : Examine project maintenance plans at hand

- Objective 3: Explore and describe end-user roles in different project phases.
- Objective 4 : Explore and describe the hand-pump challenges end-users encounter in maintaining hand-pumps

The above 3 study objectives were accomplished as respondents stated their experiences which they felt contributed to the hand-pumps project in a form of:

- a. Labour and financing before the hand-pumps were installed
- b. Training of Water Committee (WCs) and pump repairers and
- c. Having a system to trace defaulters in household agreed contributions .

10 (EU 3,4,10,17,23,34,37,38,43,50 and 51 ) out of 12 of the respondents (except for EU 11 and EU51) mentioned that they had contributed finances or labour to promote hand-pump maintenance in Nkhoma and Bvumbwe villages though both EU 11 and 51 had hand-pumps, which were not repaired. EU 11 had not contributed finances and expected the government to repair the pump while EU 51 had considered the role of village headman to be responsible for organising spare parts. Development of categories pertaining to end-user contributions for labour, finances; training of local committees implies that these are factors respondents consider enabling hand-pump maintenance. The third objective was to identify challenges.

Objective 4: Describing the challenges end-users face in the hand -pump- maintenance of water projects in rural areas of Malawi.

Respondents highlighted some challenges encountered to maintain hand-pumps as stated by EU 3. Categories developed through Stage C using CIs linked to the challenges encountered as respondents were furthermore probed into questions like '*what do you think hinders maintenance of the hand-pumps*'. This objective was met as respondent EU 4 mentioned spare part problems, which was considerably agreed by 8 respondents (EU 10, 23, 34,

37,38,43,50 and 51). In addition, lack of government or NGO support for pump rehabilitation was moreover, cited as a challenge stated by EU 11 and the category was agreed by 7 respondents (EU, 17, 23, 34,37,38,50 and 51) though disagreed by EU 43. About spare part issues as a pump maintenance category 9 out of 12 respondents mentioned/agreed that spare parts were either expensive or not found, 1 (EU 3) respondent did not mention it as an issue and 2 disagreed (EU 10 and EU 11) that it was a problem. Relating to lack of NGO support as a challenge in pump-maintenance phase, 9 respondents mentioned/agreed they needed external help for pump rehabilitation beyond their scope and ability. 3 of the respondents did not mention (EU 3, 4, and 10) or 1 (EU 43) disagreed that NGO support was an issue. This section established lack of external aid or support and spare part problems as main challenges of hand-pump maintenance. The next section was to establish if any respondent's categories considered their link with local committees.

This section of the research process sought to understand how local committee members perceived their role in the organisation of the hand-pump- maintenance. Respondents were asked: if they had been involved in any community gathering led by local committees; whether hand-pump maintenance was part of agenda for discussion; whether the respondents viewed local committees to relate with end-users on the pump maintenance; and effectiveness of the outcomes of meetings about hand-pump- maintenance. Respondents EU 10 and 11 mentioned of the roles of local committees in support of the hand-pump maintenance. This was supported or agreed by respondents EU 17,23,34,37,38,50, and 51 though EU 43 disagreed that water committees had relevant roles, and EU 23 and 37 disagreed that local government committees like VDC/ADC/DA had any roles related to hand-pumps. This section, therefore, established that majority of respondents felt local committees had a role to play in maintenance of hand-pumps.

#### **4.4.2 Summary of Maintenance Categories Developed in CI, Stage C**

In summary, the hand-pump maintenance categories' developed during CI were grouped together under 4 main headings namely:

1. Procurement of Spare Parts
2. Support of Local Government Committees
3. Household Labour and Financing and
4. NGO Back Up for Major Maintenance.

End-user labour, household financial contributions and roles of local committees were regarded as factors, which enable end-users to maintain hand-pumps while spare part problems and lack of support for major repair work were viewed as obstacles to servicing of hand-pumps. The next section defines of these categories.

The definition of categories developed during CI is done to provide a clear understanding of end-user perspectives about the categories they consider facilitating or hindering pump-maintenance. Details of the categories and associated definitions are as delineated in Table 28 below.

Table 28: Maintenance Categories and Associated Definitions

Category Identified	Associated explanation or definitions
<b>Procurement of spare parts</b>	The term referred to issues of replenishing worn out hand-pump spare parts in terms of spare part availability, costs and affordability by end-users.
<b>Labour and financial contributions</b>	The term referred to the ability of end-users to organise funds to service and repair simple faults of hand-pumps without an external aid. The term also referred to the contracted casual labour in a form of communal gardening to raise funds for the local water account with the banks.
<b>Local government committees and opinion leaders</b>	The term referred to maintenance knowledge and skills in the villages through local committees. The local committees involved were: Water Committees (WCs), the Village Development Committee (VDC), Area Development Committee (ADC) and District Assembly (DA) in supporting or initiating to find solutions about hand-pump issues in the villages. A WCs comprised of ten users often democratically chosen by users to take the lead in managing local water issues. This term referred to the presence of the WCs, their formation, and whether they are active or not. The structures spearheaded rural development in the areas. The term also included the ability of the local village headmen in organising the people for rural projects including hand-pump maintenance.
<b>Lack of sponsor back-up for heavy maintenance or refurbishment</b>	Both World Vision International (WVI) and Concern Universal demanded local contribution of about 5% of the total project facility in a kind form (contribution of bricks, sand, stones, and quarry) and at least K15, 000 (£55) monetary contributions in the localized bank in readiness to repair the hand-pump. Though this was in place in most of the villages, yet some hand-pumps were beyond local capacity to repair hence end-users felt external help for complicated faults, and asset replacement was a critical issue.

Source: Chisenga 2014

The above categories were forwarded in the fourth phase, Stage D, in which semi-structured questions were used to further confirm the maintenance categories. The results of Stage D; ICI is detailed in next section, prior to which a pilot was done as detailed below.

#### **4.5 Stage D of Primary Data Findings: Individual Case Interviews (ICI), Pilot and Main Study Results and Analysis**

This section discusses the findings from the pilot study and its linkage with the rest of the main data collection and analysis for ICIs section which follows. The aim of pilot study was to add additional guidelines for data collection.

##### **4.5.1 Individual Case Interviews (ICI), Pilot Study Results and Analysis**

###### **Pilot study findings.**

This section presents findings of ICIs pilot on each category.

Pilot Study Findings: - establishing end-user roles in pump-maintenance

Pilot study : end user thoughts on their roles as in pilot table 1 below

Responde nt	Role	Aware of pumps problems	Participate in pump- maintenance
PR1	HSA-govt worker	Yes	Yes
PR2	Pump user	none	No
PR3	Water committee	Yes	Yes
PR4	Water committee	Yes	Yes
PR5	Pump user	Yes	Yes

PR6	Pump user	None	no, thinks government officers should manage
PR7	Pump repair-village level	Yes	Yes
PR 8	Pump user	No	No

The pilot study implies that majority of the respondents considers themselves to have made some contributions for maintenance activities because they believed that their activities could influence hand-pump maintenance. PR 6 did not answer the question positively and stated that it was the government pump, and government is responsible for any repairs. Respondent PR2 did not think her activities affected the hand-pump instead she linked active role of the water committees for the hand-pumps to work. Only one respondent, PR 8, was not aware of the hand-pumps' problems within the area because she had been in, and out of the village even though they had had a hand-pump broken down once and repaired by the local technician. In the case of respondents PR1, PR 3, PR 4 PR 5 and PR 7 they had been part of the hand-pump construction phase, contributed either labour or finances during construction and witnessed hand-pump repaired by local mechanics. Local mechanics are part of the water committees. Therefore, this section correlates that end-user roles had some potential for hand-pump maintenance. End-user roles are linked to local committees.

Pilot study findings –end-user interactions with water committees.

The next stage during the interview entailed establishing the relationship between end-users and the local committees in relation to hand-pump- maintenance. The respondents were further asked if they had attended any stakeholder meetings organised by the local committees and whether hand-pump issues were part of the agenda for discussion. The researcher aimed to establish whether the respondents were aware of roles of water committees that impacted on the hand-pump maintenance and whether end-users were



working as a community group under the guidance of water committees. The pilot study findings on end-user interactions with committees showed that two of the respondents (PR 2 & 6) did not involve themselves in meeting with water committees- which deliberated about hand-pumps. 6 respondents (PR 1,3,4,5,7 and 8) said they participated in a community gathering organised by water committee and hand-pump maintenance was the key agenda. This section, therefore, suggests that most water committees had deliberations about hand-pump maintenance with end-users. In addition to water committees, village leaders and local government or development committees may also link with roles of maintaining hand-pumps.

Pilot study findings: village leadership and local development committee roles about pump-maintenance

The next set of questions aimed to find out if there is any causation between village leadership roles, as part of local development committees, and hand-pump maintenance. The researcher asked for the respondents' experiences with their local village leaders, development committees (at village and area levels) and their linkage with hand-pump maintenance. The pilot study revealed that PR 1,3,4,7 respondents thought that development committees were involved while PR2 5, 8, felt they had not played any roles. Apart from PR1 and PR7, the rest of respondents could not mention any instance of hindrance or support from development committees for hand-pumps. PR1 and PR 7 were familiar with local development committee roles because both were part of the, Village Development Committee/ Area Development Committee (VDC/ADC), the main development structures at the local level. Pilot table 2 below summarises findings.

**Pilot Table 2 Pilot Study Findings: Knowledge and Perceptions**

Respondent	Thoughts on dev. committee commitment	Any instances of hindrance or support
------------	---------------------------------------	---------------------------------------

PR1	Yes	Support-deliberates on development issues
PR2	Hindrance	None
PR3	Yes	Penalises weak village headmen
PR4	Yes	Discussed problems of all villages
PR5	Yes	Devised local rules for finances
PR7	Yes	Discusses
PR6	No support from VDC/ADC	Blames VDC for poverty
PR8	Yes	Discusses

Respondent PR 4, PR 5 and PR7 acknowledged that VDC/ADC discusses development, but they were not sure whether hand-pump maintenance was on the agenda. None of the pilot study respondents had been part of the maintenance deliberations at VDC/ADC levels apart from PR1, who was the village Health Surveillance Assistant (HAS)- a community health worker based in the village. This section implies that majorities of the respondents were not familiar to the roles of local development committees in hand-pump- maintenance. One of the VDC/ADC roles is to make local rules about end-user labour and financial contributions.

### **Pilot Study Findings: Knowledge About Labour and Financial Contributions**

The next set of issues investigated under knowledge and the respondents attitudes to household labour and financial contribution to the hand-pump project. It was also to identify whether end-users were aware of how money was used and relevance of their contributions.

### **Pilot Table 3 : Pilot Study: Knowledge and Perception on Household Financial Contributions**

Respondent	Do you know who determines contributions	Thoughts on funds usage	Thoughts on how much contributed	Knowledge of local laws on contributions
PR1	Yes	Yes- maintenance	Yes	Yes
PR2	Yes	No	No	No
PR3	Yes-chief	yes	Labour as had no money	Yes
PR4	Yes-water committee	Yes –spares parts	£0.5	Yes defaulters punished
PR5	Yes –all villagers	Yes-pay mechanic	£0.4	Yes summoned by chief
PR6	Yes-all villagers	Spare parts	none	Not sure
PR7	Yes –all villagers	Spare parts	£0.5	Yes defaulter bucket ceased
PR8	Yes-chief	Spare parts	£0.5	Yes

The pilot study revealed that majority of those interviewed had knowledge about the need to participate in raising funds (PR 1,3,4,5,6,7, and 8) for hand-pump spare parts though PR 6 did not contribute, and PR 2 was not familiar with the concept of contributions for pump-maintenance. The pilot study also revealed that respondents' knowledge varied on the procedures when asked, who set the tariffs' as respondents (PR 2&8) thought the chief set the tariffs while others (PR4) said it were the committee and others (PR 5,6 &7) felt it was all end-users in a community gathering. The thoughts on how much contributed ranged from £0.00 to £0.50 per household per month. Knowledge of local laws or policies on contributions showed a system of enforcing defaulters as stated by PR 4,5 and 7. All respondents were familiar with the village laws to enforce contributions except for PR2, who did not contribute and was not well-known with enforcement rules. This section, therefore, suggests that majority of respondents participate in household contributions (6 out of 8) and were familiar with local rules to enforce contributions for hand-pump maintenance.

Having conducted the pilot study, it helped to confirm and adjust the way questions were administered. Questioning was adjusted based on evaluation or feedback respondents gave to the questions and procedure of conducting pilot study. A few amendments made were based on feedback received after PR was asked to comment on the questions and the way questioning was done. In general, PR felt the questions were clear but discussion was taking too long and too detailed. Feedback was sought from PR based on a guide. After a few modifications, the session proceeded with the main Individual Case Interviews (ICI) using semi-structured Interviews and analysed on likert-scales to identify the most common hand-pump maintenance categories.

#### **4.5.2 Stage D : Individual Case Interviews (ICI), Main Study Results and Analysis**

This section presents the main study findings of Individual Case Interviews, from 39 end-user respondents. These findings are analysed using scores of maintenance categories on likert-type of scales.

##### **4.5.2.1 Scoring Maintenance Categories**

Stage D, using singular case interviews, was the second set of data collection/ analysis and sought to understand more of the category developed in Stage C. Stage D section presents a profile of each category from individual case interviews carried out in 9 hand-pumps of Nkhoma, and Bvumbwe projects areas. Though 4 main categories were identified in Stage C through CI, 8 questions were devised to allow some categories to be asked from different angles and generate as much information as possible. Stage D involved reporting on scoring relating to these three areas.

1. The level of categories
2. The impact the category had on hand-pump maintenance or
3. The influence of the categories on the pump maintenance.

In ICIs (Stage D) we understood or cross checked more of end-users views about the pump maintenance categories, developed during CI (Stage C). This second set of respondents asked if end -users identified or accepted the category to have operational maintenance impact on hand-pumps or perceived something differently. To explore and understand data, this section will be presented in a form of charts or graphs to help in identifying the mode- thus the most frequent item in each category. Categories were grouped according to objectives: whether they enabled or hindered hand-pump maintenance.

#### 4.5.2.2 Factors that Drive Maintenance of Hand-pumps

Results from the CI category (Stage C) show that one of the categories which drive pump-maintenance was end-user cash and labour contributions and tracing of defaulters. The next section presents the extent to which respondents in ICIs ranked this category to influence hand-pump maintenance.

#### 4.5.2.3 End-user Cash & Labour Contributions Drive Hand-pump Maintenance

Figure 15 ranks household contributions for the maintenance of hand-pumps between the case study areas.

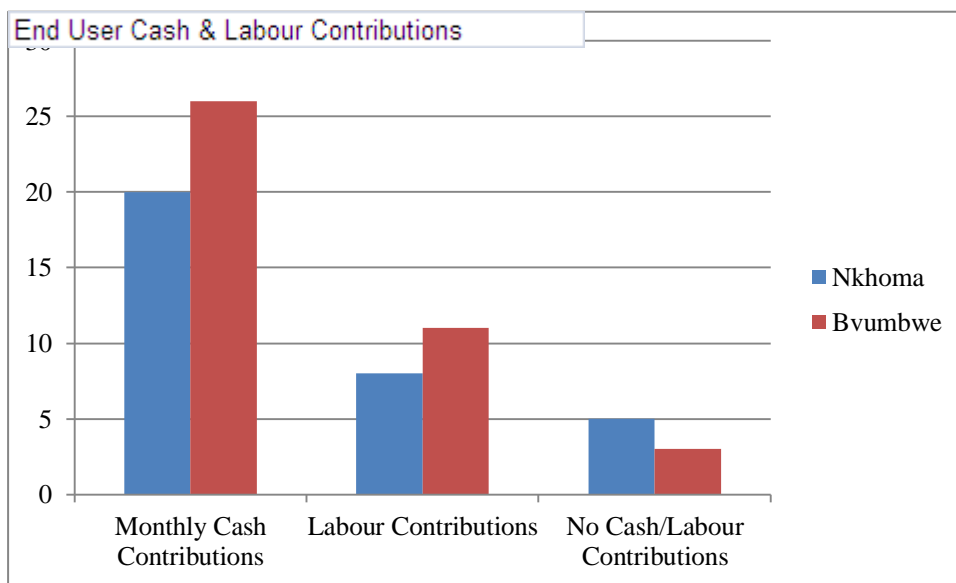


Figure 15: End-user Cash and Labour Contributions

#### 4.5.2.4 Monthly Household Cash as a Maintenance Category

The researcher investigated end-user knowledge and perceptions of labour and financial contributions. Findings show that 26 respondents in Bvumbwe (see appendix 5 page 294) and 20 respondents in Nkhoma ranked monthly cash contributions as the highest factor to

influence hand-pump maintenance. When asked to make a comment why they ranked household monetary contributions as a main issue, respondents EU1, 2, 13, 14, 26, 40, 6, 19, 31, 47, 7, 20, 32 and 48 stated that they had seen that contributed funds were used to repair the hand-pump after respondents had participated in the required economic contributions of £0.3 to £1 each household per month. This information was also verified by EU 45,47 and 49 who were local government/NGO workers at the village level. Total contributions for each village or group village at the time of the study ranged from K3100 (£15) – K30 000 (£120). £120 in such areas is a monthly wage of a junior government official in Malawi. End-user financial contributions were encouraged because both Nkhoma and Bvumbwe areas had NGOs which required local people to contribute funds for servicing, repairing, rehabilitation or replacement of hand-pumps. Respondents commented that some parts of the hand-pump failed within 6 months of hand-pump installation hence end-users were required to have funds ready for maintenance before the asset was even installed. The above figure demonstrates that respondents in Stage D strongly agreed or ranked that end-user casual financial contribution was a factor enabling hand-pump maintenance as initially suggested by respondents in CI section. The next section explains views of ranking end-user labour provision.

#### **4.5.2.5 Labour Contributions as a Maintenance Category**

Labour contribution was ranked as the second most important factor contributing to pump maintenance as perceived by 8 respondents in Nkhoma (EU 13,14,15,16,26,27,28 and 29) and 11 in Bvumbwe ( EU 5,7,8,18,19,30,7,21,20,46,&49). EU 5, 18, 30,46,16,29 and 45 further commented that labour contribution was in a form of fund raising through communal gardening. In the Bvumbwe case group of end-users were hired for labour in the farms, and the farmers made payment straight to the water committee, as this was an arrangement with water committees. Respondents (41,44,16,29,45,5,18,30 and 46 ) commented that they did

not afford to pay a monthly subscription fee instead were involved in 'ganyu' or casual labour with farmers who paid for such money directly to the water account after harvest of soya, ground nuts or maize. Labour contributions also involved clearing the hand-pump area in a form of cutting trees/grass, moulding of bricks, supplying sand and gravel for constructing the hand-pump.

End-users (EU 5, 18, 30,46,16,29 and 45) commented, '*labour is sometimes in a form sand, stones, quarry and clearing the ground to construct the hand-pump*'. Ground clearing was also reported to involve cutting the trees and clearing the grass. Once the hand-pump was installed labour also involved creating the soak way, drainage, daily sweeping the premises, creating the platform for laundry of clothes and fencing the area with bricks or straw to protect the hand-pump from being vandalised by animals. When asked to comment about labour provision, respondents (5, 18,30,16,29 and 47) stated of their willingness in both Nkhoma and Bvumbwe because they described a working hand-pump to have saved them from cholera during the rainy season. Willingness to contribute showed that end-users had personal motivation for hand-pump maintenance. This section suggests end-user provision of labour ranked as a second item in comparison to finances, in contributing to hand-pumps. Though labour is willingly done, there was still a small proportion that did not contribute.

Figure 15 also shows that 5 respondents in (EU) 42,44,45 and 46) in Kapsyepsye and 3 respondents (EU 23,25 and 26) in Kamjeda neither ranked cash/labour as a factor of pump maintenance nor did they participate in a contribution to hand-pump repairs. When asked why they did not contribute respondents (EU42, 44, 45 and 46) commented that their unwilling was conditioned of their perception of feeling they were forced, or they thought the water committee would embezzle the money. Unwillingness or failure to contribute was mainly because of discouragement after failure to maintain hand-pumps or vandalism (as seen from Kapsyepsye 2 villages). End-users who did not contribute were particularly seen in



areas where the hand-pump had been abandoned or failed to be repaired (as the case in Kamjeda (due to lack of local committees) while in Kapsyepsye 1 in Bvumbwe, it was because Concern Universal the project sponsor had phased out, and local funds contributed implies that only a small proportion of respondents did not comply with NGO contract requirements of household and labour input in both areas. This section hence suggests a correlation between household cash/labour contributions and pump- maintenance. End-users had even a system of fund's storage using hand-pump bank accounts.

#### **4.5.2.6 Existence of Hand-pump Maintenance Bank Accounts as a Maintenance Category**

This section reports findings related to the management of local funds. Apart from ranking financial contributions, respondents were asked to comment about the question, *'how satisfied they were with money governance at the village level?* In response, respondents (EU 1, 2, 14,26,40,6,19,31 and 47) commented that they were satisfied with the village monetary managements as funds in the villages were either banked or kept by a village government official or water committee treasurer. Banking arrangements were slightly different in Nkhoma and Bvumbwe.

Respondents EU 1 and 2 further stated that in the Nkhoma area, World Vision International had negotiated with Opportunity International Bank of Malawi, a New Building Society to have local water institution's open savings accounts. These banks were chosen because they had mobile banks and had minimal deposit requirements. The hand-pump committee had to have a constitution. The signatories were the Chairman, Secretary and Treasurer of the water committees. The Treasurer kept bank's records. 15 water committees in the Nkhoma area opened bank accounts however the total number of committees for the whole TA was not known at the time of the study.

Bvumbwe had a similar money governance plan as stated by respondents EU 28, 29,,3 and 7. The difference was that Bvumbwe hand-pumps had opened fewer accounts than Nkhoma. Respondents who were VDC members (EU 6, 19 and 31 ) stated that these developments were being initiated or encouraged at VDC/ADC/DA levels. In Bvumbwe area, respondents commented that bank accounts were opened with Bvumbwe SACCO, which is a mobile bank of Malawi Savings Bank (MSB).Traditional Authority Bvumbwe had a total of 150 hand-pumps constructed by EU, Oxfam and Concern Universal. Accounts were created at a group village level which meant 3-5 villages would merge to one account with the bank. Table 29 below summarises the number of bank accounts to open by the project areas at the time of the study.

Table 29: Number of Bank Accounts Opened for Maintenance

	<b>No. of Hand-pump Accounts Opened for Maintenance</b>	<b>Bank for</b>	<b>Bank Name</b>
<b>Nkhoma ADP</b>	26		Opportunity International Bank of Malawi- A New Building Society
<b>Bvumbwe TA</b>	12		Bvumbwe SACCO Mobile Bank of Malawi Savings Bank

**Source: Chisenga 2014**

End-user cash contributions and the process of tracing defaulters requires support from local government. This suggests that household contributions were audited and accounted for in the majority of surveyed villages and end-users in most cases had formal ways to ensure funds for pump maintenance were well governed. The next section presents how local government committees supported end-user cash and labour contributions.

#### 4.5.2.7 Roles of Local Committees as a Hand-pumps Maintenance Category

Results from the CI, Stage C, category shows that the nature of factors, which drive operations and maintenance of hand-pumps is also linked to roles of local government committees. The next section in Stage D, presents how respondents ranked different committees in relation to their contribution for hand-pump maintenance.

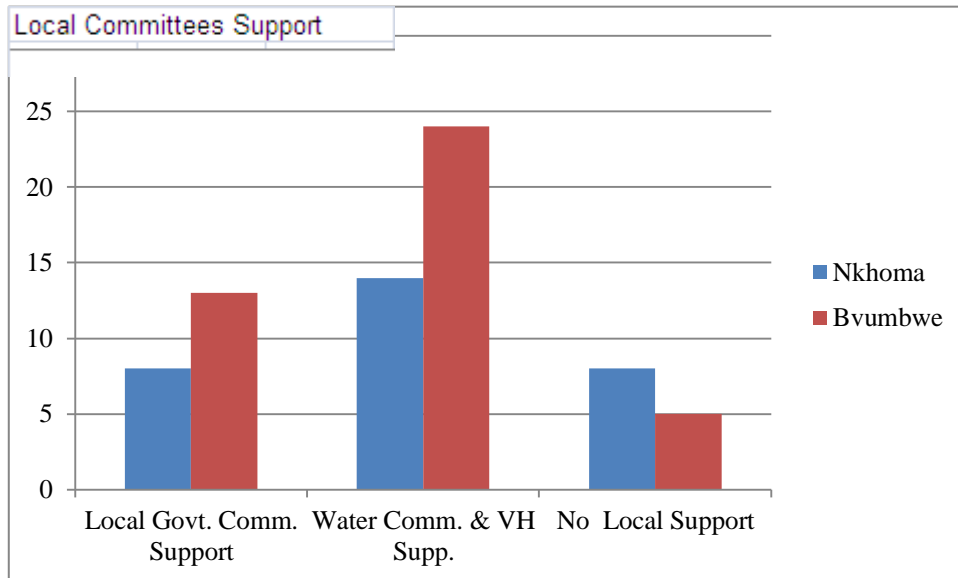


Figure 16: Ranking Local Committee Roles

Respondents were asked to score whether they linked hand-pump maintenance with any activities of any committee. The above Figure 16 shows that respondents (EU 3,7,8,9,12,36,30,40,41,27,28,29,30,12,35 and 47 in Bvumbwe and in Nkhoma (EU 18,19,20,21,10,31,32,33) linked working hand-pumps with activities of water committees. Apart from water committees, 12 respondents Bvumbwe and 8 in Nkhoma also linked working hand-pumps with actions of local government development committees like VDC/ADC/DA. When respondents were asked to comment how the water committees and local government committees did for the hand –pumps, respondents EU 15,27,42,8,21,33 and 49 stated that water and local development committees which were trained had taken some positive roles in the governance of the hand-pumps. In Bvumbwe area, the local government

committees provided more support than in Nkhoma, possibly because Bvumbwe CU project had trained their people in local government organisation and management which was probably not yet done in Nkhoma as the project had just started. Respondents EU 15,27,42 in Nkhoma area further stated that World Vision International had plans in the pipeline for additional training for water committees and local government structures. Most respondents reported that they were aware of the presence of water committees and their roles though roles of local government development committees like VDC/ADC/DA in relation to hand-pumps were only cited by a few individuals (EU 15,27,42,8,21,33 and 49). Water committees were widely acknowledged because they are a forum responsible for management of hand-pumps at a village level. However, water committees are under the umbrella of development committees, which are at different levels: group village, ward and district levels. Development committees are in direct control of hand-pumps hence most members were not familiar with them. This section has there confirmed that water committees are a main driving force for the hand-pump maintenance, supported by development committees. It also implied that training is a crucial factor for water committees and local committees in their hand-pump maintenance roles. Though most respondents confirmed active, trained committees to contribute to maintenance, few respondents disagreed.

However, few respondents were not familiar with roles of trained local committees as 7 respondents (EU 48,22,24,25, and 26) in Nkhoma and 5 (EU42, 44, 45, 46, and 43) in Bvumbwe perceived none of the local committees had any support for hand-pump maintenance. Respondents (EU 48,22,24,25, and 26) stated they were not familiar with local committees, which support hand-pump issues. EU48, 22, 24, 25, and 26 were among respondents from the villages which had unrepaired hand-pumps, and committees were either non-existent or inactive or non-trained. This section correlates training and ability of committees to perform in maintenance tasks. In general, the ICI suggests that trained water

committees are seen as important for hand-pump maintenance of rural drinking-water projects.

Water committees were asked to comment on their roles. In Bvumbwe, (EU 36, 39,3,7,8,9,28, and 29) stated that their terms of reference focused on:

- Ensuring hand-pump area was always kept clean.
- Collected hand-pump maintenance funds and ensured transparent use of funds.
- Conducted preventive maintenance and repairs of hand-pumps. It ensured the most disadvantaged groups like widows, aged, poor, chronically ill had access to clean water by exempting them from monthly contributions or ensured the mechanisms favoured their use of safe water.
- Conducted meetings with community ensuring they were familiar with management of water points.
- Collected data and produced monthly reports and sharing with VDC, extension workers and VDC. VDC was trained to promote linkages and networking with other partners, particularly the water committee as a community-based organisation.
- Active water committees were also those who shouldered water problem at their own expense.

When water committees were asked to comment further about their training in relation to their roles, respondents EU 36, 39, 3, 7, 8, 9 and 28, and 29 confirmed to have been trained in different aspects by the NGOs, including uncomplicated repairs of the hand-pump. Project reports in addition highlighted that Concern Universal had trained 50 Water Committees; and training focused on hand-pump preventive maintenance to impart knowledge and skills to manage easy hand-pumps faults without external assistance (CU Annual Project report, 2007). The training sessions covered five days, were villages based and involved both men and women. The CU training content focused on group dynamics, leadership, roles and responsibilities of committees, and hand-pump management. The practical session covered issues of operation and maintenance of Afridev and/or Malda hand-pumps. There was also a two-day session on leadership styles, committee roles and responsibilities, problem-solving

approach, coordination and communication with other stakeholders. In Bvumbwe, the trainer of trainers comprised of local elites namely: two primary school teachers, traditional birth attendant, 2 village headmen, 4 extension workers, 6 Water Committees and 4 VDC members. The approaches of the trainings were participatory methods to involve learners to identify problems analyse them and finds solutions. Training consisted of practical repairers and simple management and organisation.

Unlike Bvumbwe project areas, the World Vision International (WVI) community project staff stated that the Nkhoma water project trainings were conducted by the District Assembly team and Community-Based Organisation (CBO) team from health, community development, the district water board and WVI staff ( complimented by WVI Project Reports, 2012) . WVI Project reports indicated WVI had trained 30 VHCs out of 72 formed and 23 VDCs to manage operations out of 93 WCs. Training was about minor parts repair, resource mobilisation and hand-pumps parts and how they work.

Few water committee members stated that though training had occurred there were still some pockets, which were not functioning. Respondents described ‘in active’ local committees in a form of those who did not meet regularly, not initiating monetary and labour contributions and lack of coordination between the water committee; the village headman and the VDC/ADC. This was clearly seen in Kamjeda village which had a hand-pump constructed in 2002, had broken down yet the water committee did not respond. One Water Committee member described the situation in this way:

*‘If we can be serious, we can fund raise to buy spares. No one to start, no one to give these opinions... the chief should lead people to fund raise to end water problems in this village...’* (EU 26)

This section has suggested that trained local committee members in general facilitate hand-pumps maintenance at a village level. In addition, there are also hand-pump repairers or

mechanics within the committees equipped with remarkable skills for village operations and maintenance of hand-pumps.

#### **4.5.2.8 Roles of Local Hand-pump Mechanics / Technicians**

Pump technicians and mechanics were another category of local end-users who had knowledge and skill to repair some hand-pump faults encountered. When respondents were asked why they ranked water committees to have highest mode and ADC/VDC to have the next mode for pump maintenance, respondents EU 20,26,10,12,36,39 and 7 stated that these committees actively involved pump mechanics in their roles, at different levels, which brought much input in repairing the hand-pumps. Respondents stated end-users often reported water issues or problems to Village Water Committees. Water Committees respondents stated that their role involved minor maintenance such as repairing of caustic rods as preventative measures. A common problem was that water was corrosive, weak delayed or no flow. In Bvumbwe, 40 water committees were trained and reported on their experiences in cleaning the pump rods quarterly. Oftentimes one hand-pump had one committee comprising of ten members of which 2 members received a two-day additional training relating to Village-Level Operations Management (VLOM) of hand-pumps. VLOM was described as a minor maintenance. Each WC had two members trained in VLOM and these oriented the rest of eight members. The faults failed at VLOM were referred to the village water mechanic which was also part of the VDC (for details of VLOM refer to the Introductory and Literature Review Chapters).

The village mechanics, were the first points of contact by the water committees (WCs). They had received additional 3 days training and managed more faults than WCs-VLOM. The village mechanic in both areas reported of their ability to manage faults like replacing the O-ring, bobbin, u-seal and bearing bush. Complicated faults were either reported to the Area

Development Committee or straight to the area mechanic or technician. The mechanics in Nkhoma were called hand-pump technicians while in Bvumbwe; they were called Group hand-pump mechanics. These received more advanced training for an additional 5 days.

Though there was local capacity to repair some faults, the work load was in proportional as there too many hand-pumps demanding repairs. For example, Concern Universal trained 5 Group Water Mechanics for 5 additional days to manage complicated faults from about 250 hand-pumps in the project area of TA Bvumbwe (Concern Universal Annual Project Report, 2007). In the same way, in Nkhoma there were 2 water mechanics each overseeing about 100 hand-pumps. One of the mechanics in Nkhoma (EU 10) repair about 6-7 hand-pumps each month and in the whole year, he had failed one hand-pump as irreparable because it was beyond his scope as it involved a faulty cylinder which lacked spare parts. Respondents EU 3,27,28,29,9,and 36 also commented that since the Group Water Mechanics were trained in Bvumbwe, many hand-pumps had been repaired/maintained which the District Technician, who is part of the District Water Board would not reach because of overwhelming workload at district level, lack of transport and lack of spare parts in the government department.

This section hence suggests that pump technicians manage to repair most faults except the ones where it was beyond their scope, particularly because of lack of spare parts for major faults like the cylinder. The next section presents what respondents considered as a maintained hand-pump.



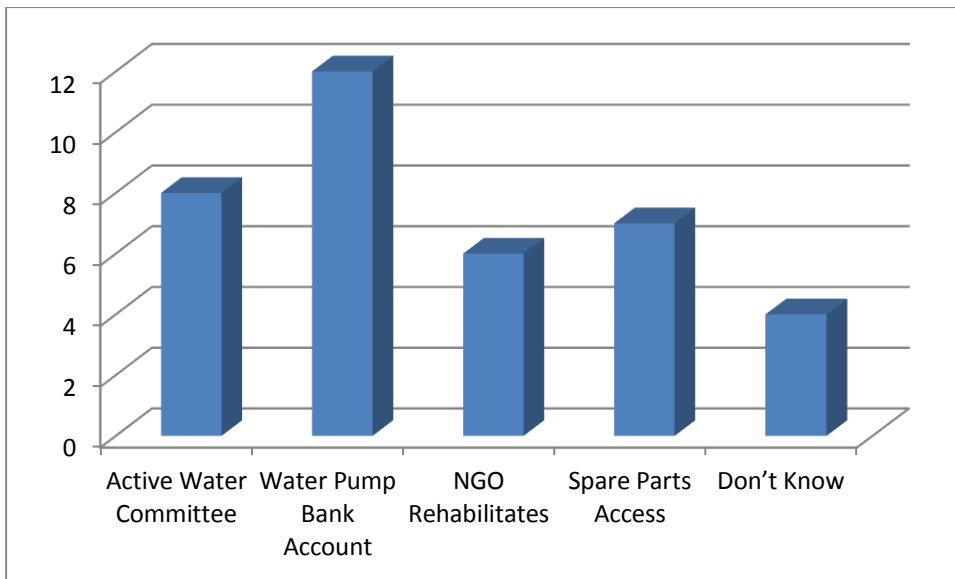


Figure 17: Ranking Significant Aspects of Maintenance

Respondents were asked to rank what they considered to be an ideal pump- maintenance organisation. As seen from the Figure 17 having a bank account was considered as the highest mode perceived by 11 respondents (EU 1,2,13,26,40,67,15,69,70,6, &7). Active water committee was scored second to the highest supported by 7 respondents (EU 31, 47, 56,63,28,48 &49). This was followed by availability of spare parts, 6 respondents (EU 53,60,54,61,20,21) and NGO assistance for rehabilitation 4 respondents (EU 54,61,8,33). 2 (EU 22and 24) respondents had no idea of an ideal hand-pump organisation. Respondents regarded having a bank account for hand-pump- maintenance as the main characteristics of a successful hand- pump followed by functioning water committees because the localized leadership and water committees formed localized policies to mobilise end-users to participate in water issues as part of the contract with the project sponsors. Such contracts demand functioning leaders and Water Committees to mobilise users to take roles in rural water issues.

Spare parts access and NGO assistance in major refurbishment were also score by respondents as necessary for a successful hand-pump maintenance in both Nkhoma and

Bvumbwe areas. Most hand-pumps were reported to be abandoned because of spare part problems; either because they had no finances or the spare parts would not be accessed. Respondents (EU 48,22,24,25 and 26) cited examples where money was not enough to buy spare part, though they had made household contributions. End users reported to be able to manage or repair most faults in Malda pumps but unable to manage complicated faults in Afridev pump pipes as seen in Kamjeda where they failed to repair the cylinder component of Afridev pump. Moreover, in Kachepa 1 village which hand-pump problem was eventually repaired by World Vision team. It was furthermore clearly seen in Mavule village where they repaired constantly the Leopard type of shallow well but failed to repair the Afridev pump. Very few respondents (EU, 42,44,45 and 26) did not deliberate about what characteristic is an ideal hand-pump. This section has further suggested that end-users rank the process of organising finances as a main factor contributing to hand-pumps maintenance followed by organisation of active local committees. The section also confirms that there are challenges facing hand-pump maintenance particularly in relation to the process of procuring spare parts and lack of the process of external aid for major maintenance. Challenges were further classified as seen in Figure 18 below.

#### **4.5.2.9 Challenges that End-user Face to Maintain Hand-pumps**

Results from the processes involved in pump- maintenance indicates that there are some barriers encountered. The next section further ranks common barriers of hand-pump maintenance from findings of Individual Case Interviews.

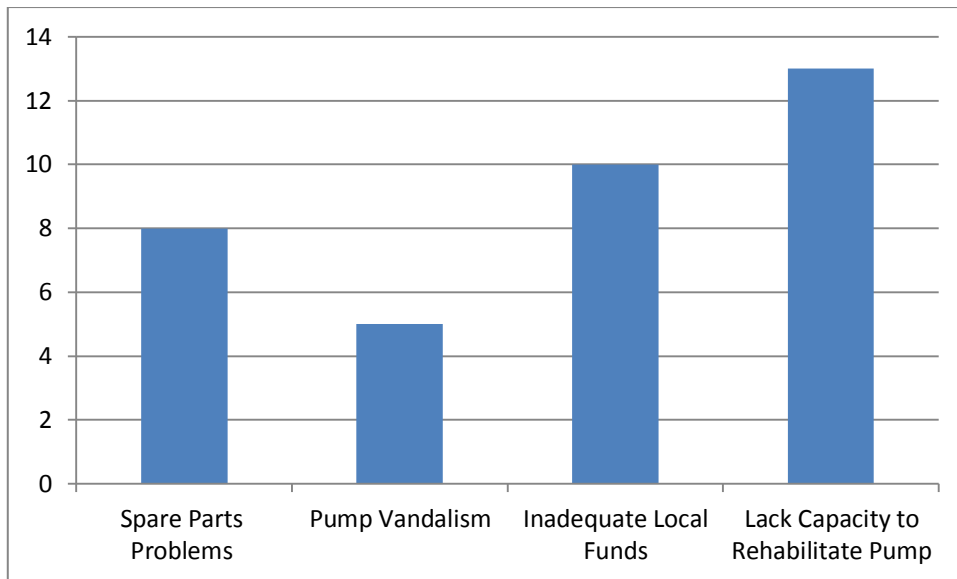


Figure 18: Ranking Main Challenges in Operations and Maintenance

The above Figure 18 show issues emerging related to the processes of pump maintenance. Four main problems were identified by respondents as seen in the above figure. Lack of capacity to repair major faults had the highest ranking with mode 9 of 12 as perceived by respondents EU 1,2,13,14,26,40,41,52,59,69,6, and 31. Respondents EU 14, 26, 40, 15, 27, 42, 28, 44 & 6 commented that pump technicians could repair most faults in hand-pumps but the Afridev pump cylinder could not be maintained. In Nkhoma, the pump technician (EU, 28 and 44) reported he was also unable to repair the cylinder because it required dismantling the part which he could attempt to do if he had the equipment to do so. This section, therefore, confirms that hand-pump heavy maintenance and/or rehabilitation still relies on NGOs at present in both Nkhoma and Bvumbwe.

Inadequate local funds as their main challenge was ranked by 10 Respondents (EU 10,31, 14,15,27,7,20,32,48,26 & 22). End-users identified this as a challenge because as much as most people were keen to contribute, most end-users were financially constrained, often hit by draughts yet subsistence farming is the main source of their livelihood and economic security. End-users were encountered with financial problems to raise money for household

maintenance, because some spare parts had cost them more than £ 120. Such expensive parts had taken rural end-users from 3 to 4 villages an average of 4 to 6 months to contribute. In Gute village, respondents EU 10 and 31 stated they had to get a loan from a local farmer to pay for the hand-pump expenses and pay back the loan over a period of several months. This section shows that though end-users are proactive in making household contributions, funds are inadequate to meet major hand-pump refurbishment, which required dearer spare parts.

#### **4.5.2.10 Spare Parts as a Challenge**

One of the challenges respondents scored was the issue of spare parts. Spare parts as a main challenge were ranked by 8 respondents (EU 12, 24,36,9,22,35,28 & 33). Spare parts problem was reported as the third mode because respondents still faced some problems to find spares. Obtaining spare parts for Afridev was considerably more difficult than obtaining them for Malda pumps. This is because Malda pumps were made locally while Afridev was imported (refer to appendix section for details of Afridev and Malda pumps). However, respondents preferred to have Afridev pumps than Malda because they were more reliable and yielded more water in wet and dry seasons than the shallow wells. This section shows that though end-users preferred Afridev pumps, but spare parts were either more expensive or not readily accessed. Furthermore, though Malda pumps were effortlessly repaired, security was an issue.

#### **4.5.2.11 Challenge of Hand-pump Vandalism**

The least ranked challenge was vandalism as perceived by 5 respondents EU 13,14,15,16,42,38 and 50. Hand-pump vandalism was also a concern as a few pumps particularly Malda pumps were easy to vandalise because they were made of plastic parts. Some villages like Mavule and Gute took strict measures to counteract this malpractice by

installing a rock or employing a watchman from the village to guard the hand-pump at night. Furthermore, in Bulaki they stated that at night, they were alerted by burking of the dogs and end-users would come out of their houses and check the hand-pump. Respondents stated they assumed such a thief came from far areas otherwise if he was from the village, they should have known him. One respondent (EU47) said if such a burgler is caught, he would be severely punished or even stoned to death. This suggests that though end-users had maintained hand-pumps, some although few individuals had ill intentions.

### **4.5.3 Summary of Stage D: ICIs, Findings**

To conclude the findings from the respondents in ICIs (Stage D), were cross checked with the findings in CI (Stage C). The findings in CI, confirmed in ICIs, focused on end-user financing, labour and active roles of local committees as factors promoting hand pumps maintenance. Additionally, end-users encountered challenges as they maintained the hand-pumps and these were : spare part issues, lack of sponsor support and vandalism. These findings were further discussed in focus groups, Stage E.

## **4.6 Stage E of Primary Data Findings: Focus Group Discussions Results and Confirming Maintenance Categories**

### **4.6.1 Introduction**

This section aims to verify if there is any difference between hand-pump maintenance categories, which emerged in Stage C using CIs and were further verified in Stage D using ICIs; if they conform with focus group categories. Focused group discussions focused on themes developed in CI namely:

- Factors which enabled hand pump maintenance including: labour & financial contributions, local committees' roles and
- Barriers of hand-pump maintenance which included: lack of sponsor support for heavy maintenance and spare part problems.

Details of respondents who participated in the focus groups were coded as in Table 24 below.

**Table 24: Focus Group Participants**

Acronym	Name	Village	
EU 63	M. Kayenka	Khuwi Village (Nkhoma)	
EU 64	M. Chekwea		
EU 65	L. Mukunba		
EU 6	R. Nkajinala		
EU 67	R. Timbeneto		
EU 68	R. Master		
EU 69	M. Planuel		
EU 70	B. Esow		
EU 71	R. Khuwi		
EU 72	S. Banda		
EU 53	M. Jana		Kapsyepsye village (Bvumbwe)
EU 54	A.Ndalama		
EU 55	P.Chogwira		
EU 56	MA.Kazembe		
EU 57	E.Nchacha		
EU 58	V. Kamulange		
EU 59	M.Lipenga		
EU 60	F.Maulidi		
EU 61	M.Watilasa		
EU 62			

Details of participants and summary of emerging responses to the themes is further highlighted in the Table 30 and Table 31 below.

**Table 30: FGs Composition of Participants Kapsyepsye Villages Bvumbwe and Theme Responses**

Respondent Classification	Relevance Significance	Changes noticed in the pump in the last 2-10 years	Is the pump affected by your actions/your role	Concern for the pump, on their lives	What you consider as a factor for maintenance
EU 61 Water committee	Spearheads maintenance	Yes	Yes	End-user contributions	contributions
EU 62 Water committee	Spearheads maintenance	Yes	Yes	End-user contributions	contributions
EU 63 Government officer: HAS	Trainer, advocate, link with health	yes	Yes	Maintenance	Community organisation, leadership
EU65 End-user	Uses water	Yes	Yes	Don't know	Don't know

EU 66 End-user	Uses water	Yes	Yes	maintenance	maintenance
EU 67	Uses water	Yes	Yes	maintenance	maintenance
EU 68	Uses water	Yes	Yes	Don't know	Don't know
EU 69	Uses water	Yes	Yes	Don't know	Don't know
EU 70 area mechanic	Repairs	Yes	Yes	Spare parts	Spare part access
EU 71	Trainer, advocate, link with health	Yes	Yes	maintenance	Community organisation, leadership

Table 31: FGDs: Composition of Participants - Khuwi, Nkhoma and Theme Responses

Respondent Classification	Relevance Significance	Changes noticed in the pump in the last 2-10 years	Is the pump affected by your actions/your role	Concern for the pump, maintenance on their lives	What you consider as a factor for maintenance
EU 50 Community WVI worker lived Over 5 years in the area	Among the trainers for local pump mechanics	. yes	Yes	maintenance	Training pump repairers
EU 51 Water committee	Spearheads pumps	yes	Yes	End-user contributions	contributions
EU 52 Government officer: HAS	Trainer, advocate, link with health	yes	Yes	maintenance	Community organisation, leadership
EU53 End-user	Uses water	yes	Yes	maintenance	maintenance
EU 54	Uses water	yes	Yes	maintenance	maintenance
EU 55 Water committee	Spearheads pumps	yes	Yes	End-user contributions	contributions
EU 56 Pump mechanic.	Repairers	yes	Yes	Spare parts	Available spare parts, training
EU 57 End- user	Uses water	yes	Yes	maintenance	maintenance
EU 58 ADC/VDC member	Spearhead rural dev.	yes	Yes	linkages	contributions
EU 59	Makes	yes	Yes	training	contributions

Village leader	village laws/policy				
EU 60	Uses water	Yes	Yes	Maintenance	maintenance

#### 4.6.2 Focus Group Perception of Labour and Financial Contributions

This part of the data collection stage verifies group perceptions about labour and financial contributions for hand-pump maintenance. Table 32 below is a summary of the issues that were discussed in the topic in Khuwi (Nkhoma) in a maintained hand-pump, and in Kapsyepsye (Bvumbwe) in a non-operational hand-pump.

Table 32: Group Perception of Labour and Finances: Bvumbwe and Nkhoma

Respondent Classification	Significance of labour and finances	Pump changes noticed due to contributions	Contributions : laws & policies	Factors hinder contributions	Suggestions to improve contributions
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When asked about labour and finance cash contributions for hand-pump maintenance in Khuwi, the response from EU 52,57,58 and 60 was that ‘*water is life*’, meaning that they cannot do without it, and other respondents hummed in agreement. Respondents EU 51, 53, 54 and 59 further complemented this with the comment that *that they had seen the need of clean water as cholera had reduced in the villages*. In Khuwi village focus discussion, one end-user (EU 54) commented as below and the rest nodded in agreement.

*‘WVI demanded us to contribute: K15000, sand, bricks, clear the pump construction place and buy 4 locks in readiness for security as previous hand-pump was vandalised... we were given a deadline of 30/3/12 for a water bank account to be opened, We met WVI requirement and WVI rehabilitated the hand-pump in Nov 2011...prior to this, we had channelled the problem to the MP and police ...who did not take any initiative....(EU 54, Khuwi village).*

When the groups were further probed about the laws and policies on contributions, respondents (EU53, and EU60) said all contribute in Khuwi village, and one respondent said.

*... there is no defaulter because everyone knows the importance of repairing the hand-pump, and we have seen the benefit (EU 60)*



Respondent EU 58 (the village head) and 51 (water committee) added that they had agreed the old may be exempted from payments. One old lady was assigned to sweeping the hand-pump premises instead of paying.

When asked about anything they would suggest for future contributions, respondent EU 56 (the local mechanic) commented that his only concern is that he fears if the hand-pump shaft breaks down the money may not be enough to buy or the spare part itself may not be available.

The Kapsyepsye village focus group, where the hand-pump was non-functional, the respondents had a different response. Respondents EU 62 (water committee) stated that labour and financial contributions were not the main issue in maintenance of their hand-pump, but rather it was the case of weak village leadership. Respondent 66 and 68 agreed, and others nodded. Respondent EU 69 stated that the village leader drinks too much liquor, so he fails to encourage development. Respondent EU 70, also said that the hand-pump was not repaired because the leaders did not take the responsibility to inform the government or NGO of the broken hand-pump and also the leaders did not initiate end-users to make household contributions so the hand-pump could be sorted. Based on the responses this study suggests similar patterns in the responses with CI and ICIs about the role of end-user labour and financial input. The FGDs helped the researcher reach saturation points on the thematic issues established of labour and household financing. The group discussions in Khuwi and Kapsyepsye resulted in the researcher concluding that hand-pump maintenance was associated with the following enablers and barriers (See Table 33):

**Table 33: Focus Group Summary of Hand-pump Enablers and Barriers**

<b>Hand-pump Enablers</b>	Payment of household agreed tariffs General organisation of funds
<b>Hand-pump Barriers</b>	Lack of external aid for pump major faults or rehabilitation End-users unable to afford expensive spare parts Weak leadership

Therefore, the focus groups confirmed that these aspects were enablers or barriers to hand-pump maintenance in the area. However, end-users worked within structures called committees so the next section explored the group perception about the local committees.

### 4.6.3 Focus Group Thoughts about Local Committees

The following section presents the findings from group thoughts on local committees' roles for maintenance of hand-pumps and their interaction with other partners or end-users. Respondents were therefore asked a question 'Do local committees have a positive role in hand-pump maintenance?' The subjects thoughts focussed on committees' commitment, examples of support or negative instances derailing support and committees' limits for hand-pump maintenance. The section aimed to examine or confirm if local committees' have positive roles in hand-pump maintenance as suggested in CI and verified in ICIs. Sub- topics in the Table 34 below guided the discussion:

**Table 34: Sub- topics Guiding the Focus Group Discussion: Local Committees**

Respondent	Thoughts on committee commitment	Any instances of committee hindrance or support for pump maintenance	Committee links for pump maintenance
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The groups were asked about what they knew about the local government committees in terms of their roles, commitment, and linkage with end-users or other partners for hand-pump

maintenance issues. In response, in Khuwi village respondents, EU 57,58,58,61 and others spoke of the outstanding and dedicated roles of water committees and pump technicians. Respondent EU 54 and 58 linked the water committees to work within governance of local government (development) committees like VDC/ADC. The water committee and the village chief (EU 58) were conversant about this link and talked boldly about it.

When respondents were asked what they specifically do for the hand-pumps one of them a water committee member (EU 51) expressed the following motivation:

*‘There is no incentive as a Water Committee member as we work almost daily with no pay ...but all I want is to drink clean water and this drives me to be a water committee member’ (WU 51)*

In Khuwi, where a hand-pump was repaired by the water committee and pump mechanic, some group members (EU 54, 60) mentioned members of the local committee they knew who were present in the FGDs and those who were not there. Respondents (EU 51,55 and 56) mentioned that WVI the NGO had trained 10 WC members and further acknowledged that some have left the village. The village had selected new ones who were not yet trained. Khuwi FG members described some committee members to be active while others were viewed as weak. Respondents (EU 51, 55 and 56) described weak committees as the ones, which did not meet regularly with others or did not give feedback to the villages about the household contributions made. EU 55 and 51 (Committee members) stated that they often met 2-3 times monthly to discuss their roles and other issues like how much money was contributed in the previous month. However, EU 51 and 55 expressed the concern that the process of gathering money could be hard as one could sit at a hand-pump all day without eating anything, waiting to collect payments as people came to draw water. One committee member (EU 51) further added that at one time the WC authorised buying a bottle of soft drink (coke) and a snack for one allocated to collect funds that day, from collected revenues, but when the end-users were told during the community gathering, they refuted the idea.

This revealed some insights on how local committees operate as volunteers without any remuneration. It was discovered that the choice of working as a committee was not voluntary but members were chosen at a village community meeting, hence they had an obligation to serve members of their village. However, though they worked as volunteers, EU 58, the village chief, stated that village volunteer had a status and was regarded as village elites.

When the group was asked what they knew about water-committee information sharing, EU 53, 54 and 60 stated that the water committee regularly told them how much money had generated from household contributions. It was interesting to note that the respondents' who were not in the water committee knew the actual amount of money they had so far contributed and how much was in the bank.

When respondents were asked what they had learned from meetings with the water-committee, one said (EU 60) (and others agreed), that they taught them to pump gently to avoid hand-pump faults; to avoid children playing with the pump as they can put coins, which dislodge the system and also to sweep the premises and keep it clean. The respondents were asked whether they were familiar as to where the water committee members refer their problems. In response to this EU 54 and 55 mentioned that they channelled their problems to the Health Surveillance Assistant (HSA) who is a health extension worker based at the village level; others (EU 58) mentioned the VDC/ADC/NGO while one mentioned the member of parliament for the area (EU53).

In Kapsyepsye, which had a non-operational hand-pump, when the group was asked the state and roles of committee, respondents were familiar and confirmed that they had a committee which they elected in 2007 though it was not active at the time of the study. Though inactive one of the respondents(EU 62) confirmed that they stopped meeting but EU 61 felt they cannot afford to buy spare parts. Though they were not meeting, but the group knew or

confirmed that they had K30 000 (£60) in the account, and the bank account booklet was kept by the HSA, who is a government village health worker, living in the village. EU 63, the Health Surveillance Assistant confirmed this. Prior to that, the group echoed (EU 65,66,68 and 69) that the committee had managed to mobilise people to mould bricks, bought sand and stones for the hand-pump which ended up being vandalised.

#### **4.6.4 Focus Group Thoughts About the Work of Village Hand-pump Mechanics**

Respondents in both villages were asked what they knew about the link of the committee members, mechanics and end-users in general. Respondents in Khuwi (EU 53 and EU 60) believed the area mechanics could repair most of their hand-pump troubles. Respondent (EU 58) stated that though the ADC set local mechanics to be remunerated about £4 yet respondents at times exceeded this agreement in appreciation for the work well done on repairing the hand-pumps. The mechanic (EU56) in the group supported this and commented:

*Since the year 2000, I have not referred any hand-pump problem to the district water department because I have effectively repaired all the ones I was called for ... I oversee more than 80 pumps (EU 56: Bvumbwe area mechanic)*

The other group members (EU 58, 60 and 54) agreed that he was an expert, and he knew his job. This section suggests that water committees and pump mechanics are an essential component of maintenance of hand-pumps as suggested in CI and verified in ICIs. However positive developments are also coupled with some challenges.

#### **4.6.5 Focus Group Thoughts About the Problems of Hand-pump Maintenance**

This section includes findings of the interview section that sort to establish the challenges that the end-users face for maintenance of hand-pumps. The section is guided by the sub topics in outlined in Table 35 below:

**Table 35: Sub Topics Guiding Discussion: Spare Parts Issues**

Respondent	Identification of spare parts as a challenge	End-user witness of challenge	EU perception of who to sort the spare part problem	End-user perceived solution
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Respondents were asked about challenges related to spare parts, whether they had actual experiences of the challenge, how they sorted and what they think could be done in the future.

#### **4.6.6 Focus Group Thoughts: Sponsor Support and Spare Parts Issues as Challenges for Maintenance**

Respondents were asked about challenges they encountered in meeting hand-pump maintenance issues and these focussed on lack of sponsor when hand-pumps are handed over to them and problems of spare parts at times as suggested in CI. Most discussion showed end users were concerned if a major hand-pump fault would occur they may not manage it without the help of the NGO. Khuwi respondents (EU 52, 53, 57, 58, 54, 59) agreed that they had experienced a problem of major spare part fault on their hand-pump, installed by Interaid, which they failed to repair till when World Vision, another NGO came on board to repair it. Respondents echoed,

*....we need external help if it is a big hand-pump problem beyond our scope’  
(EU 57 Khuwi)*

In in Kapsyepsye 1 village a water committee member had a different opinion and said:

*..’we need NGOs to help us as water pump spares are too expensive...as we had initiated contributions up to K4200 but stopped as we noted money was not enough for spare parts (EU 65)*

Respondents (EU 56) particularly mechanics also explained as to where they get spare parts but lack of spare parts for complex parts like the Afridev cylinder was again pointed out. As

previously observed, here too, the respondents expressed concern for fluctuating prices as another challenge threatening their contributions. In Bvumbwe, WCs repaired the water pumps who often spent K6500 (£26) each time of repairs. Water committees reported capacity to remove and fix rods but unable to deal with complicated faults. One respondent commented and the rest nodded:

*'European Union constructed bore hole in 2002. Concern Universal assisted to repair while they were in project phase in 2006 ...then it broke down again ...by then Concern Universal had phased out we could not repair it ....though we had made contribution of K4200 (£20)' (EU 63,65 &68)*

The situation in Kapsyepsye 2 water pump shows that local mechanics are unable to refurbish complicated faults including asset replacement as much as end users can raise funds for servicing and do some maintenance within their scope. This situation was also seen in Kamjeda water pump. Contributions were generously done for Kamjeda village water pump yet water pump was abandoned. The reasons were beyond their control because of underground problems.

In Nkhoma one respondent (EU 52 & 59) described water problems in this way before the hand pump was repaired:

*'We were in great problem whilst the Afridev pump broke down we cannot afford spare part..... the Malda pump yield low water....we wait for about two hours to fill a 20 litre bucket... we go 6 AM and comes back 2.00PM ... there are long queues... it is better off around 3 Am then you can fill two buckets before water runs out, generally water has very weak flow. There are some working hand-pumps about 2 miles away... we are forbidden to get water there as we were not part of construction and maintenance expenses. Hence we mostly use contaminated water from the unprotected springs'. (EU 52 & 59)*

When group members were asked what they did to solve lack of access to clean water, most said they used chlorine which was at times supplied by the HSA. The HSA confirmed that chlorine was not always available from the district hospital. Members also stated how they

had been hit by cholera some two years ago. The study also revealed that grocery owners were also concerned of use of contaminate water so they sold chlorine in local shop but only a few respondents reported they had always bought and used chlorine because of financial problems. The next section concludes the study findings and analysis.

#### **4.7 Conclusion**

The study findings have revealed the end-users perceive a number of factors which influence or prevent operations and maintenance of hand-pumps. Factors which drive or enable maintenance were: end-user labour and financial contributions, involvement of trained local committees and pump technicians. Factors which were challenges to hand-pump-maintenance were identified as lack of assistance of project sponsors for hand-pump replacement or rehabilitation and problems of spare parts. These hand-pump maintenance factors emerged with triangulation of secondary and primary data from four sources namely: Documents, Observation, CI, ICI and FGDs. Primary data findings comprised the main data which used interviews using CI to develop categories, ICI to verify the categories and lastly Focus Groups to confirm the findings. CI factors are summarised in a matrix while ICI is presented through tables and charts and also respondents' comments on the scored category. The above results are further discussed in the following chapter and recommendations are proposed.



## CHAPTER 5 DISCUSSION AND RECOMMENDATIONS

### 5.1 Introduction

This chapter discusses the issues that emerged from analysing the interviews and thereafter proposes a number of recommendations aimed at highlighting factors that can facilitate hand-pump- maintenance by end-users. The discussion surrounds the study's main research question which is: *'What factors facilitate or hinder effective end-user participation in successful maintenance of drinking-water projects in selected case study areas of Malawi?'* In consideration to the research question, this chapter discusses how analysis of the research findings provides answers to the research question. The discussion is based on the account presented in the previous methodology chapter which detailed the techniques used to develop categories of factors that facilitate or hinder end-user participation in hand-pump maintenance. In this chapter, each category of the finding is discussed in more details using information documents, observations, 12 convergent interviews, 39 individual case interviews and two sets of focus groups. The interviewees' accounts and literature reviewed make comparative analysis to justify the arguments and discussions provided. The first set of the discussion focuses on factors that facilitate or hinder successful hand-pump maintenance. The principal factors that promote hand-pump maintenance are; end-user monetary/labour contributions and training of local-committees. The study also identifies lack of sponsor support during maintenance phase as a chief challenge to achieve hand-pump rehabilitation, mainly because procurement of expensive repair parts is beyond the capacity of end-users' local financial contributions. Therefore, this study acknowledges the existence of strategies for small and medium maintenance in Malawi but also identifies hand-pump major

maintenance or rehabilitation as a main hindrance impinging on the pump maintenance strategies.

The last section recommends minimal standards to be met in order to overcome hand-pump failures during the maintenance phase. The recommendations are three-tiered focussing on:

1. Strengthening the demand or end-user side of the hand-pump maintenance;
2. Strengthening the supply side of maintenance, which includes roles of the project sponsors and the government;
3. Planning for maintenance by: assessing the status of hand-pump maintenance using a continuum of non-maintenance to excellent maintenance and developing a maintenance approach using risk identification, analysis and response.

Demand side involve scaling up roles of end-users in maintenance whilst supply sides are those which relate to the roles of the project sponsors, government, including policy issues affecting hand-pump- maintenance. The demand side include strengthening issues about the end-user level which include: labour and household contribution, formation of drinking-water associations and water committees exchange visits. The supply-side recommendations include strengthening issues related to NGO project sponsors and the government roles. Specifically, such recommendations to address issues related to : hand-pump manufacturers', drillers', policy makers, scaling up training of HSAs to encompass hand-pump rehabilitation, donor subsidies, credit provision or contracting out hand-pump rehabilitation all together, stimulating supply chain for parts and forming drinking water steering committee at national level. The last section highlights planning maintenance process by assessing the hand-pump maintenance status on a continuum of non-maintenance to excellent maintenance and identifying maintenance risks and responses.

Prior to detailed discussion and recommendations, a summary of findings from each hand-pump is summarised as this will be the basis for discussion.

## 5.2 Summary Discussion of Findings from Each Hand Pump/in Situ Studied

Prior to detailed discussion and recommendations, a summary of findings from each hand-pump in situ studied, including status, findings and characteristics, is summarised in Table 36 below as this will be the basis for discussion.

**Table 36: Summary of Findings in Each Hand-Pump in Situ Studied: Status, Findings and Characteristics**

<u>Hand-Pumps</u>	<u>Summary of Status, Findings and Characteristics</u>
Khuwi hand-Pump (Nkhoma)	The Afridev hand-pump was installed by the NGO called Interaid in 1998. Respondents [End User (EU) 3, 17, 7, 8, 9 and 12] report of no training nor maintenance mechanisms in place at the time of installation. The hand-pump broke down in 2008. End-users reported to HSA as a village health worker for help. The NGO, World Vision International (WVI) repaired in 2011 after the end-user fulfilled the condition of contributing sand and bricks, clearing the premises and opening a bank account with K15000 upfront maintenance funds. WVI also required end-users to build a fence on the premises, bought a security rock and dug waste water outlet; which end-users complied to.
Mavule hand-Pump (Nkhoma)	Mavule village has a Malda shallow well and a non-operational Afridev. Respondents (EU 13, 14, 15 & 16) and FG (EU 49, 50, 55, 56, 59) report of : shallow well-being unreliable as gives problems often and yields no water in the dry season; water is also often silty and spare parts are constantly worn out. Afridev hand-pump was constructed 1998 had weak water flow, due to? Underground rock and eventually stopped working, and was later vandalised. End-users are in the process of working with WVI to repair the Afridev. So far, end –users have contributed K12 000. They await seasonal harvest of soya, maize & ground nuts, from farmers who hired them for casual labour in farms for those who would not pay monthly subscription of £0.5-£1 per household-farmers will pay money to the pump bank account.
Chadza hand-Pump (Nkhoma )	Chadza also has a non-working Afridev hand-pump which was constructed in 1998 by Interaid. Respondents EU 1, 3, 5 & 6 states that there is also a Malda pump which yields inadequate water in dry season. End-users have so far contributed K 15 000 as a requirement from WVI before rehabilitating the non-functional Afridev pump.
Kachepa hand-Pump (Nkhoma)	The Kachepa Afridev was constructed in 1998 by Interaid NGO. Respondents EU 18, 19, 20 & 21 report that: the hand- pump stopped working in October 2011, repaired by WVI in 2012. Prior to that, water committees failed to repair a few times. WVI told them to contribute K15 000 as a condition for the NGO to rehabilitate the hand-pump, which they did.
Kamjeda hand-Pump (Nkhoma)	The Kamjeda Afridev hand-pump was constructed 1998 by Interaid and became non-functional in 2010. Respondents (EU3, 48, 22, 24, 25 & 26) report of attempted repairs by WVI but water did not come out due to poor drilling during installation.-which discouraged end-users to make any further contributions for maintenance. Prior to that

	end –users had actively contributed and even had a bank account for the hand-pump maintenance. In 2010, WVI gave them tools to dig for Malda pump; end users found a rock underneath so there is poor water yield, such that often they resort to use unprotected springs.
Mphenzu hand-Pump (Bvumbwe)	The Mphenzu Afridev hand-pump was constructed in 1993 by OXFAM. Respondents EU 27, 28, 29, 37, 48 & 30 report that the pump broke down in 1999 repaired by a member of Parliament of the area. The hand-pump broke down again in 2011; then the village chief borrowed money from rich farmers because the part involved was expensive for them to afford by household contributions, total amounting to K45 500. Maintenance was done by the area mechanic. Now contributions made up to K8, 700 awaits to open an account when the amount is K10 000 as a bank requirement. EU 27 & 28 (trained technicians) reports of removing and fixing rods as part of maintenance.
Gute hand-Pump (Bvumbwe)	The Afridev pump was constructed by Concern Universal in 2007. The hand pump has not broken down since then. Water committees however continue to do quarterly cleaning of rods from rust so as to prevent future break down. An account was opened to anticipate funds for maintenance
Bulaki hand-Pump (Bvumbwe)	The Afridev pump was constructed in 2007 by Concern Universal. EU 36,39,40 & 41 states that the pump has broken down twice since then one of which was theft of some parts. End-users made a one-off fee of K500 per household to cater for costs of parts, which were dearer and afterwards maintained K100 per household monthly. Hand -pump has been willed for security reasons. Pump technicians and water committees have repaired the hand –pump each time it become non-functional.
Kapsyepsye hand-Pump (Bvumbwe)	The Afridev pump was constructed in 2007 by Concern Universal. It was then vandalised after CU phased out. Respondents EU 42,44,45 & 46 state that fundraising discussed but never materialised because the village chief is passive and there is no working committee to facilitate the process. These observations were confirmed in focus groups by respondents (EU 60,61,63,65,66,67,68 & 70 .EU 43 and stated people are discouraged because of vandalism and expensive parts of the non-operational hand-pump.

Table 36 shows that findings presented in the previous chapter indicated salient factors that influenced end-users roles in the maintenance of hand-pumps in Nkhoma and Bvumbwe areas of Malawi. End-users related their actions to a successful outcome of repairing small-medium faults on 7 (out of 9) hand-pumps in Khuwi, Mavule, Chadza, Kachepa, Mphenzu, Gute and Bulaki. Two of the seven pumps (Khuwi and Kachepa) required rehabilitation or major maintenance, which was beyond local capacity to repair. Prior to the rehabilitation, the pumps were non-functional for a period of three years, the time when there was no drinking water NGO in the area. The Respondents also noted that the pumps were installed at very different times and by quite different NGOs. The Khuwi, Mavule, Chaza, Kachepa & Kamjeda pumps were constructed around 1998 by an NGO called Interaid in Nkhoma; whilst Mphenzu pump was installed by OXFAM and Concern Universal constructed Gute, Bulaki, and Kapsyepsye pumps in 2007. During focus groups' respondents (EU 49. 51, 56, 59

and 10) who are also community governments and NGO workers agreed that until WVI came on board in Nkhoma, training end-users to participate in maintenance was not commonly known. This observation was also reported by respondents (EU 27, 31, 11 & 43) in Bvumbwe.

Two of the nine pumps studied were non-functional either because: (a) they required capital costs for major refurbishment or (b) there was poor local governance. In Kamjeda, respondents (EU 22, 24, 25, 27 & 48) linked non-operational pump to drilling and aquifer problems, which eventually discouraged them to make any more initiatives, as much as they had done at the onset, when they had actively contributed for maintenance. However, for the Kapsyepsye hand-pump, respondents (42, 44, 45 & 46) confirmed in focus groups (EU 60, 63, 68 & 70) linked non-operational pump to poor local leadership and lack of a functioning water-committee. This study, therefore, has identified the following main issues:

- Respondents regarded labour and financial contributions as their main contribution in pump- maintenance.
- Water committees and pump technicians could carry out small- medium repairs, respectively, and this was the main category of faults the hand-pumps experienced.
- Lack of capital costs for major refurbishment was a hindrance to managing complicated faults in Khuwi and Kachepa.
- Respondents-related NGO way of managing the hand- pumps project as a determinant, whether they were going to actively participate for maintenance or not.
- Water committees are regarded as main drivers of maintenance operations.

The next sections' details discussions of the above and makes relevant recommendations on each aspect starting with labour and financial contributions as a main maintenance success factor.

### **5.3 Labour and Household Financial contributions as a Factor of Hand-pump Maintenance**

End-users regard household contributions of money as the most important factor for maintenance of their own pumps. Results of this research show that most end-users are prepared to pay something casually in the order of £0.3 -£1 towards the maintenance of the wells or pumps (Table 17, 18 & Fig 11). The findings demonstrate that out of the nine hand-pumps, seven pumps ( Mphenzu, Gute, Bulaki, Khuwi, Kachepa, Mavule and Chaza pumps) in the study area were repaired using household financial contributions made (EU3, 4, 10, 17, 23, 34, 37, 38, 43, 50 & 51 ). The finances raised were used to repair small to medium hand-pump faults which commonly occurred than complex faults requiring rehabilitation. Household financial contributions in this study are regular end-user fund-raising activities for maintenance of hand-pumps. The funds generated from household contributions are used to replace worn-out pump parts and pay for the stipends for the local mechanic who repairs the pumps. Small casual end-user contributions in monetary forms are critical to repairing the pumps as they assist to procure spare parts needed to replace the worn-out ones.

Procuring spare parts is critical as worn-out parts prevent or reduce the optimum functioning of hand-pumps and reduce flow of water. The causes of faulty hand-pumps include failure of parts such as the pump rods, pump head and pins resulting in delayed or weak and sometimes no water flow at all (see appendix D diagram of a hand-pump features-discussed under VLOM in chapter 1 and 2). Non-operational pumps were usually handled by local mechanics subject to spare parts being available. However, due to financial challenges not all end-users managed to raise the prescribed monthly tariffs for spare parts, as an alternative they preferred providing labour as their input for maintenance.

End –user labour provision is equally considered important in hand-pump maintenance. The results from this study demonstrate that respondents contributed different forms of labour

(see Fig 11 EU 5, 18, 30, 46, 16, 29 & 45). Labour is defined as end-user input in a form of moulding bricks, provision of sand, gravel, clearing the water premises' area, digging of the wells or involvement in community gardening with the aim of raising funds for hand-pumps maintenance. The other form of labour occurs when the hand-pumps are constructed, focusing on building the hand-pump fence with bricks/straw, washing area for laundry of clothes and daily sweeping the premises. End-user Involvement of labour just like financing is very important because it is proof of the end-users interest in the hand-pump and its maintenance, but there are also underlying policies attached.

End-user household financial contributions and labour are concerns because of the underlying project funding policies for drinking-water projects' maintenance in Malawi. The context in which hand-pumps operate is shaped by the fact they are governed by the policies (discussed in section 2. literature review) of project sponsors and funders. Project sponsors are NGOs, which install hand-pumps and then subsequently hand them over to end-users for maintenance. NGOs way of handing over pumps for maintenance is based on international water funders' policies among which include IMF (UNDP, 2008; UNICEF, 2007). IMF/World Bank donor aid policies advocate end-user contributions in monetary and non-monetary terms for rural infrastructure projects in Malawi. The aim of end-user contributions' policy is to encourage end-users to 'buy in' ownership of the hand-pump asset other than being passive recipients. Therefore, household financial contributions and labour are critical in catering for the hand-pump's running costs.

End-users household contributions are the main issue for pump- maintenance in both Nkhoma and Bvumbwe areas, but this has been a debatable issue. While some scholars argue against advocating end-user contributions, others champion it (section 1 introduction and section 2 literature review). Gutierrez (2007) and Harvey (2003) argue that requiring end-user contributions is wrong. Schouten & Moriarty, (2002) agrees that end-user contributions are a

hindrance as most cannot afford the contributions due to their low or poor economic status. Peet (2003) also argues that rural end-users cannot afford monetary contributions unless tariffs are correctly priced. Though Gutierrez (2007), Schouten & Moriarty, (2002) and Peet (2003) disagree with end-user contributions, their works, in particular, that of Schouten & Moriarty, (2002) and Peet (2003) is very much outdated. Though Gutierrez (2007), is recent, his work was founded upon results of nationwide surveys, which may not best represent the 'real' experiences of end-users as such data is rather quantitative than views of contributors. A case study approach for this study highlights up to date and actual experiences in terms of end-user willingness to contribute financially, and the positive effect the finances have on the maintenance of the seven hand pumps in Nkhoma and Bvumbwe areas of Malawi. These study findings, therefore, disagree with Schouten & Moriarty, (2003); Gutierrez, (2007), and Harvey, (2003), but these findings are also attributed to the way World Vision and Concern Universal's project management strategy for the drinking-water project, which were more inclined to demand other than supply driven.

#### **5.4 Analysis of Supply/Demand Driven Approach for Hand Pump- Maintenance**

In hand-pump projects, like other rural development projects, the maintenance phase depends upon the approach used to implement the project. The approach used to implement the project is governed by the project sponsors whom are often NGOs. The study findings show end-user involvement in maintenance activities as seen in table 17 and figure 11 and focus groups. This study correlates end-user involvement in pump- maintenance with the type or category of project management strategy NGOs used. For example, both Bvumbwe and Nkhoma project areas had some elements of a demand driven other than supply driven approach to project management, though not in full capacity. A demand driven and supply driven approach to PM is discussed in section 2 of the literature review. In a supply driven approach, the project identification phase does not include end-users hence end-users are



passive and unable to participate in the maintenance. End-users view the hand-pumps to be the property of the NGO other than their own (Woolcock & Narayan, 2000). The advantage over the approach is that the NGO does not indulge in complex procedures of end-user involvement. Moreover, NGOs are able to meet their objective though when pumps break down no one assumes responsibility. To assist end-users to take responsibility of the pump-maintenance, UNDP (2004) encourages NGOs to use a demand-driven approach as a project management strategy for the delivery of the hand-pumps' projects.

In a demand-driven approach, NGOs mobilise the end-users and facilitate them to participate in the project initiation phase, in preparation for their involvement in the maintenance phase. In this study, end-users described that the project sponsors set end-user involvement in the project initiation phase as a 'must' or condition for the sponsor to assist the end-users with capital costs of the hand-pumps projects (EU 13, 14, 15, 16, 26, 27, 28 & 29). The project sponsors, World Vision International and Concern Universal, adopted some aspects of a demand-driven approach to Project Management (PM) unlike the earlier NGOs as the case of Interaid in Nkhoma. The end-users representatives or local committees were facilitating the projects by contributing not just funds or labour but also basic maintenance technical knowledge and skills right from conception until the hand over phases of the hand-pumps. This is a proactive approach as it depends on the NGOs interaction with end-users before pumps are installed, but it is also dependent upon an end-users willingness to participate in hand-pump- maintenance. When projects arise as a result of the local stakeholder end-user initiative or when they realise the importance of the project, the end-users are involved in project identification, planning, execution and closing phases, which include maintenance of hand-pumps, which may not be so in a supply driven approach. Laverack (2001) argues that although the demand-driven approaches are advocated in the rural projects, it is complex and involves difficult training methodologies for rural people to appreciate the problems of unrepaired pump and buy in the project idea to solicit their support in pump- maintenance.

Demand driven approach of managing drinking-water projects promotes end-user participation in maintenance though other scholars view this as wrong. For example, Schouten & Moriarty (2003) argue that forcing local end-users to contribute free labour and funds is wrong and unethical because it is oppressive for rural poor people who have financial insecurity. Prokopy (2004) is of the opinion that forcing end-users to make monetary contributions is an undemocratic way of raising funds. This study opposes the notion that end-users are forced to make financial contributions. During the research, the majority of respondents stated that they contributed willingly as they linked non-operational pumps to a situation of disease and poverty.

Unrepaired pumps increase the magnitude of poverty as people resort to surface contaminated water. This study established that when hand-pumps break down then end-users resort to use open wells for drinking-water. For example, in Kamjeda and Kapsyepsye, the end-users used unclean water, and contaminated water, which resulted in the prevalence of water-borne diseases, eventually leaving the end-users with poor health. This then had a domino effect on the end users' participation in other economic activities such as farming. Furthermore, lack of end-user contribution would make the situation work as the district technical team would not manage to repair the hand-pumps. In Malawi the district water office is manned by one engineer or technician against a range of 200-300 hand-pumps scattered across the district some of which are hardly accessible (Malawi DHS Survey, 2000). In addition, the District Water Board office is coupled with huge transport and spare part constraints hence unable to manage pump-maintenance. In addition, funds from external aid are becoming more limited with an economic downfall, and donors are becoming tired a condition commonly called donor fatigue (discussed under the section 1.8, background). This study showed respondents linked their interest or motivation in pump activities or maintenance as governed by their village leaders.

Local village leaders may influence rural project operations in their villages. Lack of end users' participation is also linked to poor leadership skills as seen from Kapsyepsye where respondents (EU42,44,45) confirmed in focus groups by respondents (EU 60,63,64 67 & 69) that poor leadership failed to initiate end-users in maintenance issues. Prokopy (2007) relates local leaders imposing undemocratic procedures in local fund raising. However, Cleaver, (2005) describe local leaders dominance can be reduced if there is a system of good governance and transparency procedures. For example, Cleaver, (2005) describe that, in a well governed community, the household amounts that end-users engage in are discussed and agreed at a community meeting. Cleaver, (2005) observations align with these study findings as end-users had a community decision-making process mechanism in place to cater for those who cannot pay either because they are frail or chronically ill. For example, in Mavule hand-pumps respondents (stage 3: EU 48, 50, 55 &59) stated that they agreed that one old woman to be exempted from monthly payments instead she was assigned to clean the hand-pump premises. During the community gathering, the stakeholders decide the criteria of whom to exclude in payments. Therefore, this study's findings show that the end-user contributions for pump- maintenance can be conducted to gain support of all if conducted in a transparent manner.

End-users of Nkhoma and Bvumbwe are within regions of extreme poverty, yet they were motivated to make small contributions to help them sustain hand-pumps. This study has shown that though end-users are poor, they still engage in activities to help themselves by contributing cash or labour for the maintenance of their own hand-pumps. The findings, therefore, argue against the idea that poor people are incapacitated to do anything for themselves and end-user contributions also helps to clarify issues of who is poor (UNDP, 2000) as different villages may have different yardsticks to measure their level of poverty. For example; an individual with a goat or chicken is regarded as moderately rich in Malawi (Malawi DHS Survey, 2000) and such people would be able to pay a chicken instead of

money. Moreover, individuals who are healthy and do not have monetary contributions are involved in ganyu or casual labour in farms (Malawi DHS Survey, 2000) as a source of income for pump- maintenance. Therefore, even the poor can be employed for contributions for pump- maintenance as this is a step towards ownership.

Project's ownership is an important issue in maintenance of hand-pumps (discussed in section 2 literature review) and determines whether the hand-pump may be maintained or not. Ownership is about being self-reliant other than a donor dependent. Household contributions are therefore, an indicator that end-users are shifting on the continuum from a donor dependency towards self-reliance (Chambers, 1993). Empowerment is crucial in any rural projects, including hand-pump- maintenance because external aid that is provided by the NGOs or government is temporal. NGOs funded projects like any projects are short lived. End-users are required to assume the role of repairing the hand-pumps after NGOs phase off. Therefore, end-user contributions in maintenance are a sign of ownership and a benchmark towards the road to empowerment (discussed in section 2.5 of the literature review).

These study findings hence indicate that end-user household contributions are a factor to promote the maintenance of hand-pumps. The study concludes that for end-users to manage, minor as well as moderate maintenance, they need funds contributed locally to buy spare parts and pay for stipends for local mechanics. The advantage of this is that it is sustainable as end-users are directly in control over the provision of resources for small and medium maintenance as they assume the role of managing pump- maintenance, particularly water committees.

## **5.5 Water Committees' Leading Roles in Hand-pump Maintenance**

Drinking-water projects like any projects have phases, and each phase is led by an individual as a lead or manager (discussed during the literature review). In the context of water projects in Bvumbwe and Nkhoma, the 'lead' role is played by a team of end-users, namely, water committees. This is the cadre of the local people, the WVI and CU handed over the project during the maintenance phase.

Results of this research show that end-users associated water committees to take a leading role of the maintenance phase after the NGOs have exited the project scene. In other words, water committees as end-users assumed the role of managers for the maintenance phase. It was not easy to establish if water committees have the necessary skills required for effective, successful hand-pump- maintenance. During the interviews, one of the questions for members of the village water-committee was what they perceived their roles to be in the management of hand-pumps. Even though the question targeted hand-pumps, one of the aims of the question was to establish whether the respondents could provide a description of aspects of project management, and the duties required of leading a project phase. Different respondents provided answers that led to some understanding of the various aspects of drinking-water project management, especially in relation to their contributions to the budgeting for spare parts, maintenance scope and need to accomplish maintenance tasks within specified times (APM, 2006; PMI, 2008). The study findings show that the water committees assumed the role of project maintenance phase managers or leaders during the hand over phase (EU 3, EU4, EU 10, EU17, EU23, and EU43). The members of the water-committee interviewed did not explicitly include all the key elements of effective project phase management described in project management literature; therefore, they did not understand the complexities of project management. Most of the village committee members interviewed were very concerned with raising funds from stakeholder end-users. Respondents

did not show that they refer to set of policies, or hand over documents that clearly outlined their duties in the project maintenance phase management.

The primary task of the project manager or project management team is to manage trade-offs or competing interests. There are several skills that a project manager or project phase managers ought to possess. Pinto (2010), describe examples of PM skills to include: effective communication skills, eye for detail, leadership skills, ability to spearhead negotiations, professionalism, social skills (charisma) and the ability to manage expectations. PMI (2008) asserts that one of the key tasks of a Project phase manager is to integrate all aspects to the project and ensure that proper knowledge and resources are available for ensuring project sustenance. Perhaps the most significant outcome from the research is the fact that, during the handover phase of the projects; NGOs did not clearly stipulate, who the project managers would be and the need for segregation of duties. After the handover phase; the water-committees were now the project managers tasked with providing a comprehensive, consistent method of controlling the maintenance phase. Besides, ensuring its success; however, did not show a comprehensive understanding of the duties as much as they were trained in some pump- maintenance issues.

## **5.6 Training of Local Water Committees and Mechanics as a Factor for Hand-pump- Maintenance**

End-users consider contributions of trained water committees, pump technicians and local government committees as an important factor for pump- maintenance in both Nkhoma and Bvumbwe study areas. Study findings from CI categories (CI: EU 3,4,10,17,23,34,37,38,47 &48), confirmed in focus groups' discussions in Mavule hand-pump (EU 49,50, 53, 56& 58) show respondents linked maintained pumps to performance of trained local committees. This study shows that hand-pumps that were operational and maintained had local mechanics, water committees and development committees trained in different roles. Trained local committees in this context refer to local institutions that manage hand-pumps maintenance at

village and area levels. Examples of trained local committees include: water committees and development committees (VDC/ADC/DA). As discussed (section 2.) these are local committees are at various levels namely: village level, (Village Water Committees-WCs); at area or ward level, (Area Development Committee-ADC), and at councillor level, ( District Development Committee-DDC); and at a district level, (District Assembly/ District Water Board and District Executive Committee-DEC- ) and have varied functions of which the overall umbrella is rural development. Trained mechanics that are part of the VDC/ADC repaired almost all faulty pumps in Nkhoma and Bvumbwe, which presented with small and medium faults (see ref. 4.4 findings). In addition, trained water-committees acted as community organisations, fund raised, met regularly, were a core group of decision making, communicated with general end-users and had an idea of their roles. Different levels of training are critical to repairing of the pumps as they improve performance of local capacity.

Training local capacity was among the core objectives for both Nkhoma and Bvumbwe by World Vision international and Concern Universal respectively. Training in this context is defined as an increase in local committee's knowledge and skills to define, assess, analyse and act on hand-pump- maintenance problems. Training's content involved: accounting and bookkeeping, procuring, labour and materials, ensuring transparency and instilling accountability of their roles. NGOs conducted training in many areas that relate to end-user participation such as development of local leadership, and empowering the local committees. These NGOs provided more training in improving resource (labour & monetary) mobilisation; strengthening the link with other stakeholders; increasing end-user control over maintenance of hand-pumps, and creating equitable relationship with outside agencies (Gibbon, Labonte &Laverack, 2002). Local capacity was also part of the trainers of trainers. NGOs drew up the training curriculum. Water-committees are also trained in minor maintenance while pump mechanics are trained to do the complicated faults; Training duration varied; the pump technicians had the longest training which was for ten days in

Nkhoma and fourteen in Bvumbwe. The outcome of the trainings was that most pumps were repaired, and local governance improved.

End-users consider trained local committees to promote good governance for hand-pump-maintenance. Good governance is about a local committee's ability in involving end-users in the decision-making process and the transparency about local contributions. Results of the research (CI: EU 3,4,10,17,23,34,37,38,47 &48), confirmed in ICIs (EU 1,5,7,9 13 & 19) show that end-users were satisfied with local committees' governance in hand-pump-maintenance. Good governance concept has emerged since the 1990s with the work of Woolcock & Narayan, (2000) and is described as social capital-meaning end-users acting collectively to achieve one goal. Trained local committees have practiced the concept of good governance in Mali (Jones, 2011), Kenya (Crow, Shallow & Asamba, 2011) and Bangladesh (Hague, 2004). This study unlike Jones (2011), Crow, Shallow & Asamba, (2011) and Hague (2004) had some trained local capacity involved in: end-user participation in needs' assessment, local leadership, resource mobilization, linkages and end-user control in management and equitable relationship with outside agents.

Information relating to relevance of training of local committees at a village level for rural water project management, match with Jones (2012) in Mali; Crow, Shallow & Asamba (2011) in Kenya; Hague (2004) in Bangladesh, in South Africa (Mogale, 2005); Bangladesh (Haque, 2004); Indonesia, (Dasgupta & Beard, 2007); India (Prokopy, 2009; 2005); Tanzania (Gine & Perez-Foguet, 2008); Benin, Mali & Senegal (Jaglin, Repussard et al, 2011) and in Malawi, Uganda & Zambia, (ODI,2004). Training are conducted in maintenance issues of how to deal with group dynamics. Gibbon, Labonte & Laverack (2002) further argue that relevance of developing ability to initiate end-users to 'ask why' to critically assess their social, political and economic environment and determine causes of maintenance problems, is still a challenge.



End-users consider trained local committees to contribute to hand-pump maintenance. This study findings show hand pumps, which were maintained were done so by trained water committees and technicians (EU 10,11,27,31 & 36). However, Gutierrez, (2007) argue that some trainings are complex for illiterate stakeholders' end-users. At the same time, Prokopy (2007) argues that unintended outcomes may occur if a trainee were not involved in identification of training needs and also if trainers follow training methodologies, which are non-participatory. Participatory training methods have been effective in bringing change among illiterate committee members in Kenya and India (section 2.6 of literature review). The differences in outcome of this study's findings (positive) and Sonuga & Aliboh et al., (2004) (negative) is that there are complex issues, which affect local committees' trainings; among which are motivation and influence.

## **5.7 Motivation and Training of Local Committees**

This study has shown that training local committees (CI: EU 3,4,10,17,23,34,37,38,47 &48), that are also motivated, confirmed in ICIs (EU 1,5,7,9 13 & 19) contribute to pump-maintenance while unmotivated individuals retard maintenance. Study findings show that end-users related trained and motivated individuals to carry out pump fund-raising and maintenance in Mavule, Chaza, Kachepe, Mphenzu, Gute and Bulaki hand-pumps. However, some few individuals were also trained in Kapsyepsye hand-pump, which was non-functional, but another reason respondents gave was because leaders were weak in Kapsyepsye to influence trained water committees to be active. Respondents, therefore, linked water committees and local leadership motivation with pump- maintenance. There are different committees in the pump- maintenance with some being 'active' contrast to 'weak'. The challenge is to identify the committee and members who are motivated and would be active and bring positive change in pump- maintenance. To assist in identifying motivated

individuals, this study hence recommends using stakeholder analysis or mapping local committees (Freeman, 1984) as part of the training needs assessment to determine who has more influence/motivation so can be particularly targeted during trainings (section 2. in the literature review). The study recommends a motivation or interest /influence grid which groups local committees according to their level of motivation and their active involvement (influence) in the water project (Achterkamp & Vos, 2007). An example of how we can situate committees with influence or motivation for pump- maintenance is given in Figure 19 below.

**Influence high**

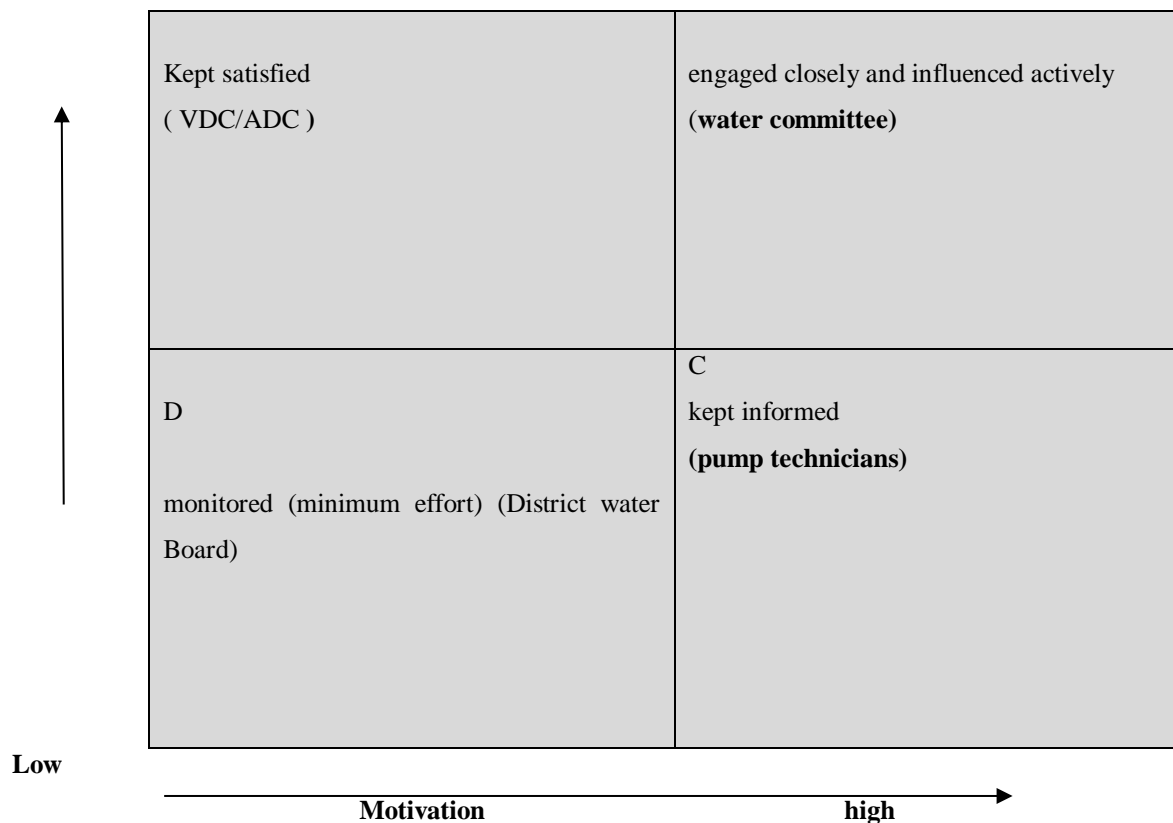


Figure 19 Local Committee Influence/Motivation Grid (Source, Freeman, 1984)

The above figure can explain the extent to which some stakeholders may need more attention than the others, using Freeman’s model dimensions. The dimension of Freeman’s model

above highlight areas that could be of priority in identifying local committees with high influence and motivation and align them with hand-pump- maintenance trainings. In the above figure, one could situate water committees and target them as the main audience for maintenance hence are most targeted for different trainings to influence their motivation and influence (Freeman, 1984; OECD, 2007:130). Water committees are situated as high influence/interest because they are decision-makers and their opinion matters. In this context village headman as part of VDC has high influence with low motivation should be kept informed as a secondary audience. In addition, pump technicians have low power but high motivation hence should be kept informed (Freeman, 1984). However, the limitation of the above model is that it does not show demarcations as the roles of water committees and VDC/ADC/DA may overlap and may change overtime (OECD, 2007). Moreover, stakeholders may not need to be tied to one role, for example; pump technician is part of the water committee as well as VDC. Some stakeholders may also be underrepresented like vendors who sell spare parts. Though stakeholder analysis may help to give information as a tool, it may not help in decision making like how we can manage conflict, or interests of local committees and how we may give priority. Conversely, the strengths outweigh the weaknesses hence the exercise is highly recommended. Though trained committees had positive roles, challenges were still encountered one of which is a lack of sponsor supports.

## **5.8 Lack of Sponsor Support as a Challenge for Major Hand-pump Maintenance**

NGO project sponsors, like Interaid, OXFAM, and Concern Universal are the main investors for capital equipment of the hand-pumps in Nkhoma and Bvumbwe, but serious maintenance flaws occurred when these NGOs phased out. These study findings show that the end-user failed to replace or rehabilitate pumps that had major faults as seen from study findings in Khuwi (EU 7,8,9,12) which was non-operational for three years and Kachepe for one year (EU 18,19,20& 21) as both pumps required rehabilitation. End-users also linked non-

functional hand-pump in Kamjeda pump (EU 22, 24, 25 & 26) because water did not come out despite a village based repairing. These observations show that end-users are unable to do heavy maintenance, which requires rehabilitation; lack of sponsor supports in the maintenance phase is, therefore, a critical issue. The context in which pump- maintenance occurred is that simple and medium faults are managed by water committees and local technicians. However, there are some few occasions when local capacity fails to maintain the pump because it requires major rehabilitation or replacement; when NGOs phase out and hand-pumps are handed over to end-users for further maintenance. Theoretically, the district water board, which is the government section, assumes the responsibility to replace or rehabilitate major faults. Due to overwhelming problems and lack of resources at the district level, the office is not able to have machinery in pump replacement in Malawi (Malawi DHS Survey, 2000). This implies that once external aid phase out, pump rehabilitation or replacement - beyond local capacity has no chance.

### **5.9 Role of the (NGO) External Aid in Hand-pump Rehabilitation**

External aid, usually funded by NGOs is needed if hand-pumps projects are to be economically viable beyond local capacity. This is supported with study findings as respondents in Khuwi (EU 8,9,12) was un operational for three years until rehabilitated in 2011 when WVI, another NGO, came on board. In the same way, and Kachepa (EU 18, 19, 20& 21) was also initially constructed by Interaid was un operational for one year until rehabilitated in 2012 by WVI as local capacity was unable to rehabilitate. This observation is also seen in Kamjeda where a pump is un operational after local capacity failed. These findings relate to literature where NGOs external aid support was seen under the form of: meeting needs of end-users (Brass, 2012); assisting in self-help infrastructure, (Njoh, 2011) promoting governance (Brown, et al.2012), and fund raising (Herzer & Nunnenkamp, 2013), besides, micro-financing (Kabeer, 2012); advocacy and human rights (Kindornay, et al,

2012). Though external aid (through mainly NGOs) is an answer to many rural problems in Malawi but this study also shows that NGOs interventions are not sustainable (Scherrer, 2009). Inadequacy of external aid by NGOs is also reported throughout the literature on the form of: causing fragmented rural health system (Pfeiffer, 2003) in Mozambique and Bolivia (Galway, Corbett & Zeng, 2012); NGOs operating without coordination in Tanzania (Levine, 2002) or misused of donor funds in Nigeria (Smith, 2012). Operations of NGOs are also seen as unethical aspects of NGO actions (Fassin, 2009) and NGO project outcomes having no intended results (Stiles, 2002). The study also confirms the research done by Harvey, Skinner & Reed (2002) in Zambia and Ghana and Ashbolt & Barnes, (2010) showing that end-users' can maintain hand-pumps, but are inadequate to meet rehabilitation and replacement costs once NGO external aid withdraws. Unavailability of external aid arises due to the way project sponsors aligns their project management structure to administer drinking-water projects.

The organisational structure NGOs adopt affect, whether activities will prevail after they phase out or not. Organisational structure can be either projectized or matrix (PMI, 2008). In both Nkhoma and Bvumbwe areas, Interaid, OXFAM, World Vision International and Concern Universal respectively used the projectized structure (PMI, 2008) to execute their drinking-water projects, contrary to a matrix structure. A projects' structure of executing projects is whereby the project has its own resources. In this structure, the project manager has high authority; the project team is in the same office, and most resources are entirely used for the project, and all departments report to the project manager. The advantage of this structure is that there is a high focus for the project. However, the disadvantage is that the project team is attached to other roles after the project phases out. Therefore, there is no follow-up of activities in the project maintenance phase. The implication for this is that though the end-user managed some maintenance at their level, operation and maintenance for asset replacement was not achieved. Therefore, rehabilitation and capital costs of the hand-pumps, is likely to continue to depend on donor funding (Lane 2004). If pumps are not

replaced the consequence is that end-users resort to use of contaminated water leading to diarrhoeal diseases and deaths of children, scaling up poverty in the long run. To promote follow-up of interventions in the post-intervention phase, this study recommends NGOs to use a matrix approach to managing the hand-pumps projects.

The matrix approach, as a way to manage hand-pumps projects, could improve sponsor support for major rehabilitation and pumps' replacement. In a matrix structure, project teams operate within the functional teams. For example, NGO project work could integrate with local-area health centre functional teams. Hence the project team would report to both the health centre functional manager as well as the NGO drinking-water project manager. The advantage of this structure is that activities can continue to operate within the functional teams after the NGO project phases out. Apart from challenges of lack of sponsor supports, end-users were also encountered with spare part challenges.

### **5.10 Unaffordable Spare Parts as a Challenge of Maintenance**

Spare parts challenges in the form of unaffordability or unavailability of stock are among the core challenges for maintenance of hand-pumps. A finding from this study shows that spare parts cost more than the end-users wanted to pay (EU, 17, 23, 34,37,38,47 &48). Another finding was that stock availability was poor (EU26, 40, 31, 15, 27, 42, 20, 32, 47, & 48) and that spare parts prices varied. Local pump mechanics stated that common faults which called for spare parts to purchase included: pump rods, pump heads and pins which often caused delayed, weak or no water flow. Spare parts to correct these faults have associated supply chain challenges.

The supply-chain problem is further linked to complex bottlenecks, longer lead times, transport problems, poor sale forecasting and hand-pump policy or technical issues. This was

shown as in Mavule village hand-pump, a spare part for the Afridev pump was not accessed (EU 13, 14, 15 & 16). The context in which the spare parts supply chain operates is that hand-pumps, particularly Afridev is manufactured outside the country, there is a horrendous supply chain for spares because Malawi is a landlocked country. The problems of parts supply chain affect the high prices end-users have to cope with which in some cases lead to hand-pump abandonment as the prices become unaffordable. The underlying reason is also that Malawi's geographical position affects the local economy.

Malawi's geographical position, policies and economy determine availability of spare parts. Supply chain problem within this context is about disruption in repairing hand-pumps either because end-users are unable to buy spare parts or spare parts are too expensive as discussed in the study background. This explanation, therefore, encompasses financial capability as an issue in a hand-pump supply chain. Finances are an issue because there are deep linkages between supply chain and overall political economy of Malawi. Furthermore, as a landlocked African country, Malawi has enormous vulnerability of the supply chain for goods, including spare parts. The findings are also similar to findings in other parts of Africa (Harvey & Reed, 2003); Tanzania (Gine & Perez-Foguet, 2008); in Zambia and Malawi Gutierrez (2007). Unlike in other parts of Africa, in Malawi procurement of hand-pump spare parts is further unaffordable and a challenge because of unstable local currency as seen from Mphenzu village of the study area hand-pump. These findings also support the argument that they are chronic logistics problems in developing countries in comparison with developed countries; moreover, that developed countries have shifted their GDP from 20% top 10% due to better supply chain and reduction in inventory holding; however, developing countries still remain at 30% due to supply chain problems. Based on the findings, hand-pump spare parts are encountered with unaffordable costs due to disruption and vulnerability of the supply chain. The implication of this is that end-users are unable to afford leading to unrepaired hand-pumps. The situation is further aggravated as end-users resort to use open wells, predisposing

to water borne disease and deaths as hand-pumps cannot be maintained because of unavailable or unaffordable spare parts. The next section proposes recommendations to improve drinking-water projects maintenance

### **5.11 Recommendations for Hand-pump Maintenance: Minimum Standards for the Demand and Supply Sides**

These study findings focussed on examining enabling and inhibiting factors for hand-pump-maintenance. Study findings show that enabling factors focussed on training and end-user contributions in a form of finances and labour. Factors that hinder maintenance are identified as lack of external aid to cater for major refurbishment and inaccessible or expensive parts for rehabilitation. Recommendations for minimum standards are hence drawn based on these factors. To overcome diverse maintenance challenges this study develops recommendations for the demand side as well as the supply side. Demand side involve scaling up roles of end-users in maintenance whilst supply sides are those which relate to the roles of the project sponsors, government, including policy issues affecting hand-pump- maintenance. The demand side include strengthening issues about the end-user level which include: labour and household contribution, formation of drinking- water associations and water committees exchange visits. The supply-side recommendations include strengthening issues related to NGO project sponsors and the government roles. Specifically, such recommendations to address issues related to: hand-pump manufacturers', drillers', policy makers, scaling up training of HSAs to encompass hand-pump rehabilitation, credit provision or donor subsidies and/or contracting out hand-pump rehabilitation all together, stimulating supply chain for parts and forming drinking water steering committee at national level. The last section highlights planning maintenance process by assessing the hand-pump maintenance status on a continuum of non-maintenance to excellent maintenance and identifying maintenance risks and responses.



## **5.11.1 Recommendation 1: Strengthen the demand side of maintenance**

### **5.11.1.1 Recommendation: End-users Labour and Household Financial Contributions**

End-users linked effective hand-pump- maintenance with their contributions of labour and finances in Khuwi ( EU 3,17,7.8.9); Mavule (EU 13,14,15,16); Chaza (EU 2,5,6); Kachepa (EU 19,20,21);Mphenzu (EU 27,29,30); Gute (EU 32,33,35) and Bulaki (36,40,41). This study hence recommends that end-users further scale up contributions in a form of cash and/or labour for every pump installed. The study also recommends that project sponsor, not to install hand-pumps unless committed to advocating end-users to make their own contributions as well as this is a sign for end-users commitment to own the asset. A few proportions of individuals were not involved in contributions because they perceived with mistrust of local money accountability (EU 48,44). Based on this the study recommends that end-users are made aware of pump technology benefits and how it works so they can engage with fund-raising activities. Another way to strengthen their power could be through formation of end-user association.

### **5.11.1.2 Recommendation: Formation of Drinking-Water-End-user Associations**

Despite local maintenance attempts, poor drilling led to silt water in Mavule (EU 49,50,51) and dry pump in Kamjeda (EU24,25,26) and there was no link known between the drillers and hand-pump users/mechanics. This study hence recommends water committees and pump providers, to form an association. Through the association, local committees are to make claims, and also deliberate about affordable and reliable hand-pumps to be installed in their villages. The association would work together with hand- pump asset providers so that there is a link to the type of technology and availability of spare parts. The study further recommends linkage between hand –pump providers or manufacturers with end-user associations. For example, the local water committee to have a cellular phone to encourage

commercial relationship between the contractors pump technicians and providers or vendors. The association could give powers to water committees to make claims, supported by, the national-level drinking water authority. Auditing of internal quality control should include end-user satisfaction as part of activity to be incorporated. This study also recommends the drinking water associations which could be at ward level to encourage exchange visits to learn from each other.

#### **5.11.1.3 Recommendation: Local Water Committees Exchange Visits as a Learning Point**

This study also recommends exchange visits of water committees and pump technicians to learn from best practices for small and moderate maintenance in areas where maintenance has worked (Campbell & Reyes-Picknell, 2006). The aim is that water committees can see and document how the others got best maintenance practices for small, medium and complex pump problems. In this approach water, committees would tap into the deep experiences of others who have done the foundation work. The study also recommends the villages or water committees whose hand-pumps were not maintained, to understand their own strengths and weaknesses before studying how others managed their maintenance. However, being specifics in terms of measures would be encouraged to learn well how others who were successful were doing and how they got their outcome. There is also needed to strengthen the supply side of maintenance.

#### **5.11.2 Recommendation 2: Strengthening the Supply Side of Maintenance**

The supply side include developing maintenance programme, restructuring and supportive policies, regulations and commitment by the government drinking-water sector and the project sponsors. The aim is to help the end-users to become more independent, and to reach

full maturity through the provision of credit facility; internal quality control and NGO follow-up visits. Recommended roles of the project sponsor and government are as delineated below.

#### **5.11.2.1 Recommendation: Hand-pump Manufacturer (Provider)**

The study recommends that the hand-pump providers deliver hand-pumps with parts in sufficient quantities through viable vendors and drilling contractors. Producers also to design pumps, which can resist vandalism as end-users reported vandalism as the main cause of an unrepaired pump in Kapsyepsye (EU 42,44,46,48, 60.65, 69).

#### **5.11.2.2 Recommendation: Introduction of Quality Control in Hand-pump Maintenance**

In Kamjeda hand-pump, end-users (EU 22, 24, 25,) reported that the maintenance problems were linked to poor drilling of the Afridev pump. This study recommends a consolidation of an effective quality assurance and customer protection system. Due to low literacy, pump producers may be defenceless against malpractice, hence the system to introduce a penalty system for technical non-compliance. For example, a list could be made and announced of certified and non- certified pump drilling contractors at a district level. In addition, the study suggests a system of quality inspection to be in place at regular intervals and outcome disseminated to end-user representatives. The study also recommends that pump drillers to benefit from refresher courses and proper remuneration in order to produce quality work. A list of quality control procedures to be formulated, and made available to: all drillers, pump technicians, and water committees.

#### **5.11.2.3 Recommendation: Policy and Regulatory Levels Support for Hand-pumps**

Local government workers in Nkhoma (EU 3, 17,) and those in Bvumbwe (EU 1, 2) reported of variable levels of trainings/activities conducted by different project sponsors. This study hence recommends creating supportive institutional environment for the pump- maintenance in the form of policies, regulations and commitment with a drinking-water sector. Government water policy should include maintenance promotion strategies besides, hand-pump installation. It is advisable that government water policy should be to make pump rehabilitation affordable for end-users. Furthermore, the government should take its role and stand in drinking-water regulatory issues such as subsidy at the Malawi Revenue Authority, for all hand-pump parts produced outside the country.

**5.11.2.4 Recommendation: Standardising Hand-pump Trainings and Scaling up the for Health Surveillance Assistants (HSA) and Health Assistants (HA) vocational training to Include water Hand-pump Rehabilitation**

Water committees and pump technicians linked their performance in pump- maintenance with trainings they had received (EU 4,10,11,21,35,8,18,19,32,36).This study hence recommends project sponsors to scale up training for small/medium pump- maintenance. This study recommends that hand-pumps be not constructed unless NGOs have put in place mechanisms of training so local capacity can manage small and medium repairs that ultimately prevent major faults. Analysis of project documents also shows intensity; length and topics covered during training in Nkhoma and Bvumbwe varied for different cadres ( see table 5 page 38). The problem is that a different scope of work varies with different sponsors. This study recommends that training be standardised at a national level. There should be standardised training and reference manuals which individuals can refer to. This study, in short, recommends that NGOs installation of pumps be accompanied by trainings at different levels: water committees, development committees and pump technicians. The study further recommends improving pump rehabilitation by introducing pump rehabilitation training as part of vocational training for Health Surveillance Assistants and Health Assistants by the Ministry of Health as this is part of the local health authority responsible for hand-pumps.

### **5.11.2.5 Recommendation: Management of Hand-pump Rehabilitation by Donor Subsidy**

In the current situation, pumps are installed, some breakdown and are never repaired as the case of Kamjeda and Kapsyepsye pumps (EU 22, 24, 25, 42, 44, 45). This implies that NGOs or project sponsors spend more capital costs to install the pumps than the return on investment (discussed in literature review section 2.4.8). Value for money is reduced because hand-pumps do not last long and lacks a system to sustain them when they require refurbishment. The idea of ‘doing less for the better’ arises in this study because almost every pump broke down at one point or another in both Nkhoma and Bvumbwe. In addition though end-users conduct small and medium maintenance, it is beyond their scope to manage complicated faults -which call for rehabilitation or pump replacement all together. The facts that end-users make little contributions and have bank accounts show that they are resourceful. Project sponsors can, therefore, help them by building fewer pumps and keep aside some money for each pump for rehabilitation. For example, instead of constructing 100 pumps, the NGO would fully fund for 60 and assign extra money to each pump in response for rehabilitation. This could increase the number of pumps working by 10-20% in Malawi. This recommendation is about small changes that could end up with lasting impact thus improving a failure rate from the current 30% to about 15% at no extra cost.

The study respondents linked maintenance problems because NGOs are short lived once pumps are installed with no mechanism to rehabilitate the pumps (EU3, 1, 7 29, 45). Hence this study recommends that the project sponsors take roles of follow up at least 15 years that are about the total life span of a hand-pump. The aim of follow up would be to check on maintenance, providing in-service training for committees and supporting for pump replacement as necessary. This study also proposes budget allocated for follow up whether by Water Board or local health authority, which could be done bi- annually after NGOs have

phased out. Apart from follow-up visits by District Health Office/ Local health Authority, NGOs are recommended to wean off slowly whilst DHO/ local health authorities are taking over the supervisory roles. For example; the first five years, funds could be released based on meetings conducted. The second five years release of funds could be based on motivation, activities done and scope of maintenance work done.

#### **5.11.2.6 Recommendation: Management of Hand pump Rehabilitation by Credit Provision and/or Contracting Out the Service**

This study recommends NGO or project sponsors to provide money for a credit provision to cater for maintenance activities. Donor's subsidy is required because NGOs phase out hence not considered a viable financial strategy. So a new financing strategy would be required in the form of credit provision to improve affordability of expensive parts. This approach shifts from relying upon the presence of NGOs for maintenance to credit provision. So the study recommends financial support from the project sponsor in the form of a revolving fund through the local banks, which are savings and credit cooperation. Therefore, this study recommends that the project sponsors do not construct hand-pumps unless each pump has been assigned money for major maintenance subsidy in advance or plans for contracting out in place.

##### **5.11.2.6.1 Contracting Out Hand-pump Rehabilitation**

This study established that the local pump technicians are unable to do heavy maintenance or rehabilitation because it requires mechanical knowledge and specialised spare parts, which may not be accessed locally. This study recommends contracting out complex maintenance; requiring specialised technical maintenance, beyond the local-level capacity, by water committees and pump technicians, which this study categorise as complicated or heavy maintenance. Complicated maintenance includes refurbishment or replacement of the assets.

It also transfers the risk of pump abandonment from end-users to contracting the party as the contracting party hence substantially reducing the element of risk and potential liability from end-users (Bhattamishra & Barrett, 2010).

#### **5.1.2.6.2 Suggested Procedure for Contracting Out Heavy Maintenance**

The study suggests that end-users take an active role in contracting out maintenance beyond their scope, with the support of project sponsors. The first step proposed is end-users involvement in developing a contract. Once the plan to contract heavy maintenance requirements is made, the next issue or concern is how the contractor productivity and performance would be known. It is necessary to conduct a thorough review of the contractor in order to certain that they have fully trained mechanics for heavy maintenance and replacement, and responsibilities that ensure performance standards are set and closely monitored. There could be 'service level agreements,' between end-users and contractors with the support from NGOs, based on minimum acceptable standards of performance results. For contracting out aspect of work, the study further recommends that each pump installed by the NGO be allocated funds for contracting out for heavy maintenance. Such funds would be kept in the water account and be used when required. The study also recommends that at national level, water policies to advocate NGO bodies or community-based organisations whose role should be to contract out services over at least a minimum of 15-20 years, and these should be well known to end-users. The local health authority could be given the mandate to check and support follow-up of contracts between end-users and hand-pump drillers; end-users and rehabilitation bodies.

#### **5.11.2.7 Recommendation: Stimulate a Market-Driven Supply Chain for the Hand-pump Parts**

The study recommends the above to shift the continuum from donor to market driven for heavy spare parts, which are beyond local capacity. This study recommends a business approach to parts supply chain so as promote availability of complicated pump parts. This would help supply chain for complicated parts to be closer to end-users. The study hence recommends involving pump mechanics in the business of spare parts at the lowest level in the form of a value chain. The advantage over the value chain is that, as a business approach, there would be small profit margins, which would propel the system to work.

#### **5.11.2.8 Recommendation: Drinking-water Programme Structure at Policy Level: Steering Committees**

The findings showed some variation in terms of intensity, level and scope of trainings. This denotes lack of standardisation. Hence this study makes recommendations at national and regulatory levels. The study recommends that at a national level, drinking-water to have a forum or a steering committee. It is advisable that stakeholders should be from diverse backgrounds. The aim of the national steering committee is to plan drinking-water, including maintenance. At a lower level, for example, at the counsellor level the study recommends a regulatory committee which could be spearheaded by the local health authority. At the regulatory level, roles to include: end-user roles, contracts with drillers, links with pump producers, capability of repairers, monitor and guide NGOs in the local area, monitor development of training and reference manuals, checking accountability and supply chain for the local area. The next sets of recommendations include broad recommendations to be included within the process of planning for maintenance and these are: assessing the status of maintenance using a grid and risk management plan.



### **5.11.3 Recommendation 3: Planning Hand-pump Maintenance by Assessing the Status of Hand-pumps and Risk**

This section highlights recommendations regarding planning for maintenance, whether by end-users or national steering, regulatory committee or NGOs. The study respondents (CI: EU 3,4,10,23,37,43,47) confirmed in ICI (EU 1,2,14,26,40,48) and focus groups (EU 42,44,46) linked threats for pump- maintenance from human, technical and financial angles. The study, therefore, recommends an improvement plan to overcome the threats, by developing maintenance plans, after assessing the current status using a maintenance grid and determining risks.

#### **5.11.3.1 Recommendation: Assessing Hand-pump Maintenance on a Continuum of Non-maintenance to Excellent Maintenance**

This study suggests innovative planning recommendations for drinking-water maintenance approaches in rural areas of Malawi. The proposed strategy emerges based on elements of maintenance practices that have proven to be effective for the maintenance of small /moderate pump faults in the villages of Kachepa, Bulaki, Mavule, Chaza, Khuwi, but have not yet been effective in hand-pump- maintenance in Kapsyepsye and Kamjeda as they required pump rehabilitation. The pump- maintenance grid or continuum, therefore, encompasses issues of pump rehabilitation. Development of the maintenance grid is done by outlining the benchmarks, stages or levels of excellence that could ultimately lead to successful maintenance and contribute to the reducing the number of non-operational pumps.

The research established that the majority of the end-users do not fully appreciate the complex nature of managing water projects; even though they contribute funds and expect to be provided with clean water. Picknell (2006) asserts that the lack of technical knowledge is a major issue that contributes to failures in hand-pump- maintenance. For example, this study established that some end-users in Kapsyepsye village still contributed money for

maintenance and expected hand-pumps to function every day throughout the year for possibly 20 years, which is often a life span of an average hand-pump. However, it is imperative that the Water Committees that spearhead maintenance carry out systematic maintenance tasks, for the end-user expectations to be met in Kapsyepsye hand-pump.

Therefore, the study recommends improvements of drinking-water projects by embarking upon a maintenance improvement plan. The first step is to assess the strengths and weaknesses of the current pump- maintenance systems because it would highlight the shortfalls. Identification of shortfalls is the first step to successful practices that can help end-users see the necessary next steps to achieve successful pump- maintenance. One of the main issues in maintenance audits is to determine the status of maintenance by using a maintenance grid or continuum. Campbell & Reyes-Picknell, (2006) suggests the use of a scale with a grid to get value for comparisons of similar factors of maintenance, comparable across different hand-pumps and end-user stakeholders. A simple grid would be used to determine levels of maintenance against the current status giving a qualitative score from non- maintenance to excellent maintenance as seen in Table 37 on the following page.

Table 37: Hand-pump Maintainance Continuum: Non-maintenace to Excellent Maintenance

	NGO/Project sponsor	Maintenance plans	Stakeholder Roles	Local communities	Policy level local government
<b>Excellent hand-pump maintenance</b>	NGO involvement of end-users at all phases Training different cadres Each pump has a maintenance budget	Complete strategy, including fundraising for refurbishment Long-term plan 15-20yrs of maintenance Funds for spare parts available	Active trained water committees Trained mechanics Bank account for maintenance available End-user labour & financial contribution	full of support of D.A, District Development fund, VDC/ADC, and District Water Board Active committees in hand-pump advocacy	System to subsidise spare parts at policy level. Government commitment
<b>Moderate hand-pump maintenance</b>	NGO involvement with end-users Training of different Cadres Pumps have no refurbishment budget.	Pumps installed No sponsor support for refurbishment End-user plans to maintain in place.	Trained water committees active & inactive Bank account available End-user labour & financial contributions	Some active and inactive advocacy committees support of VDC/ADC	Some Support From DDF Fund And District Water board System to subsidise parts in place
<b>Minimal Hand-pump maintenance</b>	NGO involved end-users No training Pumps have no refurbishment budget	No long term sponsor support End-user plans to maintain pumps	Water committees trained but not active No bank account End user contribution of labour	Trained but not active	System in place but not in effect Parts unaffordable Parts are not accessible
<b>No hand-pump maintenance</b>		No sponsor support No end-user plans for maintenance	No committee selected No bank accounts No labour contribution	No trained committees	No system in place at policy level for drinking water

(Source: Developed for this thesis)

The importance of the continuum in Table 37 is that it would act as a baseline to be used to subsequently evaluate end-user maintenance initiatives at various intervals.

### **5.11.3.2 Recommendation: Identify Risks in Drinking-Water Projects**

Hand-pump maintenance has an element of risk of failure, hence this study proposes risk management of which involve identification and then developing responses for the risks. This study proposes hand-pump maintenance by identifying risk, which is about gathering information relating to risk identification, definition and categorisation (PMI, 2008). Risk identification is the first step and involves different ways of collecting information from people who are familiar with pump- maintenance. Examples of methods of collecting information include brainstorming, face-to-face interview and Delphi techniques (Kezner, 2006). The study suggests risk identification by brainstorming with end-users themselves and their water committees to distinguish the causes, descriptions and impacts of risks for pump-maintenance. Brainstorming is defined as a process where information is collected from a group of people with the aim of finding solutions to the problem. Ideas can be stuck to the board. The process may need an ice break to allow everyone to be in the right mind to make contributions during a brainstorming session. Brain storming is ideal as it is inexpensive and directly involves internal stakeholder end-users that are end use in this context. The disadvantage is that the village elites may dominate.

An alternative to brainstorming is organising face to face interview in which an NGO official could conduct one to one a discussion with water committees. The aim of face to face interview is that water committees narrate experiences of pump maintenance. The advantage of the interview is that everyone would have a say. However, the disadvantage is that it can be a tedious process. An alternative to brainstorming and interviews is Delphi technique. In a Delphi technique, questionnaires would be distributed; data analysed until consensus emerges

about how to maintain the pumps. The advantage of Delphi is that it reduces bias, but the disadvantage in a rural setting not all people may be familiar with writing.

The other way to identify and or analyse risks involve the use of SWOT analysis. SWOT stands for strengths, weaknesses, opportunities and threats (APM, 2006). SWOT analysis can help identify uncertainties that can impinge on a pump maintenance. Once the risks are identified, they are classified according to whether they are: 1) technological (quality of pump); 2) external (spare part vendors/suppliers, water policy, weather); 3) organisational (funding, resources); and 4) pump maintenance phase/ PM (planning, estimating, controlling, commissioning). The advantage of SWOT analysis is that strong end-user areas or opportunities, which they can offer to the pump- maintenance, are identified. Moreover, it helps them identify the weaknesses that they can improve on. Besides, end-users identify opportunities; those are positive factors – external factors that are of benefit for them to maintain pumps. An example of opportunities is pumps with modern technology or new water policies, which encourage good governance for maintenance. Threats, are external factors, which disrupt, hinder or damage the pump maintenance process. An example of an SWOT analysis is presented in Table 38 below.

Table 38: SWOT Analysis to Identify Maintenance Risks

<b>Strength</b> : The hand-pump is in a good location, there is an active water committee, monetary household contributions are in place	<b>Weakness:</b> poverty, weak leaders, weak water committees, vandalised hand-pump, poor motivation of the end-users
<b>Opportunity:</b> Afridev new pump technology is installed, access to clean water	<b>Threat:</b> price hikes for spare parts, no sponsor support, poor spare part track delivery record.

Once end-users undertake a brain storming and a SWOT analysis is done, the next step is to use the **USED** strategy to further identify the threats as indicated below:

- How can we Use each strengths

- How can we **Stop** each weakness
- How can we **Exploit** each opportunity
- How can we **Defend** against each threat

To establish a detailed causation of risks, the study further recommends breaking down threats and weaknesses in a root cause analysis.

### **5.11.3.3 Recommendation: Root Cause Analysis to Identify Underlying Causes of Non-operational Hand-pumps**

Non-operational hand-pumps have underlying root causes which could be identified using a root cause analysis. There are three types of causes in Root Cause Analysis and these are grouped under 1) physical, 2) organisational and 3) human causes (PMI, 2008). Physical causes involve tangible factors an example of which are faulty pumps, parts or faulty raw materials, which are used to produce faults in tools or machinery. Human causes or factors are about human error in doing desirable action that can lead to physical causes. An example of human error factors is a failure to calibrate the depths for Afridev pumps that could lead to defects causing dry hand-pumps. However, human error factors would be due to other underlying factors like incompetence. Organisational factors relate to systems, processes or policies that impact the project. Organisational factors can be internal or external. Internal organisational factors may be the case of faulty manufacturing processes that neglect important safety checks and external could be factors like bad weather, disinterested end-users/customers or weak national economy. Root cause analysis is summarised in the diagram as cause and effects.

**5.11.3.4 Recommendation: Diagramming Techniques Used to Analyze Cause and Effects of Non-operational Hand-pumps.**

This study suggests end-users develop a cause and effect or influence diagrams. Cause and effect diagrams help to identify various aspects of ‘why’ and ‘how’. An example of cause and effect for non-operational pump is given in Figure 20 below

**Diagram of cause & effect or Ishikawa /fish bone diagram**

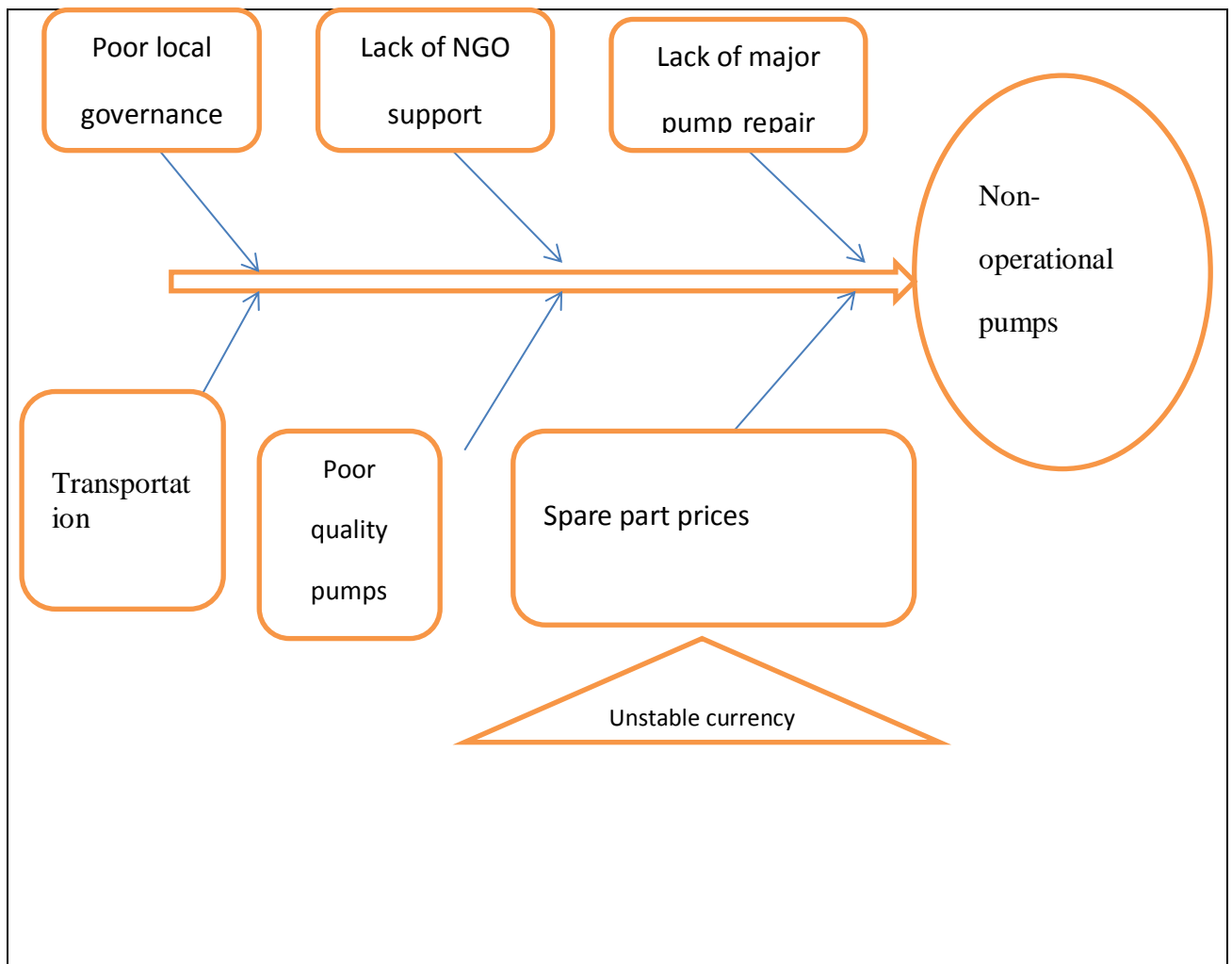


Figure 20: Non-operational Pumps Cause and Effect /Ishikawa Diagramme

The above fish-bone diagram is recommended as a tool to help in detecting potential problems arising relating to physical, organisational and human causes or risks. The cause and effect diagram shows that there are four components: the problem, the cause, the category (people and process) and the sub cause (equipment and environment) (Meredith &

Mantel, 2006).The process and the people are the main cause of the problems hence displayed on the top as seen above. Another cause category which is less aggressive is put at the bottom (equipment and environment). The problem is at the head –thus what the root cause analysis is planning to address, non-operational hand-pumps in this context. Branches identify one or more causes in each main category. The cause and effect diagram above would help end-users to identify causes and also associated risks by:

- 1) Recording the risks;
- 2) Identifying major contributing factors;
- 3) Listing causes by analysing the diagram.

Three rules that the diagrams are to have include the main category of causes (people, environment and processes); main category to branch off spine and then causes and sub-causes related to main category and risks. Once root causes are identified, end-users would then develop a risk register.

#### **5.11.3.5. Recommendation: Developing a Risk Register for Hand-pump-Maintenance**

It is, therefore, necessary to determine all the end-users or stakeholders. This research proposes the establishment of an end –user register (Kezner, 2008). The information provided by the end-users in the register can facilitate the identification of perceived risks from the different categories of end-users. This study further suggests developing a risk register as an outcome of the risk identification phase. An example of a risk register is delineated in Table 39 below.

Table 39: An Example of a Risk Register for Hand-pump Maintenance Risks

<b>RBS</b>	<b>Risk description</b>	<b>Impact cause</b>	<b>Cause</b>
1.1.0	Spare parts potential problems	Delay in hand-pump repairs	Poor delivery track record
1.1.2	Assumption	positive : more hands on	Only 8 water



	that 10 water committees will be active	for minor hand-pump repairs negative: delays in maintenance	committees are active
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From Table 39 above, end-users would determine that risk 1.1.2 is internal and can be controlled, but risk 1.1.0 is external will, therefore, need to accept the risk if it occurs and changes the baseline plans. Once a category of risks has been identified, it is imperative that the project managers, in this case the village committee links the risks to the responsible persons. This is sometimes called the risk breakdown structure (PMBOK 2008).

This study show end-users are able to identify hazards that threaten pump- maintenance, but this concept is further expanded to include a robust identification process which focuses on risks with greatest probability and impact. The study hence proposes prioritising risks as this would help to guide risk responses. High-priority risks require aggressive responses, while low priority requires fewer aggressive interventions. Furthermore, high-priority opportunities should be attended to first. We, therefore, recommend probability and impact assessments using ordinal (low, medium, high) and cardinal (0.0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0) scales (PMBOK 2008). Hand-pump committees may choose whether to use ordinal or cardinal. Water committees that have experience in maintenance would use expert judgement on how likely the risk probability and impact assessment may occur using either of the scales. The aim is to assign a rating on each risk and then prioritise each risk according to the threats or opportunities they present with (PMBOK 2008).

To ensure standardization, this study proposes that water-committees use a scale in which each of the 4 probability ratings (low, medium, high, very high) is described in detail to endure a shared understanding of its meaning. For example, low probability rating may be defined as one in 100 pumps that leads to low probability risk occurrence. If the water committee chooses to use cardinal scale numbers in a form of (0.0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0), would be used (PMBOK 2008). The numbers to

denote the probability with 0 being very low while 1.0 representing a certainty of occurring. Efforts should be made to properly explain to all the committee members, both the meaning of each value on the scale and the impact assessment issues.

For impact assessment; the water committees are recommended to determine each risk on the pump- maintenance in relation to cost, schedule and quality of maintenance. Impact may be negative (threat) or positive (opportunity). Impact is then rated for either cardinal or ordinal scales (PMBOK 2008). High/high; very high/high for cardinal and 0.80 or 0.90 for cardinal. In summary, we propose: Overall score of risk to be calculated for each pump as = probability X impact.

To determine priority risk, water-committees are recommended to use probability and impact matrix and ordinal scale.

#### **5.11.3.6 Recommendation: Use of Ordinal Scale to Determine Hand-pump Maintenance Priority Issues**

If the water committees are using the cardinal scale and probability of +0.3 and impact +0.8 (PMI, 2006); therefore, the risk score: probability X impact =0.24. 24 would be regarded as a priority because it is in shaded areas, in the above probability and impact matrix. It is necessary to ascertain the end-users visions, and the perceptions of the risks identified in order to determine the appropriate actions. Actions are interventions or potential responses to the identified risks that enable end-users to achieve their visions. It is necessary to categorise and assess the risks to enable end-users to determine the appropriate actions. Examples of actions include determination of inputs, including funds, manpower; technical skills needed to overcome the risks and achieve the stated objectives. The end-users should then develop a timetable, and a structured and detailed implementation plan. Bimonthly review meeting could be held to share successes and challenges about developed plans as part of regular risk response activities.

### 5.11.3.7 Recommendation: Develop a Risk Response and Control for Hand-pump Maintenance

This study suggests end-users develop a risk response and control strategy which is also called risk management plan. Risk Response and control is about limiting the negative impact and maximising opportunities (APM, 2006). The main steps focus on planning risk response and; manage the negative and positive risks; develop a contingency plan by establishing the reserve that can absorb the risks (PMBOK 2008). Though one may not know what risks will occur but can plan how best to manage it. Table 40 below is an example of risk management plan and how it can be used as a risk response for spare part price risk.

Table 40: An Example of a Risk Assessment Plan for Hand-pump Maintenance

Roles and Responsibility	B.C. water committee to check prices of spare parts before price hikes
Risk Analysis Définitions	Risk will be weighed in terms of fluctuating hand-pump spare part prices
Timing for Reviews	Level of risk checked every month
Risk Threshold	Planned response activated as soon as high priority risk cost double the previous year price

Explanation: risk threshold is level at which risk contingency triggers whether at low, moderate, or high. Risk specific definitions explains the criteria used to rate probability, impact and urgency of risk; in order to generate consistent and reliable risk responses. However, the focus is on high-priority risk. For low priority risks, the water-committee may just monitor. The study further suggests developing alternative fall back plan or planning B in case the risk may not be managed. Secondary risks to be also taken into account as these arise due to implementation of primary risks. An example is that end-users may get demotivated as they work all day doing revenue collection without pay. The next section suggests how negative risks can be managed.

### **5.11.3.8 Recommendation: Strategies for Mitigating Negative Risks in Pump Maintenance**

Strategies for negative risks involve; avoid, transfer and mitigate or accept the risks (PMBOK 2008). Negative risks are risks that threaten maintenance. Avoiding risks involve changing strategy. An example is choosing the type of pump, which has parts locally found as much as it may be of lower quality. Transferring risks involves shifting responsibility to the outside project or the third party through insurance, contracts, guarantees, warranting or performance bonds. Insurance, contracts, guarantees, warranting or performance bonds are common examples of dealing with negative risks. A guarantee is assurance of quality or life span of the asset, accompanied by a promise of reimbursement or replacement if the product does not live up to specific standards. Warranty is a written guarantee of integrity of a product and manufacturer responsibility for repairers or replacement of defective parts. Performance bonds as insurance may not be practical for the end-users to pay a premium for protection against pump usage loss (PMI, 2006). This study suggests contracts to be made between end-users and sellers of pumps, particularly those which are manufactured locally like Malda pumps. The study also suggests that pump drillers accept responsibility for costs for failure, as an illustration, if drilling is not completed in time, contracts to allow penalties with drillers. There should be, in addition, performance bonds between end-users and drillers as this is a type of insurance that a contractor (driller) supplies to an organisation (end-user committees) specifying money to be paid over to the local committees if a contractor fails to deliver promised results of the hand-pump. This protects against financial loss if work is not completed satisfactorily. Contingency response strategies are plans for addressing risk and done only once that risk occurs, and these may only be done if a certain milestone is achieved or missed (PMI, 2008). Contingency plan involve putting reserves in place, which means more money or costs. It is suggested that water committees calculate contingency reserves based on total EMV formula  $EMV \text{ formula} = \text{probability} \times \text{Impact}$  to work out the risk-management plan.

## 5.12 Summary of the Discussion Chapter

This chapter has discussed the findings from the research. This was done by integrating findings with the literature review. The discussion shows that the hand-pump maintenance factors, which facilitate or hinder maintenance are complex. The factors which enable hand-pump maintenance as seen from the six hand-pumps which were serviced by usage of end-user contributions and local committees. Lack of sponsor support, inadequate financing and poor supply chain for spare parts pose as major challenges for the hand-pump maintenance as seen from Kapsyepsye and Kamjeda where pumps were non-functional. Recommendations have been suggested to overcome the challenges both from supply and demand side of maintenance. The demand-side recommendations involve scaling up roles of end-users in maintenance whilst supply sides are those which relate to the roles of the project sponsors, government, including policy issues affecting hand-pump maintenance. The demand side include strengthening issues at the end-user level which include: labour and household contribution, formation of drinking-water end-user associations and water committees exchange visits. The supply-side recommendations include strengthening issues related to project sponsors and/or government roles, which include recommendations for: hand-pump manufacturers', introducing quality control, policy level issues, standardising hand-pump trainings and scaling up training of HSAs to include hand-pump rehabilitation, donor subsidies for refurbishment, credit provision for hand-pump rehabilitation, stimulating a market-driven supply chain, formation of the drinking water steering committee at national level, and contracting out hand-pump rehabilitation. Recommendations to improve hand-pump maintenance also focus on planning for maintenance by assessing the hand-pump maintenance status using a rating scale from non-maintenance to excellent maintenance and identifying risk and responses. The next chapter provides a reflection of the research process, contribution to the knowledge and study implications for practice, policy and further research.

## **CHAPTER 6: STUDY CONCLUSIONS AND IMPLICATIONS**

### **6.1 Introduction**

This chapter provides a reflection on the entire research process including its background, justification, the development of the aims and objectives, conceptual framework, research methodology and findings, discussions and recommendations. The chapter also provides a reflection on the limitations of the study and suggestions for further research.

### **6.2 Research Overview and Approach**

This thesis examined the management of water projects in rural areas of Malawi in order to establish the factors that influence local end-users ability to successfully manage the hand-pumps. The study was done because more than 1 in 5 of the world population who live in rural areas of developing countries lacks access to clean water (UNDP, 2006). In spite of various water provision initiatives by government, NGOs and treaties at international levels, Ashbolt & Barnes (2010) and Harvey (2004) contend that there has been persistent low supply of safe drinking-water particularly in sub-Saharan region of Africa. One of the challenges encountered is related to management of hand-pump technology particularly maintenance problems (Harvey & Reed, 2003). This research was based on the premise that drinking-water projects are handed over to stakeholder end-users for maintenance hence the need to evaluate different perspectives of stakeholder end-users roles. Stakeholder end-users perspectives have explained why pumps discontinue and become unsuccessful in the long term even though water projects are within budget, timeline, scope and quality, as planned by project sponsors in implementation phase (Prokopy, 2005; Gutierrez, 2005). The study therefore analysed the pump- maintenance success factors in drinking-water projects constructed by Non-Governmental Organisations (NGOs) in rural areas of Thyolo and Lilongwe Districts.

### 6.3 Reflection on the Research Problem, Question, Aim and Objectives

This research, confirmed by WHO/UNICEF, (2004); Prokopy, (2009); ODI, (2004); Harvey, (2007); Gutierrez, (2005) Ashbolt& Barnes, (2010) ; Disgupta& Beard, (2007) indicated that some hand-pumps become worn out, break down and are eventually deemed non-functional because of lack of or incompetent end-user maintenance. Failure in rural water projects tends to happen not in initial stages of the project cycle; but in the later maintenance after project sponsors have handed over the assets to end-users who often are beneficiaries (UNDP, 2006). It was therefore important to establish how end-users who are beneficiaries assume the role of managing the maintenance of the drinking-water project. The principle research question was therefore *what factors facilitate or hinder effective end-user participation in the successful operation and maintenance of drinking-water projects in rural areas of Malawi?*. The main reason behind asking this research question was to identify a comprehensive set of factors that facilitate or hinder the contribution of end-users for hand-pumps maintenance and why it happens in such a way, and develop a framework to overcome hand-pump maintenance problems. The literature review stage enabled the development of a set of aims and objectives to guide the research and provide answers to the research questions. The research objectives therefore summarised the major issues that the study set out to investigate. The study's main objectives facilitated the analysis of end-user roles in the management of hand-pumps, resulting in understanding why some hand-pumps are non-functional. This contributed to the understanding of pertinent issues that confront sustainable drinking-water project management in Malawi as a representative of other developing countries as highlighted in objective1.

### **6.3.1 Reflection on Objective 1: To Review, Examine and Analyse Literature and the Conceptual Framework**

Objective 1 was aimed at reviewing the literature and developing the conceptual framework. The literature review was aimed at establishing current thematic issues that dominate Project Management research which are applicable in the analysis of the maintenance of rural drinking-water projects and to situate this PhD within current research. The literature review revealed that there is need for exploring, analysing and establishing end-user perspectives and experiences in the maintenance of rural water projects within the context of Project Management discipline. End-users are particularly important in rural drinking-water projects because if they do not use and maintain the hand-pumps installed by project sponsors then the projects will have failed because the targeted beneficiaries will have rejected the project. Drinking- water project maintenance factors are set of circumstances, facts, or influences which contribute to operations of hand-pumps with minimal external aid. The literature review determined the theoretical parameters within which to carry out the research and facilitated the identification of variables to consider in the conceptual framework by highlighting the main debates in the analysis of rural drinking-water projects and exploring their consequences on the pump- maintenance by end-users. However, one limitation noted during the literature review was that the Project management literature have tended to focus on complex industrial projects and that there is a dearth in research literature aimed at end-user views in rural projects in Malawi, particularly hand- pump- maintenance.

### **6.3.2 Reflection on Objective 2 & 3 to Examine Hand-pump Projects' Plans at Hand and Explore the End-user Roles in Different Project Plans**

Central to accomplishing the objective 2 and 3 in the study is realism, the philosophical assumption adopted by the researcher. The researcher established that realists endorse the concept of 'cause and effect' for both the natural and social world but unlike positivists who view causality in a form of association, realist view it as a real phenomenon or an explanatory concept that is intrinsic to either the nature of the world or to the understanding of it



(Putnam,1990). The researcher also established that realism facilitated the investigation of the relationships between people and social structures thus establishing relation between the natural science and the social world. Realism therefore guided research design in terms of case study design methods using documents, observation, Convergence Interviews, Individual Case Interviews and Focus Groups. Data collected and analysed enabled to unveil hand-pump projects' plans at hand which were in a form of end-user labour and household monetary contributions, training and active roles of local committees. The study revealed that end-users actively contributed resources during the different drinking-water phases. The end-users also conducted minor pump repairs in seven hand-pumps namely Nkhoma (Mavule, Khuwi, Chadza, and Kachepa) and Bvumbwe (Mphenzu, Gute and Bulaki). In each of the above villages end-users made household contributions ranging from £0.30-£1.00 per month. Such funds were used to buy spare parts and pay for the transport and honorarium for the local mechanics who repaired the hand-pumps. It was also observed that the villages which maintained the pumps had active leadership who spearheaded hand-pump maintenance through water committees. Water committees had also been trained by the respective NGOs like Concern Universal and World Vision though respondents did not link previous NGOs like Interaid, OXFAM with any training. Some committees were more proactive than others. However the efforts, energy and concerns for end-user contributions showed that much of their contribution related to ownership of the asset other than recovering the costs for asset replacement or rehabilitation, which was beyond their ability. To conclude, although end-user payments showed a positive sign for hand-pump maintenance costs but payments for asset replacement which required major maintenance was not achieved in Malawi.

### **6.3.3 Reflection on Objective 4: To Explore the Challenges End-users Encounter in the Hand-pumps Maintenance.**

Findings show that some villages had challenges to manage complicated faults either because of lack of local technical skills or spare parts were too costly for the local

contributions. Challenges end-users encountered in hand-pump- maintenance for complicated faults were seen in Kapsyespye and Kamjeda villages, leading to non-operational hand-pumps. The key challenges focussed on limited finances for major maintenance, lack of local capacity to repair the complicated faults, and undeveloped supply chain for spare parts. In Malawi like most sub-Saharan countries, there is increased need to repair because there is no mechanism for quality control for the imported goods, hence quality of water equipment and components may be low (Harvey, 2007). The study also established that Malda pumps, designed for some Malawian shallow wells, are more advantageous because the supply chain can be followed for replacements other than those imported from other countries. Though end-users may contribute money for repairs, procurement issues are also beyond their scope as often project sponsors and donors will prefer to procure in large amounts on discounted price without taking considerations of the price of spares users would engage in. This may lead to failure to procure the right spares.

#### **6.3.4 Reflection on Objective 5: Propose Suggestions for Effective Rural Drinking-Water Project Maintenance**

The conclusions drawn from objectives 1 to 4 facilitated the proposal of an effective water project maintenance strategy. The findings established that although end-users had subsidiary plans for maintenance in Mphenzu, Gute, Bulaki, Mavule, Khuwi and Kachepa, they did not clearly spell out the operations and management business case. Also contracts between NGOs and end-users were very informal, not legally/formally binding hence responsibilities of end-users to manage hand-pumps were not articulated. The study suggests a business approach for maintenance of hand-pumps to promote their sustainability by introducing minimum standards focussing on: 1) Strengthening the demand or end-user side of pump- maintenance; 2) strengthening the supply side of maintenance which include roles of project sponsors and the government; 3) hand-pump maintenance plan by rating the status of hand-pump maintenance on a continuum of non-maintenance to excellent maintenance and developing a

maintenance approach using risk identification, analysis and response, details of which are in chapter five.

## **6.4 Research Contribution to Knowledge**

The study findings are applicable to water project management practices in rural situations that are comparable to Malawi's rural areas. The research methodology and philosophical approach have provided the demonstrable means by which realist research concepts can be applied in the analysis of rural drinking-water project management. The research therefore contributes to the scholarship on contextual variables that influence end-user roles in the practical management of hand-pumps after project managers have handed over the projects in rural areas of Malawi. The study contributes to knowledge in three ways namely theoretical contribution, methodological and reduction of rural drinking-water project failure.

### **6.4.1 Methodological Contribution to Rural Drinking-Water Research**

In general most project management research has been skewed towards natural science and understanding social processes and phenomena has received less attention. Where social projects have been researched on; most social projects have been researched using either positivists or interpretivists approaches, separately. Positivism focus on observable phenomena while interpretivists focus on perception of the social actors. Differences in approach of quantitative (positivism) or qualitative research (interpretivism) are based on the differences of philosophies and epistemologies that underpin them.

In drinking-water research world view, Positivists argue that hand-pump- maintenance has 'causes and effects' which is an issue denied by interpretivists. Interpretivists majors on 'perceptions of actors' or end-users as related to hand-pump- maintenance an issue considered as 'null and void' by their positivists counter parts. Differences between world

views can affect rural drinking-water project to suffer by impinging on workable solutions to complex drinking-water problems. Realism philosophy in this study has considered both extremes.

This study has integrated social and natural science in understanding end-user views about what makes hand-pumps to be maintained or not . Such factors are a key to operation or non-operation and usage or non-usage of the hand –pumps. Understanding end –user views is believed to one of the key issues in hand-pump- maintenance .This study acknowledges the weakness of approaching hand-pump- maintenance by using either of the two world views separately as this would fail to unveiled complex associated problems. This is because hand-pump- maintenance is a complex phenomenon requiring borrowing concepts from both positivism and interpretivism, which realism philosophy accommodates.

Realism is singled out as a philosophical view in this study because of its ‘cause and effect’ and relevance of ‘social actors’ views. ‘Actors’ who are stakeholder end-users are crucial in hand-pump- maintenance in terms of their views, intentions as they are beneficiaries and entrusted to repair hand-pumps by project sponsors. This study has therefore brought about knowledge related to integrating both quantitative and qualitative concepts in such a way as to unearth problems that would not be possible with a single approach (Bammer, 2005). Realist methods in the study allowed involving end-users in regenerating research questions from inductive (convergence interviews) to deductive (Individual case interviews) and priori theory. Convergence interviewing and focus group discussions allowed the research to accommodate mental phenomena of the ‘actors’ who are end-users about workable or non-workable maintenance factors. Priori theory in a form of success factors, stakeholder analysis, rural development theory gave a guidance of ‘cause and effect’ of maintenance aspects as viewed from a positivist angle.

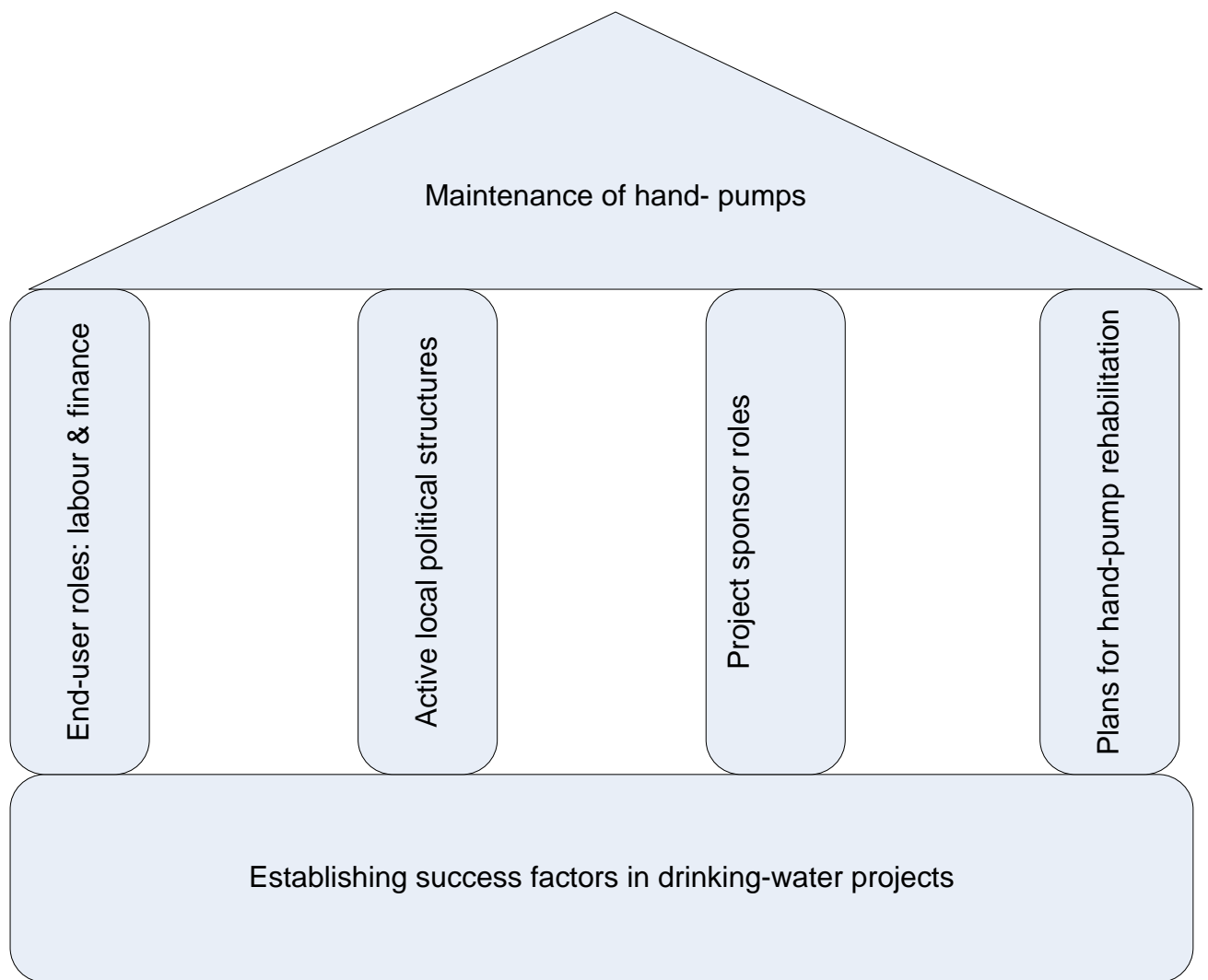
#### **6.4.2 Theoretical Contribution: Minimum Standards for Drinking-Water Projects**

This study makes a theoretical contribution by developing a conceptual framework for analyzing factors that influence hand-pump- maintenance in rural drinking-water projects. The research also employs existing literature about success factors, stakeholder management and rural development aspects to present factors which encourage or discourage operation of hand-pump in the nine hand-pump projects. These which are considered as ‘p*riori* theory’ compiled into five elements as described in figure below. Elements of the framework are further described below

Figure 7.1 below uses the classic temple diagram to illustrate the significance of the findings in the sustainable maintenance of hand-pump projects. The initial findings represent the main pillars on which successful hand-pump- maintenance is built. The four pillars include:

- 1) End-user roles through contribution of labor and household financial contributions
- 2) Active local political committees for local governance
- 3) Project sponsor roles: training and advocacy for hand-pump maintenance at local at policy levels
- 4) Plans for hand-pump rehabilitation by either credit provision, subsidy or contracting out hand pump rehabilitation

These factors are not interdependent but related. In the event that one of the pillars is not addressed, then the entire building is unsteady and may eventually collapse. The pillars are discussed in detail in the sections that follow.



**Figure 21 Drinking-water Project Maintenance Factors**

This researcher argues that ideally financial contributions that users give are supposed to cover for future hand-pump upgrade, rehabilitation and expansion costs in addition to maintenance in rural Malawi context. Hence financial contributions as a success factor cater for on-going maintenance of water assets for rehabilitation and capital costs of the hand-pumps, is likely to continue to depend on project sponsors (Lane, 2004). Findings in this study showed that measures to change one aspect of aspect management for example increased financial contribution of end-users alone cannot lead to successful hand-pumps. Another significant finding is that decentralisation of local structures as a way to overcome hand-pump failure alone is not sufficient; neither is assisting poor communities with a hand-

pump enough on its own nor sponsor roles in maintenance phase. Instead it requires all these aspects to be available to have maintained hand-pumps. Hence the approach to meaningful change in managing drinking-water projects need to use a holistic approach to address maintenance problems. The research therefore suggests a holistic approach to project management of hand-pumps that include: end-user contribution of household finances and labour; active water and local government committees at area, counsellor, ward, district and national levels; project sponsor roles including training of water committees and hand-pump mechanics, inclusiveness of end-users in the maintenance plans and developing plans for heavy maintenance / hand-pump rehabilitation which is beyond the scope of end-users.

### **6.4.3 Contribution by Reducing Hand-pumps Projects Failure**

Rural drinking-water projects failure is common (APM, 2007; PMI, 2008). Project failure is inability to meet project objectives and in compliance to scope, schedule and project cost (Kezner, 2006). Project failures is associated with poor planning and stakeholder problems hence the study of key end- users roles brings improvement in the performance of rural water projects as it would reflect their voices and opinions. Despite drinking-water project failure, stakeholder roles have not been widely researched as seen from data bases. The terms '*rural drinking-water*', '*maintenance*', '*end-user perceptions*' and '*success factors*' were used as tag words for search in SCOPUS, BIOSIS, EBSCO, web of science, Project Management Journal (PMJ), International Journal of Project Management (IJPM), rural development, data bases but did not yield any results. Carden (2008) and Khang (2008) agree that development projects which include rural projects success, is a new area in PM research. Research articles published in PM journals have mainly focussed on business projects in a form of construction and manufacturing sector projects (Soderland, 2004; Smyth & Morris, 2007; Saynisch, 2010; Turner, 2010) but rural water projects like most not for profit projects are less represented (Zwikael, et al.2005; Toor& Ogunlana,2010) and stakeholder practices have not been researched (Pollack,2006; Pollack & Bentry, 2006).

Tensaki and Hay (2004) state that development projects investigations have not been undertaken among the PM researched topic areas in prominent PM journals (IJPM, PMJ) and also there is no attention to rural water stakeholders perceptions. Winter & Smith (2006) as well as Themistocleous & Wearne (2000) work review of PM topics in publications of IJPM & PMJ shows that out of 44 PM topic areas of publications, stakeholders issues in general are not covered. Themistocleous & Wearne (2000) and Tensaki and Hay (2004) ; Winter & Smith (2006) are among the few publications in PM journals explicitly discussing the extent of Project Management and advocate stakeholders views. Also two-thirds of PM articles focus on PM issues excluding stakeholder perceptions yet stakeholders who are end-users in this context are important to sustain such rural projects.

In addition, the PM standards were originally designed to fit industrial projects which are business or profit oriented. Most rural projects may not be concerned with profitability and may not have a business focus. Muriithi (2003) & Crawford (2003) observed that transferring PM issues, which have western ideologies and value system, may contribute to project inefficiency and in effectiveness in rural projects because stakeholders in rural or developing countries are not linked to economic development but influenced by internal values and socio cultural issues. By studying end-user roles, this study develops strategic issues to fit the rural project context so as to reduce project maintenance failure in drinking-water projects of rural Malawi and beyond. The strategies issues are wrapped in a form of a catalogue of recommendations developed at the supply as well as demand side of hand-pump maintenance.

The demand-side recommendations involve scaling up roles of end-users in maintenance whilst supply sides are those which relate to the roles of the project sponsors, government, including policy issues affecting hand-pump- maintenance. The demand side include strengthening issues at the end-user level which include: labour and household contribution, formation of drinking- water end-user associations and water committees exchange visits.



The supply-side recommendations include strengthening issues related to project sponsors and/government roles, which include recommendations related to : hand-pump manufacturers', quality control, policy level issues, standardising hand-pump trainings, scaling up training of HSAs to include hand-pump rehabilitation, the project sponsor subsidies/ credit provision or contracting out hand-pump rehabilitation, stimulating a market-driven supply chain for spare parts and formation of the drinking water steering committee at local and national levels. Recommendations to improve hand-pump maintenance also focus planning for the hand-pump maintenance by assessing the maintenance status using a continuum from non-maintenance to excellent maintenance and identifying risks and responses. The next section highlights study limitations.

## **6.5 Limitations of the Study**

Although there is some degree of end-users interest to contribute funds for maintenance of hand-pumps, the size and scope of this research did not allow testing the effectiveness of fund raising. The other limitation was the process through which data was collected as did not allow much of comparison between primary and secondary data. For example access to local banks was unavailable to establish how many hand- pumps the bank accounts established for maintenance funds, the amounts of money each account invested and the conditions end-users met to have the bank accounts opened. In addition, access to procedures for legalising community institutional groups or committees was not achieved. This study has also determined what happened during the project design, implementation and handover based on contemporary end-users; though they may not lie but positivists' researchers argue that 'we view the past in the lens of the present' (Silverman, 2011). However the study used project documents which could be accessed to compliment this weakness and promote validity.

## **6.6 The Study Validity**

A realist qualitative research philosophy is primarily dependent on the researcher's subjective analysis of the research findings. This researcher's perceptions are acknowledged as both strength as well as a weakness of the research. It is possible that because of the subjective nature of the study, the findings may not be replicated however, the study has highlighted issues that affect the maintenance of rural water projects in Malawi which was its primary aim. Unlike quantitative researchers who are able to employ well-established rules of validity analysis including statistical significance and statistical tests, this research relies on the researcher's ability to present a truthful description of the data collection and analysis to make a convincing interpretation of the thematic issues derived from the research. The researcher checked the accuracy of the transcripts by selecting random points within each interview while replaying the interview against the transcript to validate consistency. The researcher then made follow up calls to respondents and also sent copies of transcriptions to the relevant respondents. Besides a few minor errors, such as misspelling of names and places, no significant errors in the data were realised.

## **6.7 Further Research**

In terms of further research, this study was exploratory in nature hence had a limitation as end-user roles were based on what they could remember of activities during conception and implementation stages of the project cycle and link with what was happening in the maintenance phase. A more extensive survey involving quantitative as well as qualitative data would be proposed to collect data from different cadres of stakeholders including project sponsors and local structures at project conception, development and implementation phases. Further research is needed on areas like: how the poverty stricken stakeholder end-users perceive compulsory financial and labour contributions for maintenance? how drinking-water projects have been influenced by decentralisation policies in Malawi? How the process

of project plans, politics, procedures and guidelines, might have influence on maintenance either in a positive or negative way.

## **6.8 Concluding Remarks**

This PhD study has outlined a clear methodological process that investigates drinking-water project maintenance within well-established realist research parameters. The research has explained the underlying reasons that facilitated the researcher's decision making in order to provide acceptable answers to the research problem and questions. The researcher has also conducted a thorough literature review that facilitated the determination of a conceptual framework and unit of analysis therefore situating this research within contemporary project management research.

The researcher has also highlighted the pertinent issues considered in establishing validity of the entire research process. The research has come up with a body of knowledge which can promote maintenance of hand-pumps in rural areas of Malawi and beyond. Finally, the research has provided areas of possible further research in rural water projects.

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# APPENDIX 1: Formal Agreement from the University of Salford Ethical Committee CES

UNIVERSITY OF SALFORD

Research Ethics Panel

## Ethical Approval Form for Post-Graduates

Project title: **PROJECT MAINTENANCE: THE CASE OF RURAL DRINKING WATER IN MALAWI**

**Is this Project Purely literature based?**

**NO**

### **Project focus**

This research will examine views of end users in defining project success in rural drinking water projects, in Malawi, East Africa. The users views will define the systems regarding operation of boreholes/water pumps, in the post intervention phase of construction. Drinking water is a global concern because 1.2 billion people in the world do not have access to safe water and one third of this population live in rural areas of Sub Saharan region of Africa (UNDP 2002; Gutierrez 2007). In 2000, the World Health Organisation [WHO] encouraged 189 UN member states to adopt the Millennium Development Goals [MDGs] of which goal 7 is '*halve, by 2015, the proportion of people without sustainable access to safe drinking water ...*' (UNICEF and [WHO] 2004). Safe drinking water in this context refers to water for domestic purposes that does not cause harm. Safe drinking water prevents diarrhoea diseases which is the main killer for children under five years in developing countries (Macro,2004).

This thesis examines long term project success factors in water projects or points constructed within the range of two to five years by two leading Non Governmental Organisations (NGOs)- namely World Vision International and Concern Universal. NGO Project Management (PM) strategy used during implementation phase seem to affect long term operations of the water points in terms of users responsibility to maintain water points (Gutierrez,2007). Hand-pump maintenance suggest that users are at a central point of functional water points. NGOs may incorporate project end users in the project cycle during implementation in preparation for post intervention phase (Anderson,2009).

Problems may arise when project managers in such projects disregard or do not prioritise users involvement(Prokopy 2005). When projects operate in an environment with complex users interests, most of whom may not have invested any money in the project, it can mean that implementing a long term successful rural water project, be a significant challenge.

The study is based on the premise that : water is a basic need but access to safe water is a problem in rural areas of Malawi (UNICEF/WHO,2004;UNDP,2002) as some projects which provide safe drinking water are abandoned or not sustained (Shant & Khan,2010;Harvey,2004) and that there is no clear criteria of long term water points success factors once constructed (Harvey,2004). This study will evaluate users views towards the long term systems or issues of water projects. The study will further validate if the success factors perceived by key project end users, match with the success factors considered by the sponsoring NGOs. It will clarify if sustainable water points, which is among the core objectives of the sponsoring NGOs, is practical and meet needs of project end users in long term. Differences among water points may be relevant in terms of how NGOs

should manage water points. In addition, success factors reported by users will be compared between projects which may suggest that NGOs address similar water problems or felt needs.

### Research question

The key research question is , ‘ what factors influence end-user roles in hand-pump maintenance in Malawi?’

### Research Design

This study will be in three sequence of stages namely: Convergent Interviewing (CI), Individual Case Interviews (ICIs) and Focus Group Interviews (FGIs). CI, which will be stage A, will be the first to be conducted. The aim of CI will be to develop a list of users perceived long term success factors or categories. Stage B, will be ICIs, and will use the category list developed during CI phase to further confirm if the list are also regarded as success categories by the other users. ICI will use semi structured interviews based on CI categorised items. The ICIs will be followed by FGIs in small groups of ten users each group. These processes have been chosen because they promotes validity of study results.

The researcher proposes to interview 120 key informants drawn from the two NGOs using purposive sampling. Yin (2009) refers to purposive or snowball ball sampling, as a type of non-probability sampling, whereby a researcher deliberately decides whom to include in the study on the basis that, those selected will provide the necessary data that is aimed at answering the research question. The rationale for purposive sampling is that the key informants are better placed to provide the list of respondents to be further interviewed. The first set of interviews will be convergence interviewing.

#### Convergence Interviewing (CI)

CI is a new qualitative methodology developed in 1990 in Australia (Dick, 1990).It has been widely used in marketing tourism and some community health programmes.CI is more ideal to engage with this study research question because CI pays more attention to data collection process than other methods (Driedger, Gallois et al. 2006).This is done as CI, starts with a broad question followed by constant comparative process and prompts are developed to explore subsequent interviews (Dick 1990; Kane 2007). An example of a general opening question to be used would be :

*‘Tell me about water pump issues in this village’*

Such open ended questions engages with the study as this study is exploratory and follow inductive research in collecting information of project end users attitudes, believes, values and expectations (Rao and Perry 2003; Reige and Nair 2004). As much as content is unstructured but process is semi- structured. CI will hence funnel analysis to clarify focal points or general categories (Rodwell, Noblet et al. 2010). **Based on** Dick (1990) the main elements of CI in this study will include : process of choice of participants selection, interview method, analysis of each round of interviews and final issues analysis. Long term project success factors will be analysed according to similarities and differences between them (Reige and Nair 2004; Rodwell, Noblet et al. 2010).A matrix of agreements and disagreements will be done about key issues as done by (Dick 1990; Kane 2007)

#### Selection of NGOs and hand-pumps / water points (cases)

Water projects in Malawi are implemented by different NGOs of different capacity and scope. This study has chosen two NGOs as they are most representative of others (Yin,2009). Selection of NGOs has been based on homogenous groups representing the others, however the difference could be that one NGO may drill more water points than the other. The two NGOs are World Vision (Dedza District, Central Region) and Concern Universal (Thyolo District, Southern Region) Malawi. Each of the two NGOs will have water points or projects to be critically examined. This choice is based of Yin (2009) argument that case study detailed examination could range between 2-12 cases. The water points selected are those which were constructed between 2-5 years whether operational or not operational.

### **Interview and analysis of CI interview**

CI will start with open ended questions like:

*'what do you think about the water pumps constructed in this village? Are things different since construction?'*

The CI open ended questions will help users to state responses while keeping the central theme of the study. Answers will be probed to help determine what they consider as positive or negative issues in the water project but the researcher will not state the what categories are being looked for as noted in literature review. If the respondent mentions an issue that can be categorised as a success factor, it will be noted and at the end of each interview, the user will be cross checked if the classification is indeed what they consider as a success factor category. If the answer is positive this category will be used for subsequent interviews. So when A1 suggest a category it will feed into interview A2 as a search for agreement or disagreement..and fed forward till point of saturation is reached. A2 will also be asked to emerge new categories which will be further searched for agreement or disagreement in subsequent respondents. If balance of agreements outweigh disagreements at the end of the CI process then such categories are accepted to go forward to next stage of ICI using semi structured interview. The CI process moves from unstructured to structured and at the end of saturation, which could range from 6-12 interviewees per water point (Dick,1990).

### **Individual Case Interviews (ICIs)**

This second phase will involve scoring the level, impact or influence of categories of long term success factors developed during CI. For example: if borehole salty water was identified as a category in CIs, in ICIs we will understand more of users views about salty bore hole water usage -using semi structured interviews -in a form of likert -type scales which will range from 0-3.

Firstly, respondent will be asked if they identify or accept the salty water as a success or failure category or perceive something differently. Summary of comments by users on each likert -type scale will be taken note of.

### **Focus Group Interviews (FGIs)**

FGIs will be in small groups of a maximum of ten end users. End users will discuss success categories of water points based on themes identified in CI and confirmed in ICIs. A total of four FGIs will be done

### **What is the rationale which led to this project**

The research problem in this study focuses on identifying success or failure factors as perceived by project users. The topic of rural water PM has not been well explored in the literature and not covered at all as regards to user perspectives. It will be argued that end users are particularly important in rural drinking water projects because if they do not use the water pumps or boreholes in long term, the project is a failure despite that the NGOs might have met their short term objectives of drilling water points. This study will help to determine whether risk management is in place towards management of water points. The study will also help to discover what users suggest regarding overcoming constraints rural water projects face in sustaining projects. There is also a need to validate if the success or failure perceived by key project users, match the success /failures actually considered by NGOs or the PM body of knowledge . Any discrepancy in success or failure is important in terms of how NGOs and users should manage each other. Existing research including : Muriithi & Crawford, (2003); Themistocleous & Wearne (2000); Kwak & Anbari, (2009), all show lack of research in engaging end users' issues. Hence the understanding of factors that influence outcome of water projects in rural areas of Africa is an imperative research agenda.

### **If you are going to work within a particular organisation do they have their own procedures for gaining ethical approval**

N/A

### **Are you going to approach individuals to be involved in your research?**

Yes

### **Access to respondents**

Seeking permission to conduct a study from responsible authorities at the place where the study will take place is also an ethical imperative. Hence, the proposal for this study will be submitted to Salford University Ethics Committees for ethical approval. At the study water points level, letters will be sent in Chichewa to seek consent of the project end users (see Appendix 3). Though 68% of rural Malawi population is unable to read or write the local language, Henderson, Mahoney, Nelson & Mwansambo (2007) argue that rural illiterate individuals can understand information given to them and make informed consent if information is given in a clear manner. In consideration of this, the researcher will provide explanations in a simple way about the reasons for the study, the benefits for the community, what we want to achieve, why they are eligible candidates and also emphasis will be about their right to choose to participate or not. The researcher will ensure that they understand information given to them during consent process and will ensure adequate time is given to explain the consent process. The consent form will be ensured to be short and precise. However, letters will also be sent to the two prospective NGOs seeking permission to conduct study in their water points (see appendix 2).

**More specifically, how will you ensure you gain informed consent from anyone involved in the study?**

### **Informed consent**

Informed consent is about voluntary decision making to participate in the study. Informed consent is a necessary prerequisite in order to safeguard the users and protect their rights. Hence users will have adequate information about the research, and understand the information which enables them to make an informed decision to participate or decline.

The main points about informed consent will be as delineated below:

- End users to freely volunteer to participate
- End users to be freely provided with information
- End users to withdraw from the research at any time from the investigation
- End users to fully understand what is required of them
- End users to be provided them with the data analysis results so they can comment again if the results are a true representation of the information they provided
- End users will have the right to withdraw retrospectively despite any consent initially given and that any data provided will be destroyed.

The information will be about: why the study is conducted; what we want to achieve; the type of data; participant selection; procedures and contact information. Considering the low literacy levels of users in rural areas (Macro, 2005), explanation will be simple without long scientific jargon, in local language which include the meaning of the original version (Henderson, Cornel et al. 2007). The researcher will then obtain both verbal and written consent from the participants and also explain the voluntary nature of the consent and the right to withdraw (See Appendix 2).

### **Confidentiality**

Privacy and confidentiality will be ensured throughout the research period. Polit and Beck (2008) reflect that all research with humans involve intrusion into the personal lives of participants and participants have the right to expect that the data they provide will be kept in strictest confidence. Anonymity is the most secure means of protecting confidentiality and this is demonstrated when the researcher can not link a particular participant with the information given. However, as a researcher, it is suggested that there will be a link between each transcript and each participant so as to be able to return the transcript for participant validation. Anonymity will be maintained through use of designated codes instead of participants' names. Notes of individual participants will have codes and not participants' names. Participants will be assured that confidentiality will be observed throughout the study period. All research materials including notes taken during the interview will be kept in a locked filing cabinet and the key will be kept by the researcher. My supervisor at Salford University is the only person who will have access to the data. However, the information produced during this research may be used for presentations during research dissemination conferences. When the research is completed, the raw data will be destroyed.

## **The right to self-determination**

The right to self-determination implies that humans should be treated as autonomous beings capable of controlling their activities (Henderson, Cornel et al. 2007). This study will therefore encourage the users to have the right to decide voluntarily to participate in the study without any coercion (Polit and Beck, 2008).

## **Protection of vulnerable rural populations**

Vulnerability is about exposure to unnecessary trauma. In rural projects, participants could be vulnerable due to poverty or the nature of interviewing.

Illiteracy and poverty predispose users vulnerable as they do not have options or alternatives to make decisions. It may also be hard to engage some autonomy issues which are stated in Nuremberg code (Bailey et al 1996) and the Social Research Association (SRA) Code of Ethics, as these may be mostly geared for the western world. For example, if a village chief authorises the study in the village, the users may not disagree due to illiteracy (Henderson, Cornel et al. 2007). This study will specify to the users that it would be alright to turn against the chief decisions should they disagree.

Sinding and Aronson (2003) also suggest that vulnerability occurs because interviewers are deeply occupied with making meanings that reside within respondents. It is worthy mentioning that the power differences may not be as evident in this study because the first series of interviewing which will be CI, involve the respondents to generate the categories. The use of an aid memoir and not a fully structured interview schedule will also help to reduce dominance on my part as the interviewer. This implies that the interviews will be mostly guided by what the participants will determine. Ray (1994) stated that in qualitative research, research questions are not predetermined but the researcher follows the cues of the participant and the conversation proceeds thoughtfully. There will be no forethought on the probing questions and it is hoped that this will make the interview sessions more dialogic and reduce interviewee vulnerability. The users will be informed of this process.

## **Risks**

Risks could be physical, psychological or social. This study does not entail physical risks as do not involve invasive procedures to cause harm. Social or psychological risks may involve stigma attachment to participants in a study. Equally the study does not anticipate this because water issues are communal issues and not individually based. This study focus is to examine the system of water project operations other than isolating individual cases. Isolating individual cases in this context could probably be selecting respondents who have had diarrhoea for using unsafe water. Interviewing such diarrhoea patients could predispose them to psychological or social risks, however this is not within the scope of this study.

## **Are there any data protection issues that you need to address?**

**Yes**

## **Data protection issues : privacy and confidentiality**

The participants will be assured that their privacy will be protected and that the research will not reveal their identity (unless prior consent is given by the respondent) and that all information they provide will be treated with utmost confidentiality. The participants will be made aware that any sensitive information they provide will be destroyed after the research is completed under the supervision of the PhD supervisor in accordance with university regulations and the Data Protection Act 1998, which stipulates that any information obtained about the participants during the research is confidential unless otherwise agreed in advance by the participants. Participants will also be informed of the procedures for contacting the researcher following their participation.

## **Personal code of ethics**

The research will not be seeking any private information about the participants' private roles in the project. This is aimed at ensuring that the resulting anonymised data is set subject to the Data Protection Act 1998. The research commits to transparency by providing data subjects with a clear understanding of what will happen to as a result of the information they have provided. This will entail a clear explanation of the nature and objectives of the research, data storage and the final destruction of all data under the supervision of the research supervisor. The participants approached will be free to choose on their own whether they be involved in the study or not.



## Sensitive data

No sensitive data will be required for this research. Under the Data Protection Act 1998, sensitive information includes issues regarding race, political opinions and affiliations, religious beliefs and practices, sexual orientations, physical and mental health conditions. All participants in the research will also be above 18 years of age.

## Data Security

After obtaining the respondent consent for recording, the researcher will ensure that the field notes are stored safely with a lock and a key in a secure brief case kept by the researcher. The list of codes linking participants and their identifiers will also be securely stored. The information will be stored in alternative formats such as transcripts and coded names in order to protect the identities of the respondents. All transcripts will be stored in a locked cupboard at Salford University and ultimately destroyed after the PhD is completed under the supervision of the research supervisor.

**Are there any other ethical issues that need to be considered? NO**

- **(a) Does the project involve the use of ionising or other type of “radiation”**
- **NO**
- **(b) Is the use of radiation in this project over and above what would normally be expected (for example) in diagnostic imaging? NO**
- **(c) Does the project require the use of hazardous substances?**
- **NO**
- **(d) Does the project carry any risk of injury to the participants?**
- **NO**
- **(e) Does the project require participants to answer questions that may cause disquiet / or upset to them?**
- **NO**
- **If the answer to any of the questions 11(a)-(e) is YES, a risk assessment of the project is required.**

**How many subjects will be recruited in the study/research? What is the rationale behind this number?**

## Selection of users and proposed number of interviewees

Selection of users will be from the general population. Selection will be based on users who have been in the village since the water point were constructed.

The study proposes to interview 120 key informants or users drawn from the two NGOs. Yin (2009) refers to this approach as purposive sampling, which is a type of non-probability sampling, whereby a researcher deliberately decides whom to include in the study on the basis that, those selected will provide the necessary data that is aimed at answering the research question. The rationale behind this is that the key informants are better placed to provide the list of respondents to be further interviewed. Dick (1990) suggests that in snowball sampling the number of units in a sample may not be decided in advance. Interviews will be conducted till saturation is reached. Saturation will be known if there are no more new categories being developed from the general open ended questions or success categories have been narrowed down till there is no more expansion to define meaning of categories.

Appendices attached : Information sheet for prospective NGOs (appendix 2), Information for participants (appendix 3), consent forms (appendix 4 ) and reference list

## **APPENDIX 2: Outline Information Sheet for the Prospective Project Managers Working for the NGOs**

University of Salford  
Salford Business School  
Project Management Section  
Lady Hale Building  
Salford M5 4WT  
United Kingdom

Dear Prospective NGO,

### **RE: Information Sheet for the Prospective NGO**

My name is Beatrice Chisenga. I am a PhD student at University of Salford (UK). I am writing you to request authorisation for your NGO participation in a study titled, 'Project Maintenance in rural drinking-water projects'. The study will examine the extent of key stakeholder practices in operational or non-operational projects.

The aim of this research is to explore experiences of key project users in relation to their maintenance roles. Water committees have been also chosen to participate as they spearhead maintenance issues of water points. As the research is around learning human relations, it will hence use a qualitative perspective. A Qualitative study is defined as empirical research conducted in any research paradigm, using largely qualitative techniques for sampling, data collection, data analysis and interpretation with human participants as sole or major source of data (Patton, 1990). Such data is important as it reveals and makes us to understand 'how' and 'why' issues related to using hand-pump maintenance are handled in the rural areas of your project.

The study is for the researcher's PhD thesis, and your project is being requested to participate in this study because you are one of NGOs working in the rural areas to promote safe water access by installation of hand-pumps in Malawi. It is alleged that you have had a substantial experience in promoting the rural people with hand-pumps maintenance. The experiences of key stakeholders, including water committees, pump repairers, if any is critical in the study, hence they will be asked to articulate their experiences. Data collection will take place from the last week of February, 2011 for a period of about six weeks. End-user respondents will be initially interviewed using convergence interviewing to determine hand-pump maintenance categories and such categories will further be cross-checked using Individual Case Interviews and sets of Focus Group Discussions. Each session may last up to one and half hours. Their participation will be voluntary. For the sake of crossing checking the data, your community project staff, who work hand in hand with the rural communities, in the area will also be interviewed.

The study is beneficial because it is hoped that the results will help to define sustainable policies and procedures for maintenance of hand-pump projects. Should your NGO accept to participate, you will be one of the two NGOs.

If you have any questions about this study, you can e mail Dr Kevin Kane, The Head of Department, Project Management, E mail: [K.Kane@Salford.ac.uk](mailto:K.Kane@Salford.ac.uk)

I look forward to working together with you as we bring empirical evidence relevant in adding to sustainable Project Management for rural water projects.

Sincerely Yours,

Beatrice Chisenga

PhD Student

## **APPENDIX 3: ‘Outline Information Sheet for Prospective Participants for the Village-Level Gate Keepers.**

University of Salford  
Salford Business School  
Project Management Section  
Lady Hale Building  
Salford M5 4WT  
United Kingdom

Dear Prospective End Water User and/or Water Committee Member

### **RE: Information Sheet for the Prospective Project End-users and Local Committee Members**

My name is Beatrice Chisenga. I am a student at University of Salford (UK). I am writing to request your permission to participate in a study to know more about hand-pumps in your village including those which are not in use.

#### **Study aim and mode of data collection**

The aim of this research is to know your views as about using the borehole or hand-pump in your village. The research is about learning peoples’ ideas, hence will be a form of a more detailed discussion. In these discussions everyone is expected to talk freely. The study will focus ‘how’ the NGOs helped you with their water point’s projects and ‘why’ water points have been handled in the way they have. It is believed that you have had some reasonable knowledge about the water pumps brought in this community by the NGOs. Your experiences are important, for this reason feel free to talk about it. The discussions may take up to ninety minutes per each session.

#### **Privacy and confidentiality**

Privacy and confidentiality will be ensured throughout the discussions. The interview session will only be audio recorded if you consent to this. Tapes of recorded interview sessions will have codes and not names in order to hide who said what. All research materials including the recorded tapes, notes taken during the interview will be kept in a locked filing cabinet and the key will be kept by the researcher. However, the information produced during this research may be used for presentations during research dissemination conferences.

#### **Benefits**

This study will benefit the community in many ways first, by addressing the underlying problems hindering utilisation of safe water it would mean that NGOs will pay more attention to capacity building issues, the rules and regulations in dealing with users of water points, more water points may be created or rehabilitated. As respondents, the discussion will be an opportunity to come up with new rules, roles in relation to maintaining water points for safe drinking-water. Should you accept to participate in the discussions, your water point will be one of the eighteen water points to be discussed in areas of Lilongwe and Blantyre.

#### **Informed consent**

You are asked to participate voluntary without force. As end project users, and VHC you will be asked to sign the consent form as a sign that you understand information given to you during consent process and agree to take part in the study. The researcher will explain what study is all about, why it is conducted and what we want to achieve. The researcher will explain the research objective in simple terms and in the local language. You will not be forced to answer all questions and you can withdrawal from answering even after the discussion has already started.

I am looking forward to working together with you as we together aim to have the best and safe drinking-water throughout in our villages.

Sincerely Yours

Beatrice Chisenga

## APPENDIX 4: Consent Forms for Participants/Respondents

**Title of the Research Project: ‘Project Maintenance of Rural Drinking-Water Projects in Malawi’.**

**Name and Position of Researcher:**

Beatrice Chisenga. PhD Student: Project Management.

1. I confirm that I have read and understood the information sheet for the above study and have had opportunity to ask questions. **Yes /No**
2. I understand that my participant is voluntary, and that I am free to withdraw at any time without giving reasons. **Yes /No**
3. I agree to take part in study. **Yes /No**
4. I agree to the interview being audio recorded. **Yes /No**
5. I agree to use of anonymised quotes in publications. **Yes /No**

**Name of Participant .....Title .....Village.....**

## APPENDIX 5: Stage C (CIs) and Stage D (ICIs) Respondents

Name of Respondent	Acronym	Village	Role
HAS Chibisa WVI E. Peter L. Kachippa M. Sanza C. Amos M. Sadzu E. Kanthukako L. Semu	EU3 EU 4 EU 10 EU18 EU19 EU20 EU21 EU35	Kachepea-Nkhoma	WVI field worker Pump technician Group technician Water Committee End-user Water Committee Water Committee End-user HSA
T. Madengula F. Kalunje L. Joel S. Henry A. Fokisi C. Tchane T. Godfrey	EU51 EU48 EU22 EU24 EU25 EU26 EU 12	Kamjeda-Nkhoma	End-User End-User End-User End-User Water committee Water committee End-User
A. Saveni M. Paterson F. Kamphau M. Leneki I. Gilliasi R. Henry S. Thomas	EU3 EU17 EU7 EU8 EU9 EU12 EU 28	Khuwi-Nkhoma	End-user HSA End-User End-User Water committee End User Pump technician
A. Seveni M. Peterson F. Kamphawi M. Lenekisi I. Giliyasi R. Henele M. Kanyondo	EU13 EU14 EU15 EU16 EU11 EU50 EU	Mavule- Nkhoma	Water-committee End-User End-User End-User End-User End-User End-User
E. Nkata E. Charles A. Malaikita O. Lewisi A. Jumbe J. Hassan P. maluwera	EU36 EU39 EU40 EU41 EU18 EU5 EU 47	Bulaki-Bvumbwe	End-User End-User End-User End-User End-User End-User HSA
G. Belito R. Feliati R. Makaliye M. Mangolo E. Lazalo E. Kaliati M. Mascumba S. Mapando	EU23 EU31 EU32 EU33 EU43 EU50 EU 42 EU38	Gute-Bvumbwe	End-User End-User End-User End-User ADC member End-User End-User Water-committee
H. Dominiko B. Khefasi E. Bwanali B. Salima M. Banda C. Feliati T. Chikalipo W. kaliati J. Benesi	EU27 EU29 EU30 EU23 EU34 EU37 EU5 EU7 EU49	Mphenzu-Bvumbwe	End-User End-User End-User Village Head man End-User End-User End-User HAS

## **APPENDIX 6: Protocol for Focus Groups Procedure**

### **Topic: Factors that Enable/Hinder Operations of Hand-pumps in Malawi**

1. Warm up and explanation
2. Introduction

Good [morning, afternoon, or evening], and welcome to our discussion.

My name is **Beatrice Chisenga**, on behalf of the University of Salford, where I am undertaking my research; I would like to thank you for attending this discussion.

This discussion is part of the water project that is being conducted by the World vision or Concern Universal in the rural areas to find out what people in the villages who use hand-pumps think about the way pumps are maintained. And if there were any particular factors that help to facilitate maintenance benefits that seem to have arisen from initiatives of end-users in the last two - ten years. You have all have taken part in the use of hand-pump in this village and should by now have an idea of whether or not you like the way pumps are maintained or not maintained and what your concerns are in your day-to-day life

By finding out if you felt there are any factors helping or hindering maintenance, we will be able to develop a system of hand-pump operations and management. Do encourage others to do what you have done –by explaining what they may gain from the way of managing pumps. Even if the pump is not working others may learn from the challenges encountered

During this discussion, I would ask you a series of questions related to hand-pump- maintenance and your experiences or involvement. When you answer, please express your thoughts and concerns about each of the questions or any other related issues. Your opinions and ideas are very important to this research whether positive or negative.

### **Ground Rules**

Please remember that there are no rights or wrong answers to any of these questions. Also, feel free to state your own viewpoints, feelings, and personal experiences.

I want and need to hear from everyone here today. The more information I get from you the more it will help me to develop a better approach to managing hand-pumps that will truly meet your needs and may encourage other people to adopt the approach and so improve rural peoples' health.

All comments are welcome- both positive and negative. If you don't have an answer or do not understand the question, it is okay to tell me so. It helps us even when you don't have an answer to a question. So please don't be worried about saying, "I don't Know" or "I am not sure what you're talking about."

Please feel free to express yourself if you disagree with someone else's opinion. We want to have many different points of view.

It is important to say what you think, but please realise that you don't have to say anything about your roles in hand-pumps that makes you feel uncomfortable.

I am here to learn what you know or have experienced with hand-pump- maintenance. I want to learn from you. Your opinions are very valuable to me. If you should have a question during the discussion, please wait until the end of the discussion and I will be happy to answer any of your questions or to refer you to someone who can help you.

### **Procedure**

I will make notes during our discussion, and because I need close attention to what you are saying, I will have to check at the end that you agree that I have captured your ideas correctly. Later, I will review the notes and your responses to my questions. I will then take the information I obtained from each group and write a report. Please remember that you will not be identified in any way. I will begin taking notes after our introductions

This discussion is strictly confidential. What you hear and what you say will not be shared with anyone outside this room. This information should stay here. Are we in agreement?

This is a group discussion, so don't have to wait for me to call on you please speak one at a time because that way everyone will hear what you say and it will make it easier for me to keep notes. Also, please be considerate of your fellow participants and give each other an opportunity to speak.

We have a lot of information to go over, so I may have to change the subject at times or move ahead in the middle of our discussion. Please stop me if you want to add additional information that you feel is important to our discussion.

Our session will last about two hours.

### **Self-Introductions**

Let's start by introducing ourselves. As I said before, my name is Beatrice Chisenga, I work at the University of Salford, and I am undertaking this focus group for my research into drinking-water project management.

Now, please introduce yourselves. Give your name, what is your role if any and how long you have been in contact with the hand-pump.

Before we begin, our discussion, please note my colleague the village health worker is writing all your names down. This information will help me to learn more about the people who participate in the discussion.

Does anyone need help? I will be happy to help you.

**N.B.** The above participants provided respondents interviewed in Stage C (the focus group interviews). To preserve anonymity the names are only referred to by number when quotation or reference to them is made in this thesis