PRE-PAID WATER METERING: SOCIAL EXPERIENCES AND LESSONS LEARNED FROM KLIPHEUWEL PILOT PROJECT, SOUTH AFRICA.

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Declaration

I declare that *Pre-paid Water Metering: Social Experiences and Lessons Learned from Klipheuwel Pilot Project, South Africa,* is my own work, that it has not been submitted before for any degree or examination in any university, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

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Abstract

Pre-paid water metering pilot project was implemented in Klipheuwel, Cape Town, South Africa in 2001. It was anticipated that the implementation of pre-paid water meters would help improve the management of water service delivery in the Cape Metropolitan Area. However, just four years after its implementation the project has collapsed. This study investigated the social factors that contributed to the failure of the pre-paid water metering pilot project in Klipheuwel. In particular, it examined water users' experiences and attitude toward pre-paid water meters. It also examined community perceptions of the project with regard to the administration of free basic water; the promotion of paying for water services; and the promotion of a water conserving behaviour. The study findings suggested that the project was not abandoned because the community disliked pre-paid water meters. In addition, that it is inadequate to base the abandonment of the pilot project on its failure to achieve some of its anticipated water management potentials.

Keywords

Access

Affordability

Conservation

Cost recovery

Equity

Free basic water

Klipheuwel

Pre-paid water meter

Sustainability

Technology

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Dedication

To my mother and my entire family

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Acronyms

ANC: African National Congress

CMA: Cape Metropolitan Area

FGD: Focus Group Discussion

IWRM: Integrated Water Resources Management

WDM: Water Demand Management

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Pre-paid water metering technology, though a fairly new water resource management innovation, raises a number of contentious questions. According to Flynn and Chirwa (2005) the constitutionality of using pre-paid water meters within the South African context is questionable. This is because the South African Constitution recognises access to water as a human right and therefore any form of restriction to water access contravenes this provision. Legally, pre-paid water meters are also considered to circumvent certain procedural requirements necessary to disconnect water supply due to non-payment. Kidd (2004) for example, maintains that the South African water legislation provides that domestic water users should be informed in advance about the intent to disconnect water supply. The legislation further subscribes that disconnection of water supply for the reasons for non-payment can occur only after the concerned domestic water user has been given a hearing. The use of self-disconnecting pre-paid water meters, however, does not provide room to put these procedural requirements into consideration.

Community experiences with pre-paid water meters also show that implementing this technology may create certain negative social problems (Deedat and Cottle, 2002; Speak, 2000; Drakeford, 1998). These problems are associated with the disconnection of water supply, especially among low-income domestic water users. For example, Deedat and Cottle (2002) illustrates that the disconnection of water supply to consumers who use pre-paid water meters could expose poor people to water related diseases such as Cholera. Furthermore, it may impose unnecessary financial burden on the low-income users. Caution is therefore required when treating water as an ordinary economic good (Savenije, 2002). The same caution is applicable to the use of pre-paid water meters as water management devices.

Notwithstanding these concerns surrounding pre-paid water meters, the technology is still being implemented in some countries. Pre-paid water meters have mostly been introduced in low-income communities with cost recovery being the main reason for the implementation of the technology (McDonald and Pape, 2002). Cost recovery proves to be difficult to achieve among low-income water users especially if conventional methods of cost recovery are used.

Pre-paid water meters have also been implemented because they can control water consumption (Marvin *et al.*, 1999b). Additionally, the technology has been implemented in some areas in South Africa to effectively administer free basic water. It is in this context that that pre-paid water metering pilot project was implemented in Klipheuwel, which falls within the Cape Metropolitan Area (CMA).

1.2 Research problem

In 2001, the City of Cape Town launched pre-paid water metering pilot project in Klipheuwel, north of Durbanville. The city anticipated that after the successful completion of the project, comparable systems would be implemented in Bishop Lavis, Netreg (in Bonteheuwel), and Richwood (AIDC, 2005; Phillip, 2005) on the Cape Flats. Pre-paid water meters would ultimately be installed across the broader CMA. The technology was projected to be a panacea to the water management problems (such as the efficient administration of free basic water; cost recovery; and controlling the wastage of water) (Sylvester, 2002).

Despite the management advantages associated with pre-paid water metering, the City of Cape Town abandoned the project in Klipheuwel in 2005. In addition, the city authorities under the leadership of African National Congress (ANC) took a policy decision against the future implementation of pre-paid water meters within its jurisdiction (City of Cape Town, 2005). The basis for this policy decision was that pre-paid water meters have negative social effects,[1] and are expensive to operate[2]. To date, studies on the social factors that contributed to the collapse of the pilot project in Klipheuwel are lacking. Also, research that highlights water management potentials associated with pre-paid water meters in South Africa is limiting.

1.3 Research aim

The study investigated the appropriateness of pre-paid water meters as a water resource management tool in low-income households; this was undertaken by studying the possible

[1] Pre-paid water meters are considered to place a burden on low-income households who limits water use to the most essential needs because of the inability to pay. Immediate disconnection of water by the meters deprives poor people water, encourages begging for water, subject women and children to their traditional roles, limits water use, and exposes them to health risks among others (see Fiil-Flynn and Naidoo, 2004).

[2] Fiil-Flynn and Naidoo (2004: 6) claims pre-paid water meters are sold at a higher price (around R1,000) than other meters because they are viewed as a "high-tech solution". They have also proven to be technologically unreliable and attract high maintainace costs.

social factors that might have influenced the abandonment of the pre-paid water metering pilot project in Klipheuwel.

1.3.1 Research objectives

To address the research problem, the study was guided by the following objectives:

a. Explore the experiences of water users and attitude towards pre-paid water meters;
b. Assess the impact of pre-paid water meters on water users' access to free basic water;
c. Establish the influence of pre-paid water meters on promoting payment for water services; and
d. Determine the impact of pre-paid water meters on people's behaviour in conserving water.

1.3.2 Research hypothesis

The study was based on the following hypotheses:

1. Water users have a negative attitude towards the use of pre-paid water meters;
2. Pre-paid water meters fails to ensure access to free basic water to water users;
3. Pre-paid water meters do not encourage water users pay for water services;
4. Pre-paid water meters fails to encourage water users to conserve water.

1.4 Research methods

1.4.1 Study area

The study was conducted in Klipheuwel, a low-income community located north of Durbanville (AIDC, 2005) in the CMA. The area comprises both informal and formal settlements. The study focused on the formal settlement, since houses in this part of the settlement were fitted with pre-paid water meters. At the time of the field study, the formal housing area comprised 147 houses. The area was inhabited mainly by the coloured working-class people; a number of black (African) households also existed there.

Each of the houses in the formal settlement in Klipheuwel had both electricity and water. During the pilot project, pre-paid water meters were installed in 138 households (Dreye, 2003). The meters were programmed to dispense 6,000 litres of free water to each household every month. In addition, the meters were also calibrated to provide 200 litres of water for

emergency purposes. Furthermore, a vending shop that sells water credit was located within walking distance (less than a kilometre) of the community.

When the pilot project was abandoned, pre-paid water meters were replaced with conventional water meters. The account system usually associated with conventional water meters was resumed. At the time of the study, the account system was used with increasing block tariff structure. The increasing block tariff is aimed at punishing higher water consumers through pricing. Under this tariff structure, the volume of water consumed falls within predetermined blocks. Each block has a given range of the volume of water but also a specific price of water per unit volume. The first block has the lowest price of water per unit volume because it has the lowest level of water consumption. The second block has higher price per unit volume than the first but lower than the third. This progression of volume of water within each block and prices per a given unit volume continues to the last block.

In Klipheuwel, the first 6,000 litres of water constituted free basic water. This block is "zero" rated. In other words, the first block was not charged. Starting from the second block and its succeeding blocks were charged on an escalating tariff based on the volume of water consumed.

1.4.2 Data gathering

Self-administered questionnaires were used to collect quantitative data. Focus group discussions (FGD) and observations were used to collect qualitative data.

1.4.3 Sampling

The selection of Klipheuwel as the study area was purposively made, as a pre-paid water metering pilot project was implemented there. Due to the relatively small community, all the 138 households were selected. The FGD, however, involved eight people who were purposively selected based on their ability to speak English.

1.4.4 Data analysis

A Statistical Package for Social Science (SPSS) package and Microsoft Excel were used to analyse quantitative data. The data was coded first, entered, and then analysed. Qualitative

data was analysed manually by transcribing, and then categorised to establish the emerging issues and themes. These themes have been presented as narrative scripts and quotations.

1.5 Significance of the study

The study attempts to highlight pre-paid meters as a water resources management instrument in the administration of water supply. Drawing on lessons from Klipheuwel, the study determines whether pre-paid water meters are an appropriate management instrument in urban water supply service.

Given that the pre-paid water meter is a relatively new innovation, limited literature on the subject is available. The study was motivated and designed to fill this gap in the literature. The findings of this study could add another dimension to the understanding of pre-paid water metering technology in academic and water resource management spheres.

The study also attempts to locate pre-paid water meters, as new technological innovations, within the broader context of Integrated Water Resources Management (IWRM).

1.6 Scope of the study

The scope of this research was restricted to eliciting the social responses of domestic water users to pre-paid water meters, in explaining why the Klipheuwel pilot project was abandoned. It does not address the technical and administrative elements associated with pre-paid water meters.

1.7 Organisation of chapters

This thesis is divided into five chapters. This chapter introduced the thesis by providing the background information to the study. It also discussed the research problem, research aim and research objectives, research questions and research hypotheses. A brief overview of research methods as well as the significance and scope of the study are also addressed.

Chapter two will summarise two books criticising cost recovery and the use of pre-paid water meters. The chapter then addresses the implementation of pre-paid water meters and the problems associated with the use this technology. It also includes a review of the literature on

the relationship between pre-paid water meters and users' attitudes; free basic water; cost recovery; and water conservation.

Chapter three presents the conceptual framework and research methods for this study. The chapter starts making a clarification of the concepts used in this thesis. It then presents the conceptual framework for the study. The chapter concludes by illustrating data collection methods; selection of study units; ethical consideration; data analysis tool; validity of the instruments and sources of errors for the study.

Chapter four analyses and discusses the empirical results. The quantitative results are presented as tables, charts, graphs and maps. Emerging patterns are explained with regard to water user's attitude, access to free basic water, paying for water and water conservation. Qualitative results are presented as descriptive narration, explaining why the pilot project was abandoned.

Finally, in chapter five, the study findings are synthesised. The results are also elaborated on, and implications of the study are assessed. The chapter concludes by identifying areas for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Pre-paid water meters emerged in post-apartheid South Africa in response to management problems associated with water services. As indicated in the previous chapter, three key reasons have played a decisive role in the introduction and implementation of pre-paid water metering projects in South Africa. These reasons are (i) first, the need to administer free basic water in a cost-effective manner, (ii) second, the need to recover the costs of providing water in order to ensure financial sustainability, and (iii) third, growing concerns over water scarcity which required the conservation of water. Pre-paid water metering was perceived as the panacea to these water resource management challenges. Surprisingly, pre-paid water meters have mainly been implemented in low-income communities, where cases of non-payment for services are common.

This chapter first summarises issues related to pre-paid water meters and cost recovery in the two books that guided this study. The chapter then outlines water service delivery in South Africa, and pre-paid water metering technology. Subsequent discussions include the general user's attitude towards pre-paid water meters; the basic needs approach (through free basic water); cost recovery (promoting payment); and finally water demand management (encouraging water conservation).

2.2 Book Summaries

2.2.1 Cost recovery and the crisis of service delivery in South Africa

(From "Cost Recovery and the crisis of service delivery in South Africa," edited by McDonald and Pape, and published in 2002 by Human Sciences Research Council – Cape Town).

Through the provision of both theoretical and empirical evidence, the book focuses on cost recovery in South Africa. The advent of pre-paid water meters is generally viewed to be due to the change from a welfare to a market-oriented approach in service delivery. Consequently, pre-paid water meters are viewed as a cost recovery tool in low-income communities. The

emergence of cost recovery is considered to be a result of the introduction of neoliberal or market principles in the provision of services and propelled by globalisation. The general picture painted by the book is that the application of cost recovery in the delivery of municipal services has extensive social implications for low-income water users. Since affordability determines access to services, the application of cost recovery and the implementation of pre-paid water meters undermine access to an essential service. Consequently, cost recovery has had far-reaching negative impacts on the low-income water users in South Africa. In an effort to ensure cost recovery without contravening the constitutional right to access water, free basic water services were introduced.

According to various authors, non-payment for municipal services in South Africa emanate from the problems of affordability and the sub-standard quality of services. By implication, the authors argue against the notion that non-payment in South Africa is due to a 'culture of non-payment' stemming from payment boycotts during the apartheid era. They further view the application of cost recovery to entrench the magnitude of poverty and inequalities in access to municipal services. The succeeding paragraphs present summaries of the articles in the book relevant to this study.

The first article by McDonald (2002) introduces the theory of cost recovery and its practical application in South Africa. Theoretically, cost recovery has been justified by fiscal, moral, environmental and commercial arguments in South Africa. However, the manner in which cost recovery has been applied triggered major social problems, particularly among low-income service users.

The article by Ruiters (2002) discusses experiences in the application of cost recovery measures in Fort Beaufort, Queenstown and Stutterheim. The author argues that the commodification of basic services and the introduction of cost recovery have encouraged local authorities and politicians to work against the community that they represent. At the same time, it has damaged the cordial relationship between communities and local governments, because local authorities use stringent cost recovery approaches such as the disconnection of water services. Therefore, pre-paid meters have been introduced in some places to mask the disconnection of water services and its corresponding consequences.

Khunou (2002) maintains that service users consider cost-recovery and the disconnection of services as an infringement on their rights. The author further argues that under cost recovery citizens' rights are confused with consumer rights, implying that water users can only exercise their right to access the services if they can afford to pay for the services. Those who cannot afford to pay are therefore excluded.

Deedat and Cottle (2002) highlights the direct correlation between the implementation of pre-paid water meters and the outbreak of cholera in Madlebe, Kwa-Zulu Natal. The article states that the implementation of pre-paid water meters was associated with high and unaffordable registration and connection fees. The pre-paid water metering system would frequently breakdown. These factors left people without water for extended periods. Consequently, the low-income water users were compelled to use traditional alternative sources of water supply that were often unsafe.

Xali (2002) argues that affordability is the major constraint leading to non-payment of municipal services. In a study conducted in Khayelitsha, cost recovery through service cut-offs caused poor people to stay without essential services for prolonged periods. The communities responded to water disconnection by re-connecting the services illegally. With the prevailing levels of poverty, Xali (2002) believes that cost recovery is unlikely to succeed in South Africa. Furthermore, the author predicts an increased intensity of the social struggles against cost recovery policies.

Deedat's (2002) study established that pre-paid water meters in the Northern Cape Province had reported numerous technical problems. In Lennertsville, most water users could not afford to purchase water. The system did not allow water users opportunity to negotiate for the services in instances when it was unaffordable. As a result, most people did not use pre-paid water meters.

2.2.2 The Age of Commodity: Water privatisation in Southern Africa

(From "The Age of Commodity: Water privatisation in Southern Africa" edited by McDonald and Ruiters, and published in 2005 by Earthscan - London).

The book provides a theoretical discussion of the privatisation and commercialisation of water within a Southern African context. In the first chapter, McDonald and Ruiters (2005) give an overview of privatisation and commercialisation. They argue that, to varying degrees, the privatisation of water services is the transfer of ownership and/or decision-making responsibility from the state to private organisations. It represents the social intensification of capitalism. The book maintains that privatisation of water services threatens access among poor domestic users. Apart from privatisation, the corporatisation of water services also threatens equitable access to water. Corporatisation is a form of public service reform in which publicly owned services are operated as private businesses. Privatizing or commercializing the public service sector is primarily driven by the financial crisis of the state, the liberalisation of markets and the creation of new areas of capital investments. Water commodification becomes an important element in ensuring the success of operating water services as a business.

Through case studies, the book also considers the implications of these reforms on low-income domestic water users. An article by Flynn and Chirwa (2005) states that the commercialisation of water services is unconstitutional in South Africa. The application of a business model in the provision of water services limits the constitutional rights of some citizens. The poor are largely the victims of this constitutional breach, since they may not be able to pay for water services. The article concludes that cost recovery and any form of water disconnection is undesirable and perpetuates inequalities in water access. It considers the application of pre-paid water meters to be unconstitutional, and should therefore be outlawed.

Harvey (2005) views pre-paid water meters as a new technology for "managing" poor people. With empirical evidence from Johannesburg, the article maintains that pre-paid water meters emerged following privatisation. The meters were introduced as water demand management tools to control water consumption. However, pre-paid water meters impose enormous hardships on poor people by individualising problems of water access in low-income households. Moreover, it acts as a punishment to those unable to constantly purchase water.

Because of the problems associated with pre-paid water meters, the low-income communities in Johannesburg have greatly opposed these meters.

Smith *et al* (2005) analysed the use of market-based approaches to the provision of water services in Nelspruit, South Africa. Their results show that privatisation is associated with an increase in water tariffs, as well as the use of draconian or stringent cost recovery approaches against defaulters. They conclude that privatisation may improve water infrastructure, but it may not result in affordable and sustainable water services for the poor.

In a study conducted in Pretoria, McInnes (2005) established that corporatising water services is likely to exacerbate the inequalities in access to water. According to the article, the application of cost recovery measures such as pre-paid water meters conflicts with government's commitment to ensure equitable access to water. The affordability of water services can only be attained if profit-making cost recovery is abandoned.

According LaRRI (2005), water privatisation in Namibia is considered to be a new form of apartheid. Water cut-off and the use of pre-paid water meters that followed corporatisation is unconstitutional and an unacceptable mode of debt collection. Corporatisation of water services has intensified the use of strict credit control measures. Low-income water users in Namibia are opposed to pre-paid water meters. The article concludes that water should be treated as a human right, and that government should abandon the disconnection of water services and the use of pre-paid water meters. Instead, it should provide free basic water to the poor.

In summary, the two books argue that the introduction of pre-paid water meters is a result of the privatisation and commercialisation of water services. The shifts from a state-owned operator to a private operation have resulted in far-reaching negative implications among low-income water users. The use of business management approaches in the operation of essential services is not only unconstitutional, but poses enormous problems for the poor. Furthermore, using pre-paid water meters as a cost recovery approach is highly opposed by the poor, and may not be attained in a highly impoverished area.

2.3 Water service delivery in South Africa

Pre-paid water meters in South Africa emerged following the commercialisation of water services after 1994 (McDonald and Ruiters, 2005, McDonald and Pape, 2002). Commercialisation refers to the introduction of market practices in the operation and decision-making process in the provision of water services. It involves treating water as a commodity, with water services operated as a business unit. In this regard, the previously state-owned and -operated water utilities are privatised or corporatised.

The introduction of market principles in the provision of water services may have positive impacts on the quality of services, improvements in the infrastructure and the environment (Dore *et al.*, 2004). It may, however, have negative social effects. According to Loftus and McDonald (2001) the poor have been trapped in a cycle of water disconnection and debt under marketised water services. Notwithstanding the negative impact of commercialisation on low-income earners, neoliberal or market principles have still been introduced in South Africa. This occurred without regard to the fact that the country is characterised by deep-seated socio-economic inequalities between the rich and the poor (Roberts, 2005; Wilkinson, 2004: 719; Turok and Watson, 2001); South African society is polarised along racial lines - a legacy of apartheid.

Water service delivery also follows this socio-economic schism (Hemson and Owusu-Ampomah, 2005). Wealthy South African suburbs (usually occupied by ‘white’ people) enjoy better services, while townships (dominated by ‘black’ people) receive middle to low quality services. Corresponding disparities are also reflected in infrastructure investments within the water service sector. Jaglin (2004) observed that historically there has been under-investment in water infrastructure within poor townships. Under-investment in water infrastructure has crippled the efforts of water services providers to adequately maintain the system. Consequently, water infrastructure in poor communities has been left in a dilapidated state. In the wealthy suburbs, the water infrastructure is well maintained. Furthermore, Khosa (2002) dismisses official claims that there have been significant improvements in service delivery in the post-apartheid South Africa. This suggests that the South African government still requires to make a great effort to decrease the existing disparities and backlog of water service delivery.

In order to address inequalities in access to water, the South African national government launched the Free Basic Water Policy in July 2001 (Mackay, 2003: 70). The policy was ushered in by the provisions within the new constitution, which was approved in 1997. The constitution recognised that access to potable water is a basic human right for every South African citizen. The Free Basic Water Policy was therefore tailored at minimising the problem of unequal access to water in order to safeguard this constitutional requirement.

The policy, however, created a new challenge of making water services institutions financially sustainable. This is because free basic water policy overshadowed cost recovery (Peters and Oldfield, 2005; Alence, 2002). In the Cape Metropolitan Area (CMA) for example, free basic water policy was implemented at a time when there were already financial problems. A budgetary officer in the CMA council expressed concerns over this situation by lamenting that the council "*… is not in a healthy financial situation due to badly-designed tariff structures, accumulated unpaid accounts and unsustainable management of resources*" (Jaglin, 2002: 239).

Apart from cost recovery problems, the literature suggests that South Africa is also battling with water scarcity. The CMA for example experiences enormous water shortages (Saayman and Adams, 2002). The current water supplies are failing to cope with the burgeoning demand for water. These management challenges possibly explain the introduction of pre-paid water meters in South Africa.

2.4 Pre-paid water meters

Pre-paid water meters have emerged following the redefinition of the management philosophy that came with privatization (Markou and Price, 1999). The process of privatising and/or corporatising water supply services in South Africa begun in 1994; just three years later, in 1997, the first pre-paid water meters were introduced (Van Zyl, 2004). Some of the places where pre-paid water meters were implemented include Moddersprui t (North West Province), Masakhala (Eastern Cape), Khutsong (Gauteng), Koffiefontein (Free State) (Tse Water Services, 2001).

In South Africa, it appears that the era of privatisation impelled the need to overcome the high levels of non-payment for water services in low-income communities. This is demonstrated

by the implementation of pre-paid water meters primarily in low-income areas (McDonald and Pape, 2002; Drakeford, 1998). In addition, Jaglin (2002) and Tewari and Shah (2003), further contend that the implementation of self-disconnecting pre-payment technology has been influenced by the need solve problems associated with service provision to low-income communities. Such problems include non-payment, debt, servicing large numbers of small water users, illegal connections and lack of permanent addresses.

More apparent in the literature, is that cost recovery is the primary aim for the installation of pre-paid meters (McDonald, 2002; Marvin *et al.*, 1999a). The emphasis to recover costs is primarily driven by neoliberalism (Dore *et al.*, 2004; Van Rooyen, 2002). Here, market principles guide management and the general operation of water services (McDonald, 2002). The management quagmire of applying cost recovery in the provision of essential services is that it has its inherent negative social effects, but remains the best approach for ensuring the sustainability of water services.

As a cost recovery device, it is therefore not surprising that pre-paid water meters have been mainly installed in poor communities where affordability is the main concern (Bakker, 2005). However, pre-paid water meters in poor communities imply that a lack of money translates to no access to water. The negative social effects resulting from lack of access to water has initiated public resistance to the privatisation of essential services (Hall *et al.*, 2005). At the centre of this resistance are issues of pricing and profit-making imperatives of privatization, which seem to have unpleasant effects on poor people. For example, Dore *et al.* (2004) asserts that privatisation led to the intensification of disconnection of water supply for nonpayment in the United Kingdom and France. In addition, experience from other areas demonstrates that there is social hostility against pre-paid water meters as a cost recovery tool. In the United Kingdom for example, such hostility culminated in the prohibition of pre-paid water meters in 1998 (Drakeford, 1998).

The manner in which cost recovery has been enforced seems to have influenced the attitude of water users towards the commercialisation of water services. For example, the disconnection of water supply has generally been politically explosive in poor communities and in many cases it has generated revolts in South African townships (Smith, 2004). The implementation of pre-paid water meters to allow for the automatic disconnection of those who cannot afford to pay for water services may influence the attitudes of poor people towards using of these

meters. The following section reviews the literature on the attitudes of water users to pre-paid water meters.

2.5 Attitude towards pre-paid water meters

Literature that explicitly explores the attitudes of domestic water users towards pre-paid water meters is limited. As a result of this shortfall, the nature of peoples' reaction to the introduction of the pre-paid water meters has been examined to determine their experiences and attitude towards this technology – this is mainly because the attitude of a person influences the actual behaviour of that particular individual (Luzar and Cosse, 1998). In general, it seems that the reaction of people towards the use of pre-paid water meters has either been positive or negative. The succeeding sections elaborate the attitude of domestic water users toward pre-paid water meters, in order to understand the general experiences of domestic water users. This may be useful in determining whether the application of pre-paid water metering technology will be implemented throughout South Africa in the future.

2.5.1 Positive attitude

Given that pre-paid water meters automatically discontinue water supply in the event of non-payment, it is expected that literature emphasising a positive attitude towards pre-paid water meters may be lacking. Marah *et al.* (2004a), however, indicates that a nation-wide survey conducted in South Africa revealed that the majority of the respondents had a positive attitude towards pre-paid water meters. In addition, Johannesburg Water (2006) also claims that most water users in Soweto (South Africa) prefer to use pre-paid water meters. The people preferred using pre-paid water meters because its implementation was accompanied by improved water services. Furthermore, the use of pre-paid water meters was viewed as a means of conserving water. This suggests a positive attitude towards the use of pre-paid water meters. These claims are in agreement with Goldblatt's (1999) who maintains that improvement in services promotes willingness to pay. Jorgensen *et al.* (2001) also insists that water users are more willing to pay for the protection of the environment.

Considering the range of the articles reviewed, discussion with regard to the positive attitude towards pre-paid water meters is limited. There is also no indication whether water users prefer this technology because of its inherent benefits. Such benefits may include: improved knowledge of water use; proper budgeting; convenience; not disconnection/reconnection cost;

no deposits; and empowered water users (Tewari and Shah, 2003). In contrast, the negative attitude towards pre-paid water meters is more prevalent in the literature. This tendency questions on whether it is a universal truth that people disapprove of pre-paid water meters.

2.5.2 Negative attitude

In contrast to the lack of literature describing a positive attitude towards using pre-paid water meters, a number of scholars demonstrate the negative attitude towards using this technology (Deedat and Cottle, 2002; OFWCC *et al.*, 2004; CAWP, 2004; Simes *et al.*, 1993). Simes *et al.* (1993), for example, predicted that the introduction of pre-paid meters would attract antagonism from some segments of the community (particularly the poor segments). In Orange Farm (South Africa) the Orange Farm Water Crisis Committee *et al.* (2004) also established that water users did not approve of pre-paid water meters. What could possibly explain this perception? Is it the question of affordability, or could other factors explain this.

Higgs and Worthington (2001) provide a possible explanation of why people disapprove of metered water supply, and by implication, pre-paid water meters. They argue that domestic water users do not prefer to use a volume-based water billing system. In other words, people prefer flat water tariffs to those based on the volume of water consumed. Since pre-paid water meters employ a volume-based water tariff, it is anticipated that water users may be unwilling to use these meters. Affordability could account for the non-preference of people to use pre-paid water meters; however, such an explanation may not provide a fair and general picture of the attitudes. It may therefore be useful to transcend our projection beyond such simple conclusions, by focusing on the underlying causes of such attitudes.

Deedat and Cottle (2002: 91) come closer to explaining this negative attitude by highlighting some of the problems associated with pre-paid water meters. They argue that the experiences in Madlebe (KwaZulu-Natal) demonstrate that pre-paid water meters have key problems – these include: high water prices; health risk; persistent breakdowns; absence of a backup system; and failure to respond swiftly to system breakdowns. The community's frustrations with these problems resulted in opposition to the use of pre-paid water meters.

The Coalition Against Water Privatisation (2004) argues that inadequate stakeholder consultation and unpleasant experiences with pre-paid electricity in Phiri (Soweto) caused

negative attitudes towards pre-paid water meters. This argument conflicts with the claim made by Johannesburg Water (2006), that people prefer pre-paid water meters. Such contradictions may be explained by looking at the interests of these two sides. For example, Johannesburg Water, as the implementer of the project, is expected to claim that the community prefers to use pre-paid water meters because it would like to see its initiative succeed. On the contrary, one would expect the Coalition Against Water Privatisation to argue that people do not like pre-paid water meters - they are arguing from an anti-privatisation background, and are therefore likely to oppose anything to do with privatization.

Tewari and Shah (2003) support the argument by the Coalition Against Water Privatisation (2004) that, in Soweto, political influences seems to influence the negative attitude towards pre-paid metering technology. They argue that in highly politicised places, unwillingness to use pre-paid meters is largely driven by the societal fear of relinquishing political power. Such political power provides the community with a bargaining leverage. This might be a plausible explanation, considering South Africa's rich political history of reducing social inequalities. The negative attitude and opposition to pre-paid water meters, however, may also have undeniably been influenced by some politically explosive issues such as disconnection of water supply and the associated social repercussions.

It is interesting that most of the scholars claiming that people are disinclined towards pre-paid water meters are in favour of providing free services. They, however, do not provide an alternative option to cost recovery. Where alternatives are not provided, one would assume that maintaining either volume-based rate (associated with conventional water meter) or flat-rate is better. Regardless of whether one is using a pre-paid water meter or a conventional water meter, water should still be paid for. In this regard, the use of either pre-paid water meters or conventional water meters may have little influence on people's attitudes, since water is to be paid for either way. The major source of hostility against pre-paid water meters may stem from the automatic disconnection of water supply. It could also result from the new political relationships between the water users and the services provider, fashioned by the use of pre-payment technology itself (Marvin *et al.*, 1999b). The affordability of water services is an important element, but how can one overcome the problem of affordability of water services where a great proportion of the population is poor.

2.6 Basic needs approach

The failure to meet the basic human water needs is considered to be among the greatest challenges toward sustainable development (Postel, 2003; Gleick, 1998). The basic needs approach is a water planning and management approach that aims to meet basic human water and sanitation needs (Gleick, 2000: 131). It also aims to ensure that the 'life-line' water services are affordable to all. Most scholars support the basic needs approach by affirming access to water as a basic human right (Langford, 2005; Klawitter and Qazzaz, 2005; Razzaque, 2004: Gleick, 1998). This does not imply that paying for water should be neglected completely (Langford, 2005). Among the supporters of water as a human right, only Gleick (1998) prescribes and quantifies the volume of water sufficient to meet the basic human needs.

According to Gleick (1998: 496), 50 litres per person per day (i.e. 5 litres for drinking; 20 litres for sanitation; 15 litres for bathing; and 10 litres for food preparation) is the minimum requirement to sustain life. However, Klawitter and Qazzaz (2005) acknowledged that despite international affirmation of the right to water, implementation has been a major challenge. This could explain why the South African government has not fully attained universal access to free basic water (DWAF, 2006).

Most of the scholars who advocate the basic needs approach, except Gleick (2000), place more emphasis on the importance of providing and safeguarding the right to water access. They neglect other dimensions of water management. They do not recognize or show the interconnections among meeting basic needs, institutional sustainability and ecological integrity. It is generally agreed that meeting basic human water needs is very essential for achieving sustainable development; equally important is safeguarding the institutional sustainability and ecological integrity on which the sustainability of providing basic water may depend (Postel, 2003). For this reason, this study provides a broader view of pre-paid water meters as a water resource management device. The objective is to harmonise access to water, equity, and sustainability. The preceding section has concentrated on the theoretical understanding of the basic needs approach. Based on this understanding the discussion will now focus on its application.

2.6.1 Free basic water

Free basic water is a concept that is used to address the legal requirements of satisfying basic human water needs. In this study, the term free basic water is understood as the volume of potable water that the government supplies free of charge to domestic water users. Each household with a connected water supply is entitled to 6 000 litres (DWAF *et al.*, 2003: 68). The amount of free basic water is based on a daily per capita consumption of 25 litres in a household of 8 people.

A number of authors illustrate how the South African legislation supports the human right to water (Flynn and Chirwa, 2005; Kidd, 2004; Stein and Niklaas, 2002); thereby supporting the basic needs approach. Much of the debate on water legislation is concerned with issues of social equity. However, little or no emphasis is placed on legislative provisions that relate to sustaining water services and water needs for ecosystems. Only Flynn and Chirwa (2005) acknowledge that the Municipal Systems Act of 2000 and the White Paper on Water Policy of 1997 make provision for full-cost recovery. Thus, the free basic water aimed at promoting access and equity should not be implemented at the expense of financial and ecological sustainability. This is a major challenge facing local governments in South Africa today.

The following section explores the literature related to the research question: What was the impact of pre-paid water meters on users' access to free- basic water?

2.6.2 Free Basic Water Policy

The free basic water policy was launched in July 2001 (Mackay, 2003: 70) because of the government's commitment to ensuring equitable access to water. The policy was aimed at reducing inequalities in access to water, a legacy of apartheid era. Peters and Oldfield (2005) have established that free basic water policy has failed to reduce inequalities in access to water when implemented within a framework of cost recovery. Likewise, the policy fails to enhance the financial capacity of municipalities to operate sustainably.

Aside from ensuring equitable access, it appears that the policy depends on the financial sustainability of institutions responsible for water services. In order to address inequalities of access to water, the first step should be to ensure financial sustainability of the water services institutions. Substantiating this argument, Zehnder *et al.* (2003) and Savenije and Van der

Zaag (2002) demonstrate that providing free services weakens the capacity of water institutions to maintain the infrastructure. The resultant collapse of the water system due to the lack of infrastructure maintenance forces poor people to obtain expensive water from vendors, or use unsafe water sources. Because the rich can afford to pay for the services, they are able to enjoy a good supply of safe water at a reasonable price. This widens the gap between the rich and the poor people. This implies that not only does Free Basic Water Policy threaten the financial sustainability of water services; it also defeats its primary long-term objective of ensuring water access and equity.

Razzaque (2004) views free basic water and cost recovery to be in conflict with water resources management goals; however, cost recovery and free basic water are actually complementary and interdependent goals within IWRM. Without cost recovery, the local governments would fail to provide free basic water primarily because of financial constraints.

2.6.3 Pre-paid water meters and Free Basic Water Policy

The link between prepaid water meters and Free Basic Water Policy has not been extensively researched. However, some research does point to a correlation between the two.

Alence (2002) and Marah *et al.* (2004b) present a useful starting point for understanding the link between pre-paid water meters and Free Basic Water Policy. These authors argue that Free Basic Water Policy has undermined cost recovery efforts in South Africa. Alence (2002) further states that the policy had three important implications. The Free Basic Water Policy: (1) created the need for the local governments to re-examine and adjust cost recovery approaches; (2) strengthened the need to recover the costs to domestic users consuming more than the basic water; and (3) made the metering of domestic water and the use of increasing block tariff structures necessary. Pre-paid water meters offered a solution to these problems.

With Free Basic Water Policy in place, it seems that the local governments not only lost a sizable source of income, but also had to generate additional income to finance the provision of water services. The latter task is probably more difficult considering the prevailing high level of non-payment, particularly in low income communities (Smith, 2004; Smith and Hanson, 2003). A new system was necessary to efficiently measure consumption, “zero rate” the first free block, and promote cost recovery from consumption above the basic water. Pre-

paid water meters are ideal for these tasks since the meters are capable of executing multiple management functions (Marvin *et al*., 1999b).

Marah *et al.* (2004a) expresses that the policy directed local governments on where pre-paid water meters should be implemented. Since the policy justified cost recovery for water consumption above the basic water use, the utilisation of efficient tools, such as pre-paid water meters, were mandatory in places where the collection of payments proved to be difficult. This argument therefore supports the installation of pre-paid water meters in low-income communities.

There is little doubt, as it have been noted, that pre-paid water meters were intended to provide free basic water, while simultaneously promoting cost recovery. However, it would be interesting to know is whether pre-paid water meters ensured access to free basic water. Hardly any information on this topic can be found in literature. This supports the path taken in this study to confirm whether pre-paid water meters protected access to free basic water or not. Nonetheless, certain inferences can be drawn by looking at criticisms of the Free Basic Water Policy.

2.6.4 Criticism of free basic water

Equity is a key element if water is to be treated as an economic good within the context of IWRM. Water pricing should be undertaken only after taking into account water needs of the poor. In ensuring equity in water pricing, Savenije and Van der Zaag (2002) suggested four conditions that should be met. Water pricing should: (i) prevent imposing unnecessary burden on the vulnerable groups; (ii) be reasonable and affordable to achieve full cost recovery; (iii) be higher to those who are able to pay higher prices in order to cross-subsidise the poor people; and (iv) provide for free/subsidised ‘life line’ to poor people or charge them a nominal fee.

It is with this background that this section discusses the criticisms directed at pre-paid water meters. This is undertaken in an effort to establish the effect of water pricing through pre-paid water meters on water users in the presence of the Free Basic Water Policy. The question as to whether water pricing under pre-paid water meters meet the criteria above is discussed.

Most of the criticisms of the Free Basic Water Policy question the adequacy of the free basic water in addressing the equity problem. McInnes (2005); Kidd (2002); and Stein and Niklaas (2002) agree that, by international standards, 25 litres per person per day is inadequate in meeting the basic human water needs. Kidd (2002) further adds that standardising free basic water to 6 000 litres per household fails to adequately meet the requirements of households consisting of more than eight members. Sawkins and Dickie (2005) and Smith and Green (2005), contend that the implementation of welfare policy is not a solution to the problem of affordability of water services. The implementation of Free Basic Water Policy in the presence of pre-paid water meters was also found to be inadequate to meet the basic household needs in Stretford (Extension 4), in Orange Farm (Fiil-Flynn and Naidoo, 2004).

Perhaps the most surprising and interesting criticism is that the Free Basic Water Policy fails to eradicate inequalities and affordability of water services (Peters and Oldfield, 2005). It fails to extricate poor households from water debt, cutting-off supply and restricted water supply. This is particularly true when the policy operates within a cost recovery paradigm, suggesting that pre-paid water meters as a cost recovery tool cannot solve the equity problem. Consequently, using this technology is likely to exert unnecessary burden on the poor. The Coalition Against Water Privatisation (2004) reports that water prices under pre-paid water meters were not affordable for the poor in Phiri (Soweto). The report does not tell us though, whether or not, that water prices were affordable prior to the installation of pre-paid water meters.

These arguments imply that the use of pre-paid water meters in low-income communities acts against the equity principle upon which the free basic water policy is based. However, from a critical point of view one would note that the policy to some extent attempts to reduce inequalities to water access. Besides this, the government could not simply increase the free basic water to 50 litres per person per day without considering the long-term financial sustainability of water services institutions. Failure to consider the sustainability of water services institutions may, in the long-term, undermine the provision of free basic water services. Finally, it is not mandatory that countries should abide by the international standards of basic water. Presently, few countries can claim to have emulated South African efforts of providing free basic water. Therefore, the step taken by the South African government could be viewed as a major movement towards equality in water access.

These criticisms suggest that with pre-paid water meters, Free Basic Water Policy cannot address the problem of equity. Instead, pre-paid water meters will increase inequality, and therefore work against the ethics of IWRM.

2.7 Cost recovery

The concept cost recovery in this study has been adopted from McDonald (2002) and interpreted as an action of retrieving, in part or in full, the costs associated with the provision of services. Cost recovery is not viewed as a means of ensuring economic efficiency by pricing water at its economic price but as a means for ensuring financial sustainability of water services institutions (Savenije and Van der Zaag, 2002). Paying for water is thus an important element of cost recovery and conforms to the principles of IWRM.

It is with this background that this section examines the relationship between cost recovery and pre-paid water meters. It addresses the research question: What was the influence of pre-paid water meters on the attitude of water users paying for water services?

2.7.1 Institutional financial sustainability

In the literature, it seems that the aspect of ensuring sustainable water service provision is accepted by most, if not all, researchers in this field. Promoting this through water pricing is a much contested issue, especially where the ability to pay is lacking. Yet, the sustainability of water services provision is largely dependent on cost recovery (Savenije and Van der Zaag, 2002). Cost recovery through proper pricing is seen to be the best approach to improving water services (Merrifield and Collinge, 1999; Mehta and Pathak, 1998). Despite the fact that paying for water has become highly contested with the increase of the consciousness of basic needs, Page (2005) argues that paying for water is not new and remains very important to the sustainability of water services.

Like in other developing countries, cost recovery in South Africa has not been easy, particularly in low-income communities (Smith, 2004; Smith and Hanson, 2003; McDonald and Pape, 2002; Booysen, 2001). For example, by 2001 the estimated debt to the City of Cape Town was R460 million, and was increasing at the rate of R50 million per annum (Jaglin, 2004: 242). Water services cannot be sustained under such conditions. Why do water users not pay for water? – an answer to this question may initiate a path toward identifying

appropriate intervention measures. The subsequent section discusses non-payment for water services in South Africa.

2.7.2 Non-payment

Two views explain non-payment for water services in South Africa. The first explains non-payment for services in terms of a 'culture of non-payment'(Breier and Visser, 2006). This 'culture' is viewed to be payment boycotts that are directed against the quality of services and stringent cost recovery measures. This emerged from payment boycotts of municipal services during the apartheid era, and directed against illegitimate local authorities. This is the perspective of the water services institutions, and therefore ignores certain important social dynamics.

Whether this interpretation fully explains non-payment for water services is debatable. The argument, however, explains non-payment from an assumption that people have the ability to pay. This is questionable considering the high levels of poverty where issues of non-payment for water services are common. Basing cost recovery on this interpretation may be in line with the financial sustainability objective of IWRM, but it may a work against the equity criterion.

The second view is that the affordability of water services is a primary factor that causes the non-payment of services in South Africa (McDonald and Pape, 2002; Booysen, 2001; Smith, 2001). According to Booysen (2001: 695), nothing explains non-payment better than the inability-to-pay in low-income communities. Water users simply fail to pay for water because they cannot afford to. Affordability is argued from the water user's perspective, and focuses on access and equity. This explanation does not totally neglect the element of financial sustainability in water pricing. The problem, however, is that it fails to clearly define a price at which water is affordable whilst also adequate to ensure financial sustainability. Pricing of water that harmonises social, economic and environmental objectives are quite complex and difficult to establish (Howe, 2005; Garcia, 2005).

Using affordability, as the basis of management decisions may not be practical since income alone does not influence non-payment (Ntengwe, 2004; Kayaga *et al.*, 2003). IWRM requires decision makers to have a holistic view of water problems and possibly utilise both views in understanding non-payment in South Africa as a basis of an intervention. This study explores

the effectiveness of pre-paid water meters in blending the equity and institutional sustainability principles.

Equally important to understanding non-payment, is examining how local authorities have dealt with the issue. Of relevance to this discussion is the disconnection of water supply as an approach of inducing payment.

2.7.3 Water supply disconnection

Historically, implementing stringent credit control measures has been a conventional way of resolving non-payment in South Africa (McDonald and Ruiters, 2005; Marah *et al.*, 2004b; Smith, 2004; Smith and Hanson, 2003). These measures include sanctions such as warnings, disconnection, legal processes, eviction (Smith and Hanson, 2003: 1533). However, non-punitive measures such as the Masakhane campaigns have also been used as well. In most of the articles reviewed, it seems that the disconnection of water supply has been the most common cost recovery strategy.

Marah *et al.* (2004b) and Alence (2002) view water supply disconnection to be an antidote to the problem of non-payment and thus cost recovery. As there are major shifts in South African water policy, the sustainability of municipal services becomes more important. Encouraging full cost recovery through the application of service restrictions may be necessary. This may only be true when the financial sustainability of water services institutions is threatened.

2.7.4 Pre-paid water meters and cost recovery

McDonald (2002: 19) identifies a pre-paid water meter as the ultimate cost recovery tool. This device, unlike conventional water meters, can perform multiple functions. A pre-paid water meter is capable of both measuring the volume of water used, and persuading water users to pay for water. Some of the management functions a pre-paid water meter can perform include: promoting payment (Drakeford, 1998); recovering debt (Dore *et al.*, 2004: 45); cutting administrative costs (Jaglin, 2002: 238); and transforming political relationships between the service institution and water users (Harvey, 2005; LaRRI, 2005; Marvin *et al.*, 1999a; 1999b).

Since the focus of this study is on the role of pre-paid water meters in cost recovery, this section will look at the first two management functions. Savenije and Van der Zaag (2002) maintain that water pricing should enable water service institution to be financially self-sustaining in terms of operation and maintenance. The prices should allow the institutions to be financially autonomous, to operate sustainably, to achieve full cost recovery, and to allow savings for future investments. Even though financial sustainability is the main aim of water pricing, it should not compromise the minimum water requirements for the poor. Where trade-offs are required, it is important to give the financial sustainability of the institutions the first priority. The next section explores the use of pre-paid water meters in promoting payment and the recovery of debt.

2.7.4.1 Promoting payment

In South Africa, like elsewhere in the world (see LaRRI, 2005; Drakeford, 1998), pre-paid water meters were introduced to address the problems of non-payment (Marah *et al.*, 2004a: 52; McDonald and Pape, 2002; Ruiters, 2002: 53). The researchers agree that pre-paid water meters are very efficient in promoting payment for water services, they fail to lay emphasis on this. Instead, most of these researchers only emphasise the negative social problems associated with the manner in which pre-paid meters enforce cost recovery. The argument on these negative social problems may be more applicable where water access and equity are key problems. However, this argument can not be applicable within a context where there is a welfare policy addressing inequalities (e.g. Free Basic Water Policy in South Africa). This study therefore attempts to establish some of the positive elements of pre-paid water meters.

2.7.4.2 Debt recovery

In the Northern Cape Province of South Africa (Deedat, 2002), like in the UK (Dore *et al.*, 2004), pre-paid water meters were intended to recover debt from defaulters. The accumulated debt of R7 million demonstrates the need to implement stringent cost recovery measures. Pre-paid water meters may be calibrated to deduct a certain percentage from every purchase of water to settle an accumulated debt. The efficacy of this system is somehow questionable, especially where low-income water users have accumulated enormous water debt over a prolonged period of time (Smith and Hanson, 2003). It is however clear that non-payment makes water institutions financially unsustainable. To argue that debt recovery is not important is as good as saying that sustainable water service is not important.

2.7.5 Criticisms of cost recovery

This section discusses a number of criticisms against the use of pre-paid water meters in recovering costs. It is important to note that these criticisms mainly revolve around equity of access to water.

Disconnecting water services for non-payment goes against the constitutional right to water access in South Africa (Kidd, 2004; Stein and Niklaas, 2002). Furthermore, using pre-paid water meters avoids the legislative procedural requirements under which disconnection can take place (Flynn and Chirwa, 2005). However, legislation does not prohibit water service providers to disconnect water supply for non-payment (Stein and Niklaas, 2002). Scholars arguing from a legal perspective criticises the use of pre-paid water meters since the meters are perceived to undermine access to water, which is protected by water legislation and the constitution.

Smith *et al.* (2005), views the failure to pay for water services in South Africa as a political problem of poverty and not a technical question. Therefore, using technical solutions (i.e. pre-paid water meters) to address a political problem (i.e. paying for water) is not viable. The ability to pay, and not willingness to pay, should be the main consideration in water service provision. Ignoring the importance of affordability by using pre-paid water meters has subjected South African low-income water users to similar hardships experienced in UK (Fiil-Flynn and Naidoo, 2004; Drakeford, 1998) and Namibia (LaRRI, 2005).

Deedat (2002) finds pre-paid water meters unsuited for recovering debt in low-income communities in South Africa, because most poor households in South Africa have large outstanding debt for services. This mode of cost recovery would only recover an insignificant proportion of the debt that rapidly accumulates with interest charges. Van Rooyen (2002) observed that the governments departments and businesses accumulate a huge debt with municipalities for services. This implies that directing cost recovery on the low-income water users' does not target the real defaulters.

In Namibia, pre-paid water meters encouraged illegal connections to the water supply (LaRRI, 2005). This also occurs in poor communities in South Africa (Smith and Hansom,

2003: 1542). Using pre-paid water meters may therefore encourage illegal connections, thereby defeating the purpose of the meters.

According to Xali (2002), the cost of implementing cost recovery outweighs its benefits. Cost recovery strategies such as pre-paid water meters are highly expensive, and lead to excessive spending of the local authorities on infrastructure. Haughton (2001) supports this argument by claiming that cost recovery is socially regressive, and has negative impacts on poor people. Speak (2000) also agrees that pre-paid technologies tend to marginalise poor people, and intensifies their financial burden.

The ability to pay is more important if cost recovery is to be meaningfully achieved (Ntengwe, 2004; Booysen, 2001). Where the means is lacking, no measure of persuasion or threats can make people to pay. Neither can the use of welfare policies solve the affordability problem (Miraftab and Wills, 2005; Sawkins and Dickie, 2005). Pre-paid water meters cannot be an appropriate cost recovery tool where people cannot afford to pay for water.

2.8 Water demand management

Demand management refers to the "development and implementation of strategies aimed at influencing demand, so as to achieve efficient and sustainable use of water (Savenije and Van der Zaag, 2002). Water Demand management (WDM) is also aimed at encouraging equity and ecological integrity. Water pricing, as an economic instruments for demand management, should therefore also consider equity and sustainability dimensions.

2.8.1 Environmental concern

The international community became conscious and concerned about the environmental issues through the World Conservation Strategy (1980) and the Brundtland Commission (1987) (Pigram, 1999). The United Nations Conference on Environment (1992) and Agenda 21 further renewed the need for sustainable utilisation of natural resources. However, it was the Dublin Conference on Water and the Environment (1992) that recognised that water is a finite, vulnerable and essential resource (Savenije and Van der Zaag, 2002). The conference called for the management of water through an integrated approach. Governments around the world, including South Africa, committed themselves to ecologically sustainable management of water resources. The National Water Act also promotes and protects environmental right

by allowing for 'ecological reserve' (cited in Stein, 2005). This commitment is reflected in the National Resource Strategy (DWAF, 2004).

It is internationally accepted that water is a scarce and vulnerable resource, with WDM viewed as a promising approach to sustainable utilization of water (Chen *et al.*, 2005; Mazungu and Machiriza, 2005; Frame and Killick, 2004; Gumbo, 2004; Gumbo *et al.*, 2003; Dube and Van der Zaag, 2003; Rothert, 2000; Dziegielewski and Baumann, 1992). The conventional supply-oriented water management approach is proving inadequate in dealing with the invariably increasing demand for water. Gumbo *et al.* (2004) and Al Radif (1999) argue that WDM is an integral component of IWRM. In South Africa, for example, water loss through various means account for an estimated 50% of the total urban water supply (Rothert, 2000). The current water supplies are also failing to cope with the burgeoning demand for water. As a result, the Cape Metropolitan Area incorporated WDM in the planning and management of water resources in the area (Frame and Killick, 2004; McKenzie *et al.*, 2004).

Water pricing is an economic instrument for controlling wasteful use of water (De Azevedo and Baltar, 2005; Hajispyrou *et al.*, 2002; Pigram, 1999). Liu *et al.* (2003) observed that water pricing is one of the most important non-structural WDM tools. This is based on the understanding that the demand for water is sensitive to water prices. There is, however, disagreement on the role of prices in WDM, especially for domestic water use.

2.8.2 Demand management and water metering

McKenzie *et al.* (2003) considers the proper metering of water supply to be a prerequisite for effective WDM. Consumer water meters are vital in fostering efficient water use and minimising water wastage. Gleick (2000) notes that in many cities around the world, inefficiency in water use emanates from a lack of metering and unsuitable tariff structure design. This explains why Tsinde Development Consultants' (2002: 10) and Zhang and Brown (2005: 470) view the power of water meters to promote efficient water utilisation as dependent on the influence of water tariffs on water consumption. In addition, Merrifield and Collinge (1999) looked at efficient water pricing in water scarce areas to encourage water conservation. Water metering and water pricing are therefore inseparable within the context of WDM.

While within the context of IWRM, water pricing is considered a WDM tool when equity and financial sustainability have been taken into account. Savenije and Van der Zaag (2002) contend that water pricing is considered a demand management tool only when water prices are reasonable, allows cost recovery, and forces large water users to conserve water. Increasing block tariffs are therefore advocated.

2.8.3 Pre-paid water meters and water demand management

Few researchers have studied the influence of prepaid water meters on water demand. From these researcher two schools of thoughts emerge – termed the advocates and the adversaries. The former perceive pre-paid water meters as promoting WDM, while the latter contend that pre-paid water meters do not influence WDM.

2.8.3.1 Advocates

Advocates maintain that smart meters such as pre-paid water meters encourage water users to conserve water (Marvin *et al.*, 1999a and 1999b). Within the energy sector, Hartway *et al.* (1999) observed that smarter meters (pre-paid meters included) are developed with a view to providing differentiated tariffs that would reduce wastefulness. In addition, the differentiated tariffs protect lower-income households; minimise high transaction costs; and discourage lack of payment. In other words, pre-paid water meters can contribute towards WDM. In addition, the protection of low-income users and minimisation of transaction cost are part of equity and financial sustainability respectively. However, what may be true within the energy sector may not be applicable in the water sector.

Merrifield and Collinge (1999) contends that appropriate water pricing policy promotes both water conservation in water scarce regions, and is a source of revenue to water services institutions. Marvin *et al.* (1999b) also proposes that pre-paid water meters have great environmental potential which are not fully exploited. The meters can be used for environmental applications such as: tariff management; load and flow profiling; load control; information provision; and network efficiency (Marvin *et al.*, 1999b: 111). Pre-paid water meters, for example, may allow for the use of multiple tariffs, with the aim of managing demand where there are water shortages. These environmental applications are not fully exploited mainly because most service providers focus on meter functions that promote

revenue collection, suggesting that pre-paid water meters and a good water tariff structure could control demand for water.

Buckle (2004) considers pre-paid water meters a better WDM tool than conventional water meters. The author maintains that with conventional meters, the service providers have very little control over payment regularity. With pre-paid water meters, the automatic disconnection of water supply gives the service providers a certain amount of control. In order to ensure that they do not run out of water, and also the fear of paying high costs for water forces domestic water users to reduce the volume of water they use under pre-paid water metering. The water savings realized from wise water use, among other things, contributes to reduce further exploitation of water reserves but also reduces the volume of water pollution each day. Buckle (2004), however, considers pre-paid water meters an expensive tool for enhancing water conservation.

2.8.3.2 Adversaries

In Orange farm (Stretford, Extension 4) the Orange Farm Water Crisis Committee *et al.* (2004) observed that pre-paid water meter do not reduce the wastage of water among the poor. Instead, it reduces consumption for essential uses of water. Water savings realised by using these meters is just part of the water trimmed from essential water uses such as drinking, cooking, washing and bathing. Hence, it undermines the access and equity criteria in IWRM.

Marah *et al.* (2004a) argues that pre-paid water meters do not reduce water consumption. They only brings water consumption to the level that the household would have consumed under any other tariff regime; implying that with or without pre-paid water meters, water users will use a predetermined volume of water.

Other studies suggest that pre-paid water meters cannot be a WDM tool. For example, Kolokytha *et al.* (2002) found that water pricing had little influence on water demand in the city of Thessaloniki (Greece). In Khartoum (Sudan), Cairncross and Kinnear (1992) also demonstrated that changes in water prices had little effect on demand for water in low-income households. Creedy *et al.* (1998) also failed to identify any changes in demand for water between a single-metered supply and group-metered supply in the Western Australia.

Nevertheless, this metering study acknowledges that lower water prices may possibly have an influenced over their results. This illustrates that essential domestic water uses are price inelastic, and therefore that the use of pre-paid water meters may have less influence on consumption for water intended for vital domestic uses. In low-income households, the influence may be less significant because a larger proportion of water consumed is used for essential uses.

Finally, Fiil-Flynn and Naidoo (2004: 6) maintain that WDM through pre-paid water meters is discriminatory. The strategy is only directed at reducing the consumption of the poor, while neglecting wastage by wealthy water users. Davies and Day (1998) noted that wealthy households are more wasteful than poorer ones. Fiil-Flynn and Naidoo (2004) further argues that the installation of pre-paid water meters as a means of promoting water conservation only allows the service providers to escape from their responsibility of reducing unaccounted-for water within the reticulation system. They avoid using approaches such as retrofitting, pressure management, and monitoring leakages. Therefore pre-paid water meters may not have significant influence on water conservation.

2.9 Summary

In Chapter 2, it was established that low-income water users generally have negative attitudes towards the use of pre-paid water meters. This is largely because access to water is determined by the availability of money, and a lack thereof implies no access to water, resulting in community opposition toward pre-paid water meters.

Furthermore, the implementation of pre-paid water meters in South Africa was primarily driven by the need to address management problems experienced in water services sector. These included: the administration of free basic water; the need to recover costs of water services; and the need to conserve water. It is apparent that cost recovery has been the main reason for implementing pre-paid water meters.

The chapter has also revealed that even with the free basic water policy, high levels of non-payment are still prevalent, thereby contributing to the implementation of pre-paid water meters in South Africa. In this regard, pre-paid water meters are viewed as water management device for effectively administering free basic water, without undermining cost recovery by

promoting paying for water services. They do, however, fail to eliminate social problems associated with cost recovery despite the availability of free basic water in low-income households. Here affordability determines access to water and many criticisms of the technology are raised and these are largely centered on the constitutional aspects of using pre-paid water meters.

Conflicting views emerge with regard to the role of a pre-paid water meter in promoting water conservation. The first view considers pre-paid water meters to be an effective water demand management tool. The second view considers pre-paid water meters to lack the ability to conserve water. Water conservation, however, has also been a water management reason for implementing the pre-paid water meters.

CHAPTER THREE

RESEARCH METHODS

3.1 Introduction

Chapter three presents the research methods used in the study. It discusses data collection procedures as well as the instruments that were used to analyse the data for this study. This study used both quantitative and qualitative primary data. Hence, both quantitative and qualitative data collection and data analysis instruments were employed. This chapter discusses the following: clarification of concepts and conceptualizing the hypothesis; defining key variables; the conceptual framework guiding this study; data collection instruments used; the procedure used to select study population; how the field study was conducted and the procedures followed to the collect data; and finally, consider sources of error in the data collection methods.

3.2 Concept clarification

3.2:1 Hypothesis conceptualisation

The study is based on five hypotheses, which were based on the literature reviewed. Each of the hypotheses has a bearing on the focus of the study. The research hypotheses are as follows:

H1. Water users have a negative attitude towards pre-paid water meters

This hypothesis presupposes that water users in Klipheuwel have a negative view towards pre-paid water meters.

H2. Pre-paid water meters did not ensure users access to free basic water;

The hypothesis assumes that the use of pre-paid water meters did not improve the administration of free basic water. The assertion is based on an assumption that although pre-paid water meters can be calibrated to dispense 6 000 litres of free water to each household every month, it does not guarantee that the free basic water would be provided.

H3. Pre-paid water meters did not promote users to pay for water services;

This suggests that pre-paid water meters fails to help users to pay for water services in Klipheuwel. This is based on the fact that the poor cannot be persuaded by a pre-paid water meter to pay for water if they lack the ability to pay.

H4. Pre-paid water meters did not encourage households to conserve water.

This assumption maintains that the use of pre-paid water meters in Klipheuwel did not promote water conservation as anticipated. The reason is that the poor households mainly use water for essential domestic uses only.

3.2.2 Definition of key variables

Four main variables have been investigated in this study. These variables are: water user attitude; access to free basic water; paying for water; and water conservation.

Water user's attitude relates to either a positive or a negative feeling/disposition/view that the water user has toward using pre-paid water meters. Attitude may be represented by preferences and perceptions, and may also be an expression of values and beliefs.

Access to Free Basic Water refers to the ability of a household to receive the 6000 litres of free potable water every month, which is supplied to meet the minimum human water requirements. It forms part of efforts towards ensuring equitable access to basic water in South Africa.

Paying for water is the ability of the household head to pay for water consumed above the free basic limit. This thesis regards paying for water as an element of cost recovery that is aimed at fostering financial sustainability of water services institutions. Cost recovery involves recouping all the cost associated with the provision of water services (McDonald, 2002).

Water conservation relates to the optimal use of water by adopting efficient water-use practices. It constitutes one of the elements of WDM. Water demand management entails

controlling the amount of water required for consumption or wasted. It contributes towards ensuring ecological sustainability.

The following section looks at the conceptual framework for this study.

3.3 Conceptual framework

In this study, Integrated Water Resources Management (IWRM) is used as a conceptual framework for examining the social aspect of pre-paid water metering pilot project in Klipheuwel. The IWRM concept can be traced back to the Dublin Conference on Water and the Environment (see Savenije and Van der Zaag, 2002). According to (Jonker, 2002), IWRM refers to a process of "managing people's activities in a manner that promotes sustainable development (improves livelihoods without disrupting the water cycle)". In other words, IWRM is tailored to promote sustainable development. While the definition of the concept of IWRM may vary, there is consensus among scholars that its guiding principles include: access; equity; and sustainability.

3.3.1 Access

Gleick (1998) claims that the failure to meet the minimum human water requirements has been a major challenge during the 20th century. The author further argues that in the developing countries, there is enormous backlog of access to safe water with most people being at risk of contracting water-related illnesses. Universal access to water is therefore an important element in the drive toward sustainable development.

3.3.2 Equity

Equitable access to water involves ensuring that the interests of different water users are taken into account. Central to the principle of equity is the promotion of fair allocation of resources. Equity in the South African context, is synonymous with addressing historical inequalities to water access. In this study, emphasis is laid on the protection of the interest of all domestic water users. In particular, the importance of ensuring access to water services to the low-income water users.

3.3. 3 Sustainability

Sustainability in water resources management may be viewed from financial, social and ecological angles. Financial sustainability entails ensuring that the water services institutions are financially autonomous to operate sustainably and adequately maintain the systems. According to Merrifield and Collinge (1999) appropriate water pricing that allows cost recovery is the route towards attaining financial sustainability of water service institutions. Water services cannot ensure a sustainable society if the institutions are financially unsustainable. This raises the issue of the free "water dilemma" (Savenije and Van der Zaag, 2002; Liu *et al.,* 2003). Providing free water is a recipe for creating financially unsustainable water institutions (Zehnder *et al.,* 2003). The consequences of having financially unsustainable water institutions are that the poor may have access to water that is either expensive or of poor quality water (Savenije and Van der Zaag, 2002). In contrast, the rich and powerful may still enjoy better quality water services at reasonable rates. Thus, the inequality schism between the rich and the poor is perpetuated. Arguably, social inequalities may create unhealthy condition for the sustainability of the society. As the poor continue to be marginalised in the provision of basic services, social protest may unfold (Hall *et al.,* 2005).

Ecological sustainability aims at protecting the resource base upon which all activities depend. In this regard, water resources management should ensure that the water needs of this generation and of generations to come are met whilst providing and safeguarding the water requirements of ecological functions. Demand management is a water resource management approach tailored to foster ecological sustainability. It aims at ensuring efficient and sustainable use of water as well as promoting equity and ecological integrity (Savenije and Van der Zaag, 2002: 99-100).

In the context of IWRM, economic instruments such as water tariffs and metering are required to balance access, equity and sustainability. Establishing this harmony is the major challenge to water managers, particularly in developing countries. Where economic instruments have been applied, caution is necessary. Savenije (2002) warns that water is not an ordinary economic good. It is a special good that does not conform with market principles. Progressive tariffs are therefore considered an ideal solution that can ensure access and equity without compromising sustainability. Savenije and Van der Zaag (2002: 102) argue that with progressive tariffs in place, "*one can reach full cost recovery, institutional sustainability,*

equity and, purely as a fringe benefit, send out message to large water consumers that water is precious and needs to be conserved".

By implication, the application of pre-paid water meters as an economic water resource management device requires a holistic understanding of water supply issues. There is more to the management of water services than just focusing on the financial objective. This is perhaps a common mistake committed by most water managers, and has most likely led to social protest against the technology. Pre-paid water meters should only be applied after the questions of water access, equity and sustainability have been fully considered. Only then, as an after thought, would pre-paid water meters be compatible to IWRM.

3.4 Data collection instruments

Both quantitative and qualitative instruments were used to collect the data for this study. The main reason for employing both data collection instruments was that a combination of data types could allow for triangulation (Barbie, 2001). In this regard, the results from the data collection instruments could be compared. The advantage of quantitative data is that it ensures that the researcher focuses on explaining relationships that are relevant. It also strengthens the findings when its findings are comparable with those from qualitative results. With qualitative data, the researcher does not fall in a trap of discussing issues to a greater depth, which may not provide a collective impression of the study population (Bless, 2006). The qualitative findings provide an explanation to the theory behind the patterns emerging within the quantitative data.

Self- administered questionnaires were used to collect quantitative data while FGD and observations were used to collect qualitative data.

3.4.1 Self-administered questionnaire

Self-administered questionnaires were the main data collection instrument used to collect primary quantitative data for the study from the heads of household. The instrument was used to collect data on water users attitudes and experiences with pre-paid water meters; the influence of pre-paid water meters on access to free basic water; the influence of pre-paid water meters on paying behaviour; and the influence of pre-paid water meters on water

conservation. Responses to these questions provided important information to carefully examine the overall impact of pre-paid water meters on low income water users.

3.4.2 Focus group discussion

Focus group discussions were used to collect qualitative data that supplemented the quantitative data collected through the questionnaire method. The issues discussed at the FGD meeting were determined by the patterns emerging from the analysed quantitative data. Open-ended questions were debated – these included: Why most people prefer pre-paid water meters? What were the reasons for disbanding the project in the area? The FGD was used to gain an in-depth understanding of the community's view on pre-paid water meters. The discussion was mainly aimed at strengthening the quantitative findings. It was also aimed at understanding the theory underlying the community's view of pre-paid water meters in Klipheuwel[3].

3.4.3 Observations

The researcher also collected information for this from the study area through observations. Notes were taken on the observations made about the people in the study area, and on elements that had a bearing on this study. Issues noted through observations were then incorporated in the analysis of the data to supplement the information data collected from other instruments.

3.5 Selection of the study units

3.5.1 Site selection

Klipheuwel, a formal settlement north of Durbanville in the CMA, was selected as the study area. The criterion used to select this area was that this was the only area in the CMA where the pre-paid water metering pilot project was implemented. Since the focus of the study was on pre-paid water meters, the selection of the study area was purposively done.

[3] See Appendix B which contains a Focus Group Discussion (FGD) question guide.

3.5.2 Study population

The household questionnaire was administered in 138 households. This was the total number of houses that were involved in the pre-paid water metering pilot project in Klipheuwel. The sample population was relatively small, and consequently all houses that were involved in the pilot project were all given questionnaires to complete. For the FGD, eight participants were deemed to provide adequate information for the study.

3.5.3 Selection procedure

In Klipheuwel, pre-paid water meters were installed in 138 households. All the households that were involved in the pilot project were selected to complete the questionnaire. The selection of the entire population of households was based on two reasons. The first was that the responses from all of the households involved in the project would provide a fairly true reflection of the general attitudes towards pre-paid water metering in Klipheuwel. Secondly, the household population was relatively small to handle. Administering the questionnaire to all households was considered manageable.

The responsibility for identifying and selecting the participants in the FGD was delegated to a community leader because of her familiarity to the people in the community. The selection was also purposively done. The ability to speak and understand the English language was used as the selection criterion. Purposive selection of the participants was required because the community is predominantly an Afrikaans speaking. If other sampling methods were be used would have implied the use of Afrikaans at the discussions. The researcher would have had difficulty comprehending and guiding the discussions if Afrikaans had been used as a language of communication. In order to avoid language barrier, only heads of households who could understand and speak English were identified and selected to participate in the discussion. Only eight members of the community participated in the FGD. The selection of the FGD participants may have introduced sampling bias in this study. The use of multiple data collection instruments minimised this bias.

3.6 Data collection

3.6.1 Ethic statement

Research ethics were followed in the manner in which the field study was conducted. The inclusion of ethical procedures in this study was mainly done because this study investigated human views and attitudes to pre-paid water meters. The following sections provide a detailed description of compliance with ethical issues in the collection of field data from the study area.

3.6.1.1 Local authority consent

Permission to enter the study area was obtained from the local authorities prior to conducting the field study. Letters detailing the general conduct of the study were sent to the police, municipality, and the community leader in Klipheuwel. The letters outlined the aim of the study, how the study would be conducted, when and where the study was to be conducted and who would be involved. After authorisation to conduct the study was obtained from the authorities, the study commenced.

3.6.1.2 Respondent consent

Respondents to the questionnaire and the participants in the FGD were given an overview of the study and then asked for their consent to participate in the study. It was communicated to them that participation was voluntary, and that their involvement would not attract any remuneration. The importance of the study and the value of the community's input were, however, explained. No measure of compulsion or intimidation was exercised to prompt people to participate. In order to promote involvement, respondents were assured of a high degree of confidentiality of the information provided. Furthermore, the community was assured that the findings of the study would be disseminated to the community.

3.6.2 Data collection procedure

Questionnaires were distributed in person with the help of a research assistant, and were completed by the head of household. The questionnaires were left with the respondents for a period of about one week, and were collected after they were completed. During the

distribution of the questionnaires, the research assistant explained the instructions on how to complete it. Instructions were also printed on the cover page.

The questionnaire required the household heads to check the correct option to answer a corresponding item. Approximately 15 minutes were adequate to complete the questionnaire. Respondents were asked to carefully record and check the correct options to an item. When the questionnaire was given to a household, the researcher recorded the number of the house in his record book to keep track of the respondent to a questionnaire.

Where the respondents were unable to read, the researcher interviewed them directly with the help of the research assistant. Interviews were also conducted in cases where the respondent to a questionnaire required clarification on some of the items. In order to trace the household, the house number on the questionnaire guided the researcher where call-backs were required. Respondents were thanked for their contribution to the study.

3.6.3 Dates and setting of data gathering

Data collection in the form of questionnaires took place over a 10 day period from 6th July 2006 to 16th July 2006. The period for the study was set during this time because of the school holidays. It was expected that the researcher would find at least one household member at the house during this period. In addition, school children were expected to help their parents who were unable to complete the questionnaire by themselves. The community leader was informed in advance about the date of the commencement of the fieldwork. The questionnaire collection process was intensified during weekends on the assumption that most of the people would be at home.

For the FGD, the date and time for the meeting was planned and communicated to the respondents a week in advance through the community leader. The FGD discussion was conducted on 29th August 2006.

3.6.4 Data capturing and data editing

The data was captured by using questionnaires (quantitative) and a tape recorder (qualitative). The data from the questionnaires was edited in two phases. The first editing of the raw data collected was completed before leaving the household that completed the questionnaire. Field

data editing was done by ensuring that all the items were responded to. The other strategy used to edit the questionnaire in the field was to observe whether some key questions about an issue had been answered with the corresponding responses. The second data editing was done before the data was coded and entered. For the FGD, the editing of the data from the discussions was done when the data was being transcribed.

3.7 Data analysis

Quantitative data were analysed by using the Statistical Package for Social Science (SPSS) and Microsoft Excel computer software packages. After editing the completed questionnaires, the raw data was firstly coded. Numeric coding of value labels from 1 to 5 was used. These value labels were determined by the key variable each questionwas trying to elicit. The edited and coded raw data was then entered into the computer and processed. The software SPSS was used to analyse the data and to establish patterns and associations within the quantitative data. The processed information was presented as graphs and tables.

Qualitative data was analysed manually. The discussions from FGD were firstly transcribed. The transcribed data was read and the essential issues were annotated. Furthermore, the transcripts were assembled in order to identify the emerging meaningful themes. Themes established from the transcripts have been presented as a descriptive narration. In addition, interesting quotes from the transcripts have also been presented.

3.8 Reliability and validity of the instruments

Measures were taken to ensure that the data collecting instruments used were reliable and valid. The first measure was to use multiple data collection instruments to collect data for the study. Three data collection instruments used for the study included: the questionnaire; FGD; and observations. The findings from these different data collection tools were triangulated or compared to see whether they provided similar findings.

A five-point Likert's scale was used to construct the questionnaire in order to allow respondents to discriminate responses. This was undertaken to ensure that the respondents had a variety of choices. The Likert scale was selected for because the scale has been successfully

used in related studies (*see* Haider and Rasid, 2002; Raje *et al.*, 2002)[4]. Originally the questionnaire was drafted in English[5]. To ensure that the questionnaire was reliable, it was then translated into Afrikaans.

Before the main field study, the questionnaire was trial-tested by ten students of the University of the Western Cape. Trial-testing was undertaken for the purpose of ensuring the validity of the questions and reliability of the questionnaire to collect relevant data. In addition, expert judgment about the validity of the questionnaire was obtained from a statistician, a researcher and a linguist.

The FGD was guided by the patterns emerging from the quantitative data. This was done to ensure that the data collected was relevant and filled the gaps within the questionnaire data. A tape recorder was used to record all of the information from the participants.

3.9 Shortcomings and sources of error

The study had a number of shortcomings that could also be sources of error. The greatest shortcoming was that of the 138 selected households, 124 households received the questionnaires. The remaining 14 households either refused or were vacant structures. Of the 124 questionnaires issued, only 88 households returned the questionnaire despite 9 follow-up visits were made. Only 81 questionnaires were fully completed while the remaining 7 were cancelled. Failure to obtain all the questionnaires could be a source of error for the study. However, a sample of 61.4% is adequate to make conclusion in social sciences (Bless, 2006).

The questionnaires were also prepared in Afrikaans since the impression given by the Klipheuwel community was that it was predominantly Afrikaans speaking. However, a few Xhosa speaking households were encountered; these were administered English questionnaires. Lack of understanding an English questionnaire was another shortcoming of the study.

In the FGD, the number of females was also greater than males. Of the eight participants at the discussions, only two were male. The source of error in this regard may be that the

[4] The common scale used in the questionnaire constitutes; *strongly agree, agree, not sure, disagree, strongly disagree*.
[5] See Appendix A which contains an English version of the questionnaire.

discussion could possibly have been influenced that the gender of participants. However, it is women who use most water, and therefore the FGD sample may be representative of the water users.

CHAPTER FOUR

RESEARCH FINDINGS

4.1 Introduction

Chapter four presents an analysis of the quantitative and qualitative field data in order to approve or disprove the hypotheses set in this study. The quantitative data obtained by the questionnaire is analysed in four categories, namely (i) water users attitudes and experiences; (ii) access to free basic water; (iii) paying for water services; and (iv) water conservation. Qualitative data is presented in the form of graphs. The frequency tables are presented in appendix C. Since the rating scale used contained discrete variables, this analysis is presented mainly in the form of percentages. The total number of the questionnaires analysed was 81 (N = 81). The qualitative data from focus group discussion (FGD) and observation were also analysed. This data has been presented as scripts, important quotes from the discussions and narrative description.

4.2 Attitude and experiences

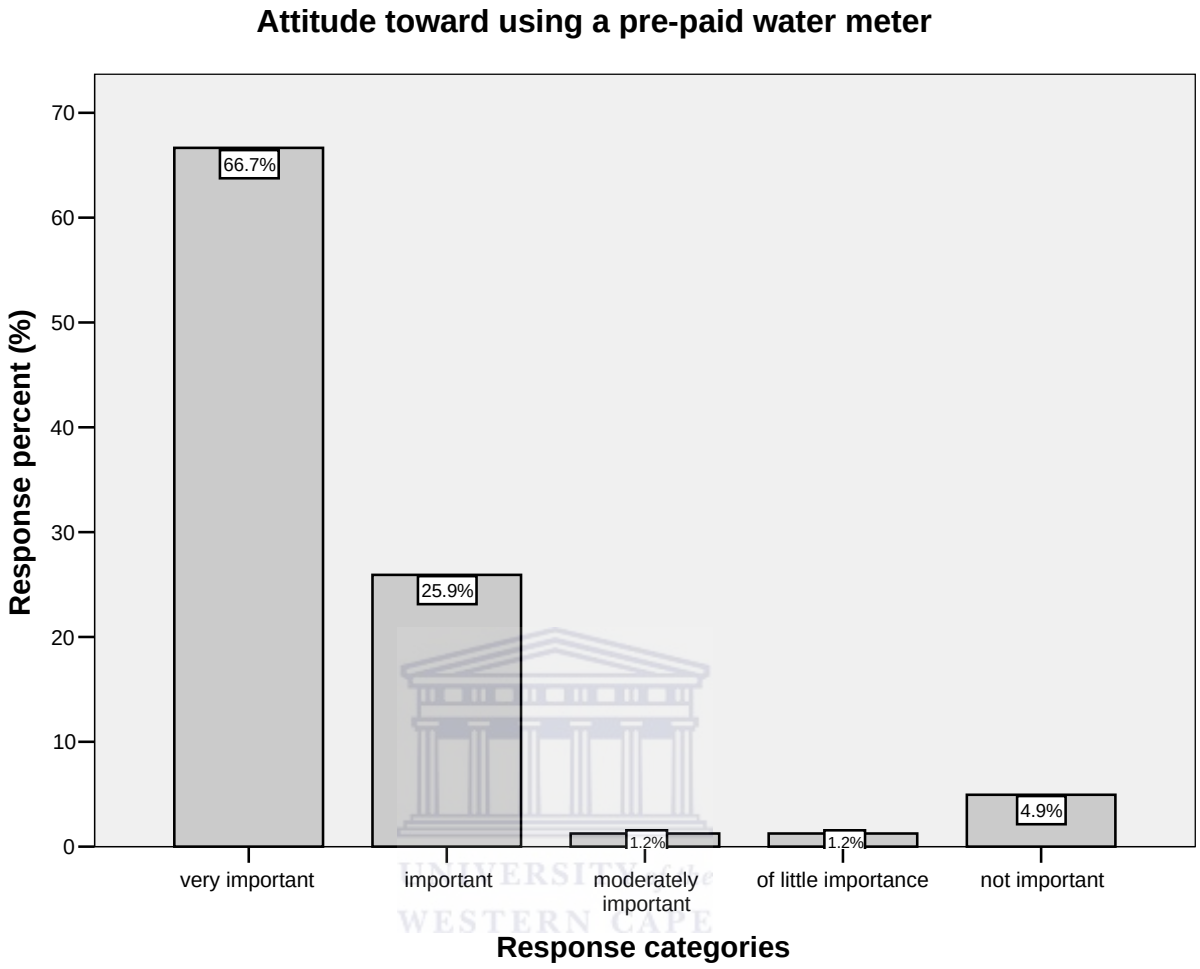
In an effort to answer the research question on the experiences of water users and attitude towards pre-paid water meters, a number of items were included in the questionnaire. The following section presents the responses to these items. It should be noted that most water users in Klipheuwel are low-income water users[6]. Based on the literature, it was anticipated that water users would have problems with paying for water services, and thus pre-paid water meters.

4.2.1 Water user's attitude

In the questionnaire, question 1 was intended to collect information about the attitude of the respondents towards using pre-paid water meters. Figure 1 show frequencies and percentages of the responses to this question - how the household heads ranked their feelings about using a pre-paid water meter.

[6] Tables 1.1 to 1.4 in the Appendix C show demographic characteristics of the 81 households who completed the questionnaires. Of importance, Table 1.3 which indicate that 49.4% earn less than R800 per month. About 46.9% earn between R800 and R 2000. The remaining 3.7% earned between R2000 and R5000 per month. Also the community has a high percentage of unemployed 29.6% in the Table 1.4.

Figure 1



(N = 81)

The figure shows that most of the household heads (66.7%) in Klipheuwel considered using a pre-paid water meter very important, while 25.9% felt it was just important. Thus, 92.6% of the 81 water users were certain that using a pre-paid water meter was important to them[7]. Only 1.2% ranked using pre-paid water meters to be moderately important while another 1.2% ranked it to be of little importance. The remaining 4.9% did not consider it important to them.

The FGD revealed that water users in Klipheuwel had a positive attitude towards pre-paid water meters. This is because pre-paid water meters allows water users to understand better the amount of water that they use each month. The meters promoted water-wise use so that

[7] See Table 2.1 in the Appendix C.

consumption remains within the free basic water limit. Since most households in Klipheuwel have less than eight members[8], the system was advantageous to these households. Pre-paid water meters empowered the water users to budget and manage their water usage.

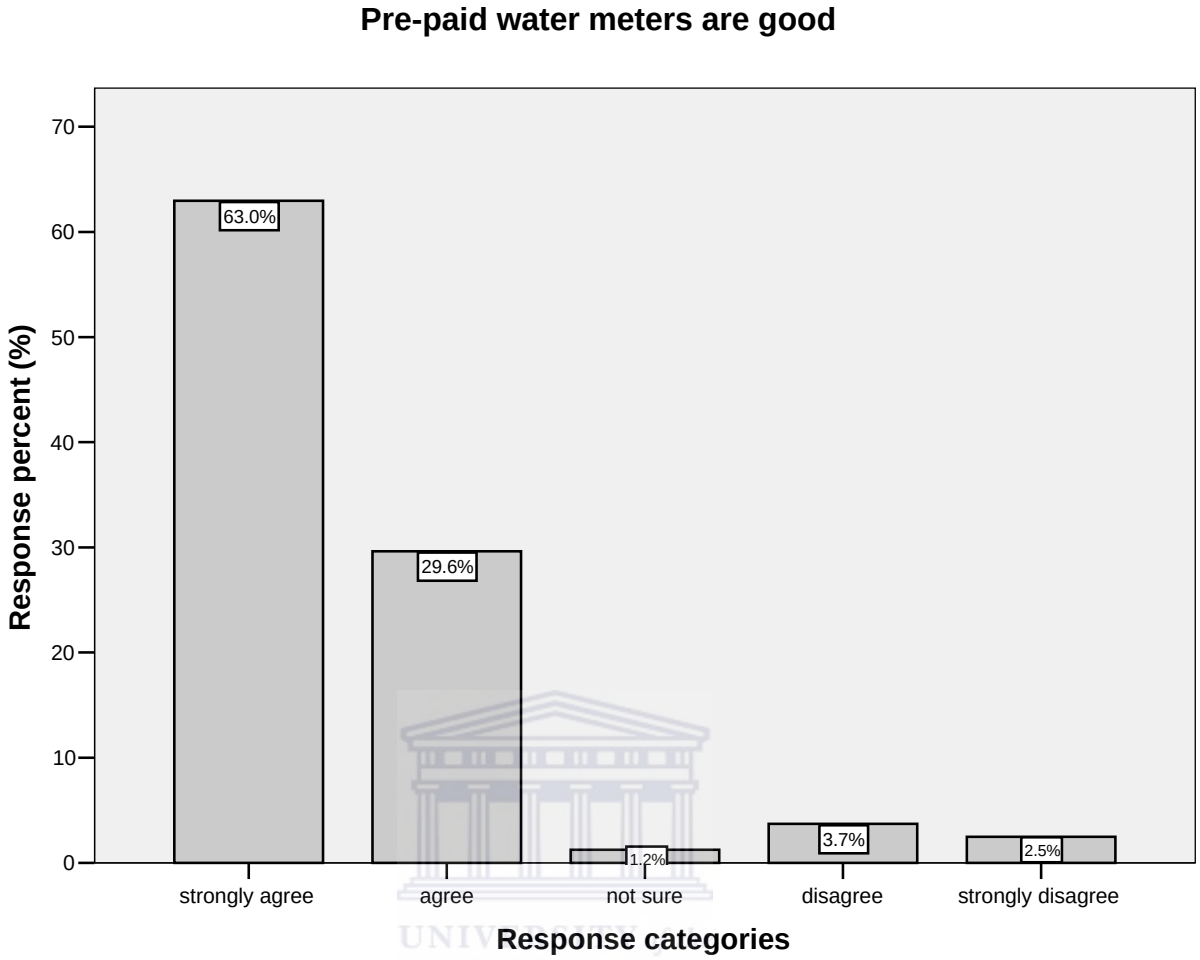
Another positive aspect is that users of pre-paid water meters do not require to pay the reconnection fee associated with conventional water meters. It also assisted water users to avoid accruing interest when they failed to pay water bills. Furthermore, pre-paid meters eliminated the administrative problems associated with reconnection; there was no need for the user to wait for the authorities to come and reconnect water supply. Pre-paid water meters also eradicated the danger of inaccurate meter reading.

Pre-paid meters were also viewed to be more flexible in-terms of making payments, as well as allowing for payment in small denominations. It was also more convenient to pay because the vending shop was located within the community, and within walking distance of all houses. The claim that service delivery is a problem with pre-paid water meters because vending stores are often not within 200 metres (Fiil-Flynn and Naidoo, 2004: 18) of the household is unfounded in the case of Klipheuwel. What could be important to consider may be the distance from a household to a water tap, and not the distance to a point of making service payment. If the distance to a point of service payment in emphasised, then the use of conventional water meters would be equally problematic. However in Klipheuwel, respondents identified times when there were problems at the shop and water users had to travel to Durbanville to purchase units.

These results suggest that most of the respondents in Klipheuwel had a positive attitude towards using pre-paid water meters. Similar results were also obtained from other questions aiming to capture water user's attitudes toward pre-paid water meters in the questionnaire. For example, figure 2 presents a bar chart of water user's responses to question 5 (a) – the extent to which water users agreed or disagreed that pre-paid water meters are good.

[8] See Table 1.3 in the Appendix C.

Figure 2



(N = 81)

The graphs show that 63.0% strongly agreed that pre-paid water meters are good, while 29.6% just agreed to the statement. Of the remaining 7.4%, 2.5% strongly disagreed; 3.7% just disagreed; and 1.2% was not sure. This illustrates that 92.6% of the 81 respondents (heads of households) considered pre-paid water meters to be good. These findings are compatible with the general impression that the researcher received from the community at the time of data collection.

In the FGD, all the participants agreed that pre-paid water meters were excellent. The participants claimed that almost all of the people in the community thought that pre-paid water meters were good. Members of the community were surprised to see that pre-paid water meters were removed without consulting them. Some of them did not allow the council technicians to remove the pre-paid meters from their houses. As one of the participants stated

that: “My pre-paid water meter is still in my house (but it does not work) because those two guys (council technicians) did not tell me the reasons for taking out my pre-paid.” The person went further to say that “I do not care if the meter does not work, but its going to stay there because I love the pre-paid system”. The discussions revealed that the community was fully consulted when the pre-paid water metering project was being launched, but not when it was being disbanded. Furthermore, the community in Klipheuwel wanted to have pre-paid water meters reinstalled.

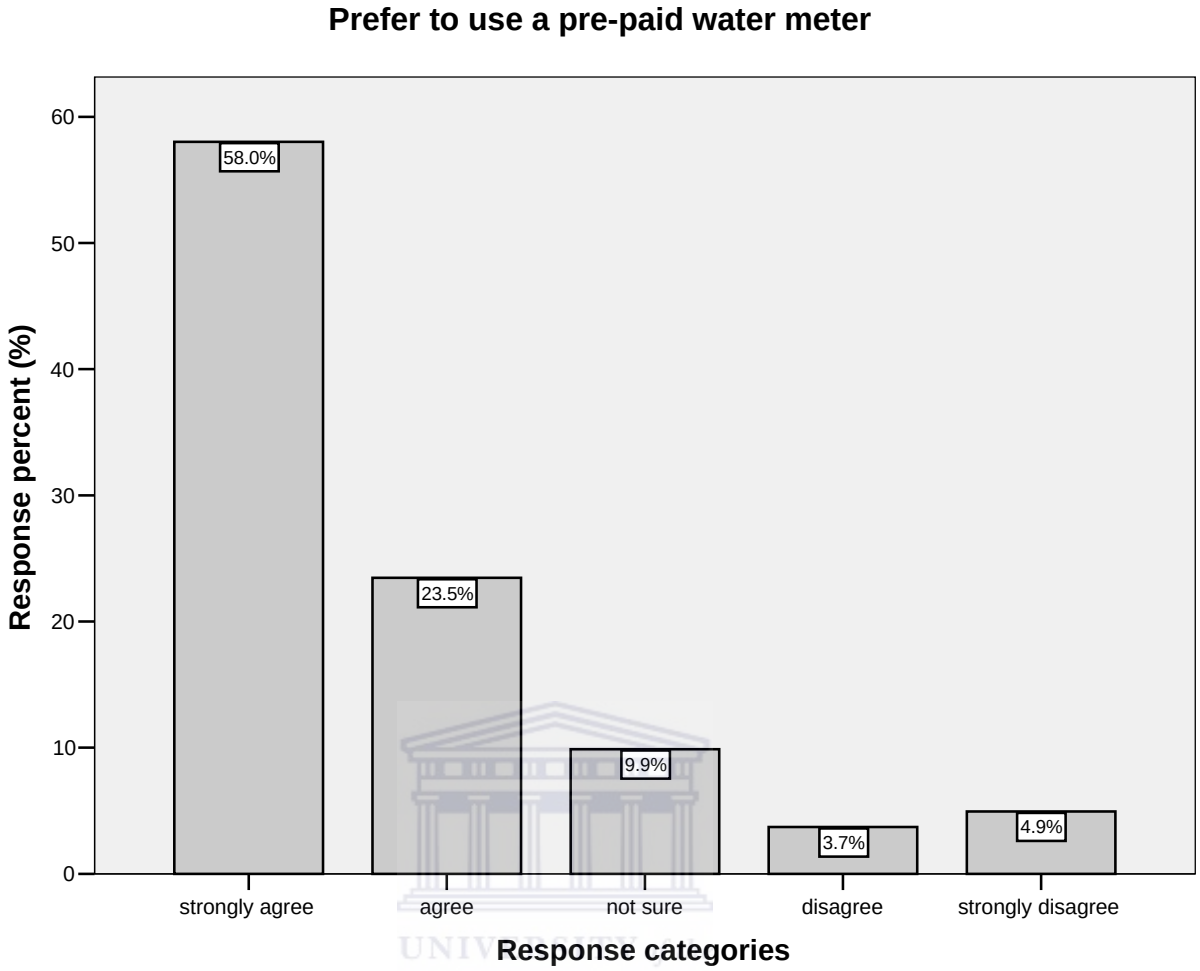
Interesting results were also noted after cross tabulating responses to question 5(a) (in Part B of the questionnaire) with those to question b. (occupation of the head of household) and question d (income of the head of household) (in Part A of the questionnaire)[9]. The results reveal that the largest proportion of the people who disagreed that pre-paid water meters were good, were those employed and those earning high monthly incomes. From a logical point of view, the unemployed and those earning lower income are expected to be the majority opposing the statement that pre-paid water meters are good. Work interactions and the influence of workers unions could possibly explain this irregularity.

4.2.1.1 Preference

The majority of the water users in Klipheuwel also prefered using pre-paid water meters rather than the conventional meter. This is illustrated in Figure 3, which shows how the household heads responded to question 5(d) - whether water users in Klipheuwel liked to use pre-paid water meters or not.

[9] The tables 2.4 and 2.4 in the Appendix C provide information on the cross tabulations between household head occupation and family income with the responses to the statement “Pre-paid water meters are good.”

Figure 3



(N = 81)

According to the Figure 3, 58% strongly agreed that they preferred using pre-paid water meters, while 23.5% just agreed. In total, 81.5% of the household heads stated that they liked using the pre-paid water meter in their household. Of the remaining respondents, 8.6% preferred not to use pre-paid water meters and 9.9% were not sure.

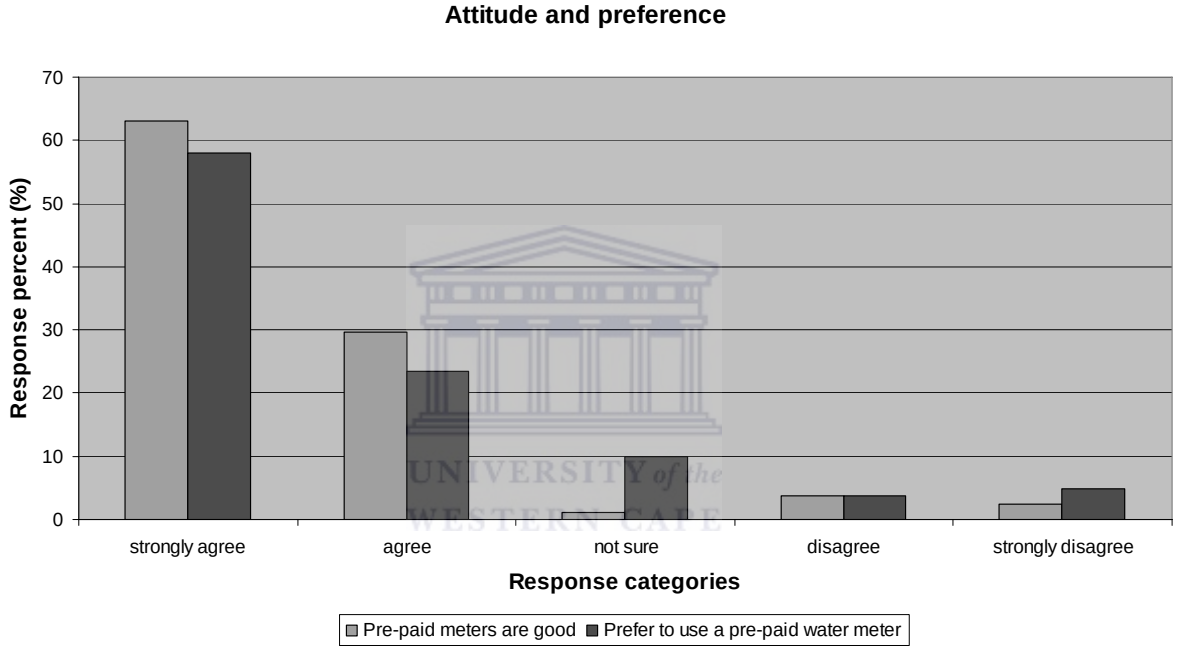
An unusual pattern emerged in the cross tabulation between preference and income[10]. Of the 50.6% household heads earning more than R800 per month, 6.1% disliked using the pre-paid water meter. In contrast, of the 49.4% heads of households earning less than R800 per month, only 2.4% disliked using the pre-paid water meter. Considering that each of the two groups (those earning more that R800 per month and those earning less that R800 per month) comprised almost 50% of the 81 people, more people earning higher income dislike the pre-

[10] See the table 2.6 in the Appendix C.

paid water meter than those earning low income. In an ideal situation, one would have expected more people earning a lower income to dislike pre-paid water meters.

The results from the cross tabulation of family size and preference are anticipated. Most people who disliked the use of pre-paid water meters were those with a larger family[11]. This is because larger households are likely to consume more water. In this way, larger household are more exposed to the burden of paying more for water due to higher usage volumes.

Figure 4



(N = 81)

Nonetheless, there is a slight discrepancy in the proportions of respondents who claimed that pre-paid water meters are good and those who actually preferred to use them. Notwithstanding this difference, most of the household heads considered these water meters to be good and liked using them.

[11] Table 2.7 in the Appendix C shows that 1.2% of the households with less that 4 members (i.e. 27.2% of the total households) did not prefer using a pre-paid water meter. While 7.4% with more than 4 members (representing 72.9%) also disliked the pre-paid water meters. The Ratios for the former and later are 1:23 and 1:10 respectively.

The qualitative analysis of the FGD indicates a number of reasons why people in Klipheuwel prefer using pre-paid water meters. The first reason is that pre-paid water meters allowed them to get 6000 litres of free water at the beginning of every month. Unlike the conventional meters, with pre-paid water meters, water users in Klipheuwel were able to see that their free basic water has been credited. Most of the participants were unsure whether free basic water was provided with the conventional water meters.

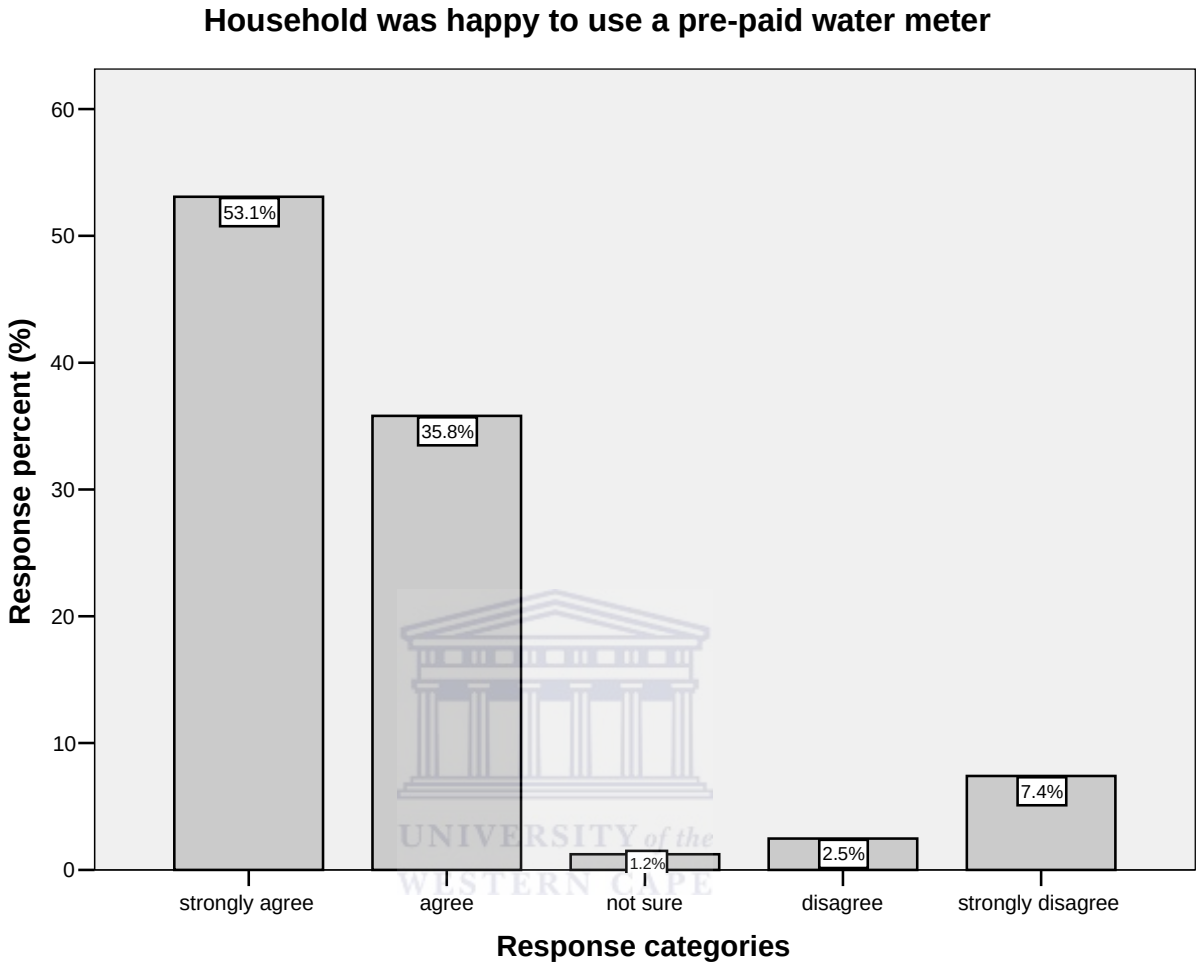
The most notable reason why the community members favoured pre-paid water meters was that it allowed water to be purchased in small denominations, as opposed to the large monthly payment that is required when using the conventional meters. Pre-paid water meters were thus considered more affordable. As one of the participants stated "*…some people cannot pay every month R200 to R500, but if they have got a pre-paid and they have a R5, then they can still buy the R5 water*." It appears that the ability to purchase water in small amounts was equated with affordability of water services in Klipheuwel.

The collapse of the pre-paid water metering pilot project in Klipheuwel led to the re-introduction of the conventional meters and the account system. Water accounts of most households started to accumulate once again due to non-payment of water bills. The escalation of unpaid accounts has created a perception that the administrative staff for the council are incompetent. However, one participant in the FGD stated that the accumulation of the unsettled water debt did not result from administrative incompetence, but from the unsettled accounts prior to the pilot project. These accounts accumulated as a result of the charging of interest during the time when the community was using pre-paid water meters. Perhaps, the failure of water users to understand their water bills also indicates why most people in Klipheuwel prefer to use pre-paid water meters.

4.2.1.2 Satisfaction

Question 5(e) in the questionnaire was intended to reveal whether household heads in Klipheuwel were happy to use a pre-paid water meter. To be happy with using pre-paid water meters indicates a measure of satisfaction with the technology. The Figure 5 shows how the household heads responded to this question.

Figure 5



(N = 81)

According to the above figure, 53.1% and 35.8% heads of households respectively strongly agreed and agreed that they were happy to use a pre-paid meter in their households. This represents 88.9% of the total household heads that responded to the questionnaires. A total of 9.9% of respondents were not happy to use a pre-paid water meter while the remaining 1.2% was unsure.

The FGD also revealed that most of the participants were satisfied with pre-paid water meters. In the discussions, there was consensus that most water users in the community were satisfied with pre-paid water meters. No community member complained to the community leader about pre-paid water meters. Efforts to discuss the removal with council officials were

fruitless. Community members still seek an explanation from the municipality as to why the meters were removed and want them reinstalled. These findings suggest that most water users were happy to use pre-paid water meters. Claims that pre-paid water meters are not suited for low-income users are not applicable in Klipheuwel. This is a further indication of a positive attitude toward pre-paid water meters. It also demonstrates that the water users had fewer problems with the meters.

In summary, most water users in Klipheuwel have a positive attitude towards pre-paid water meters and like using this technology. The research findings are compatible with the initial impression given by water users in the study area. The results are however not in agreement with most of the literature that suggests that users are antagonistic to the technology. Therefore, in Klipheuwel, the attitude of water users towards pre-paid water meters is not for the abandonment of the pilot project.

The study now examines the experiences of water users with pre-paid water meters in Klipheuwel, explaining why most people have a positive attitude toward pre-paid water meters. In addition, the succeeding section also endeavors to ascertain the negative social effects associated with pre-paid water meters in Klipheuwel.

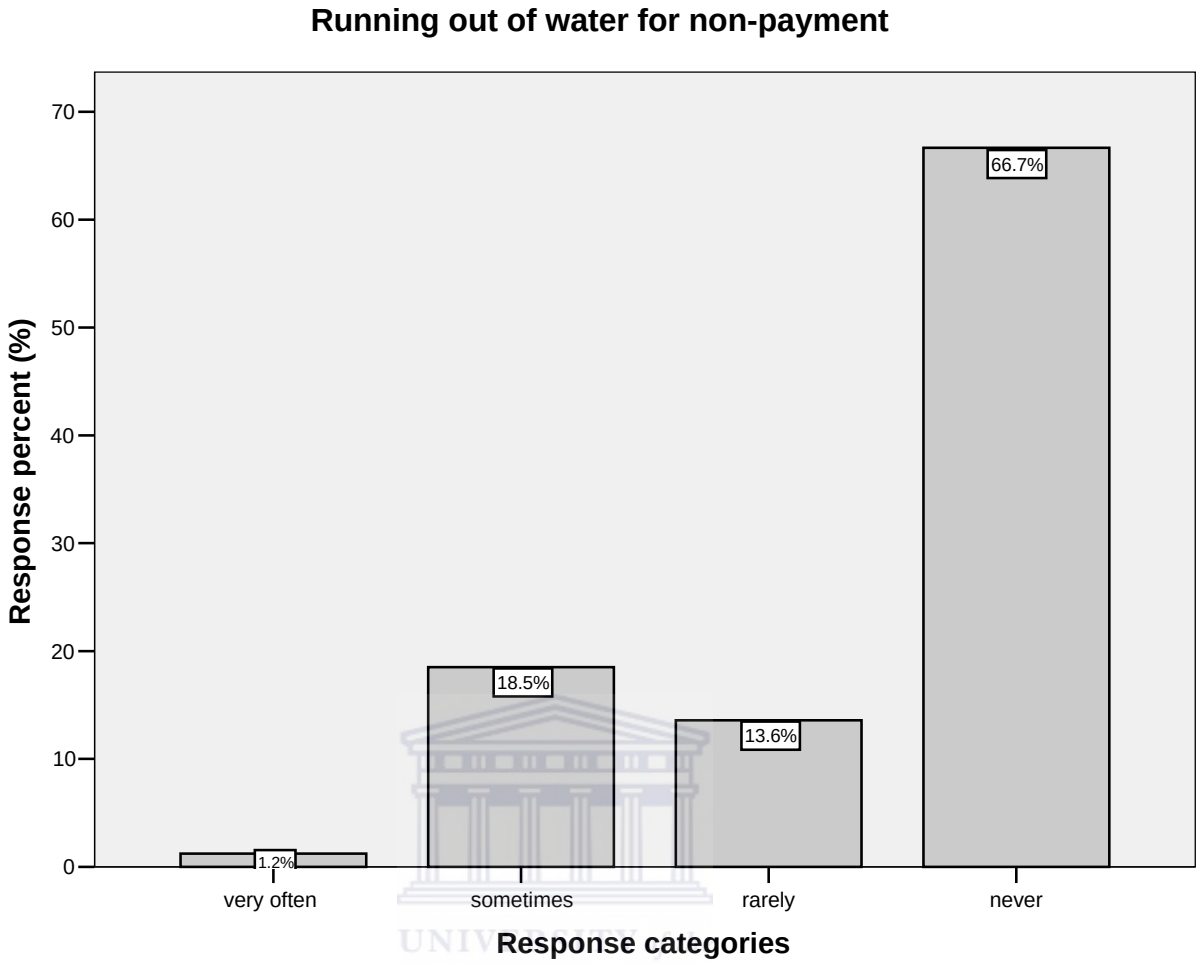
4.2.2 Water user's experiences

The experiences of water users with pre-paid water meters were captured in the questionnaire by exploring a number of aspects. These include the quality of water services; maintenance of the system; access to water; disconnection of supply; system of payment; and technical faults with the meter. The next section will focus on the disconnection of water services for non-payment, the quality of water services and experiences with faulty meters.

4.2.2.1 Disconnection of water supply

Literature shows that the disconnection of water services for non-payment has been the most common but highly criticised cost recovery approach (Peter and Oldfield, 2005; Kidd, 2004; Jaglin, 2002). Figure 6 shows the experiences on water service disconnection for non-payment in Klipheuwel. The figure has been constructed from the responses to question 7(a) - the frequency of service disconnection for non-payment at the time of pre-paid water metering.

Figure 6



(N = 81)

The figure indicates that 66.7% households never experienced service disconnection for non-payment. In other words, they never ran out of water during the time they were using a pre-paid meter. However, 13.6% stated that they were rarely disconnected while 18.5% claimed that they were sometimes disconnected from water services. Only 1.2% alleged that a pre-paid water meter disconnected their water supply very frequently. On average, the majority of the households in Klipheuwel either never experienced water disconnection or rarely had their water disconnected.

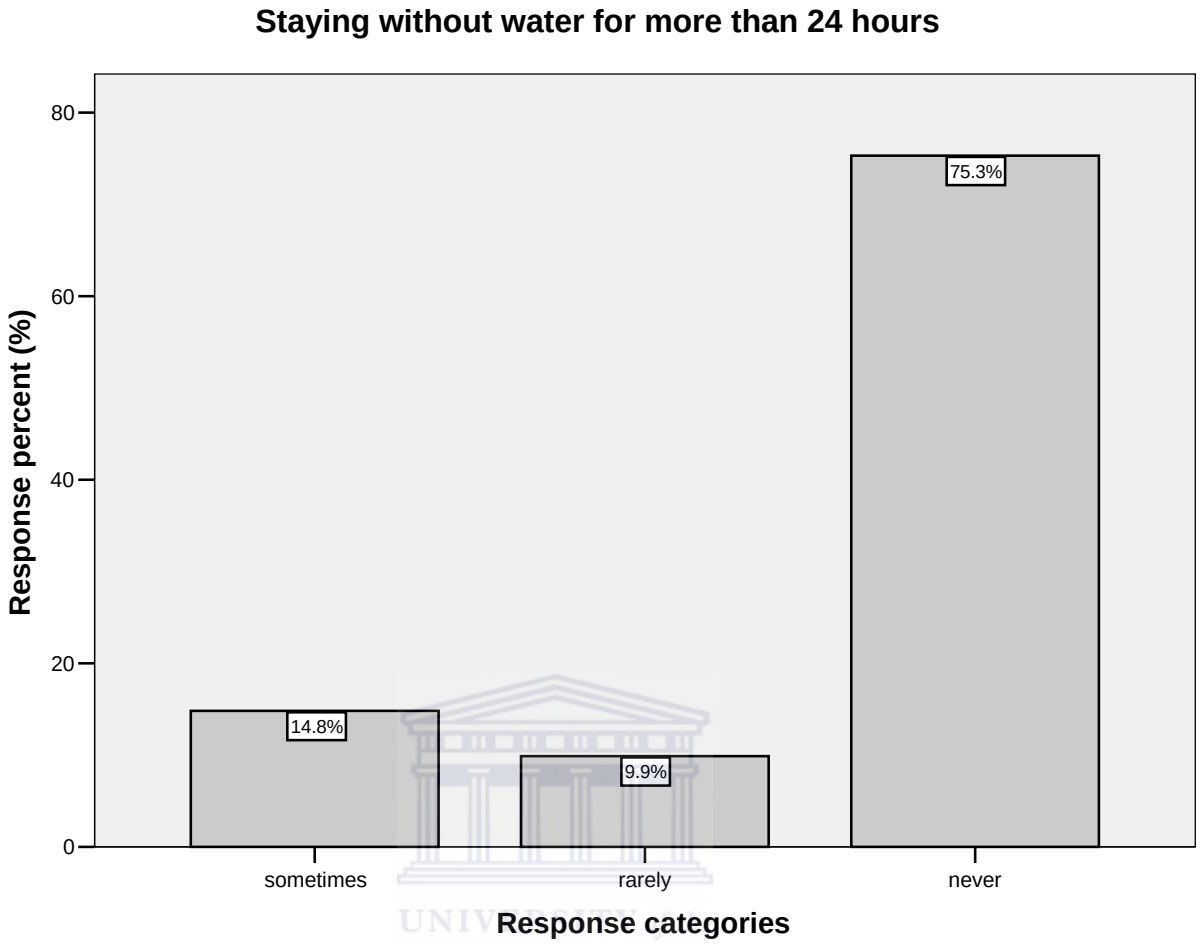
The FGD revealed that the community felt that pre-paid water meters were much better than the conventional meters. The water units displayed on the meter made users aware of how much water was available, and allowed proper budgeting. In addition, the system allowed users to borrow water (i.e. emergency water of about 200 litres), when one ran out. Because

of this, the participants agreed that the disconnection of water supply under pre-paid water meters was not an issue.

The disconnection of water under conventional water metering was deemed to be a bigger problem. When water was disconnected for non-payment under the account system, water users had to pay the outstanding account before having access to water. Reconnecting supply can take a long time, especially when they do not have money. Besides, the account system was perceived to trap water users in vicious circles of water debt. Failure to settle the account caused the debt to increase because of the interest charged. Once trapped in this financial predicament, users were under constant fear of legal action, disconnection of water and even eviction. One participant stated the following: "*even if they cut-off six months, you still have to pay the debt. But with a pre-paid, if I save a R5, I can get water*".

The study further explored the duration of service disconnection. The responses of the heads of households to question 7(b) have been graphically illustrated by the Figure 7 below.

Figure 7



(N = 81)

Figure 7 illustrates that about 14.8% of the respondents had their water supply sometimes disconnected for more than 24 hours. This is quite a substantial percentage considering that water is an essential resource and that staying without supply for more that 24 hours is detrimental to human health. 9.9 % of the household heads stated they rarely experienced disconnection. The remaining 75.3% claimed that their water services were never disconnected for the reasons of non-payment. Similar results were obtained from responses to question 7(f)[12].

In Klipheuwel, 20% of the respondents reflected that they sometimes experienced water disconnection for failure to buy water. With this magnitude of water disconnection, one would

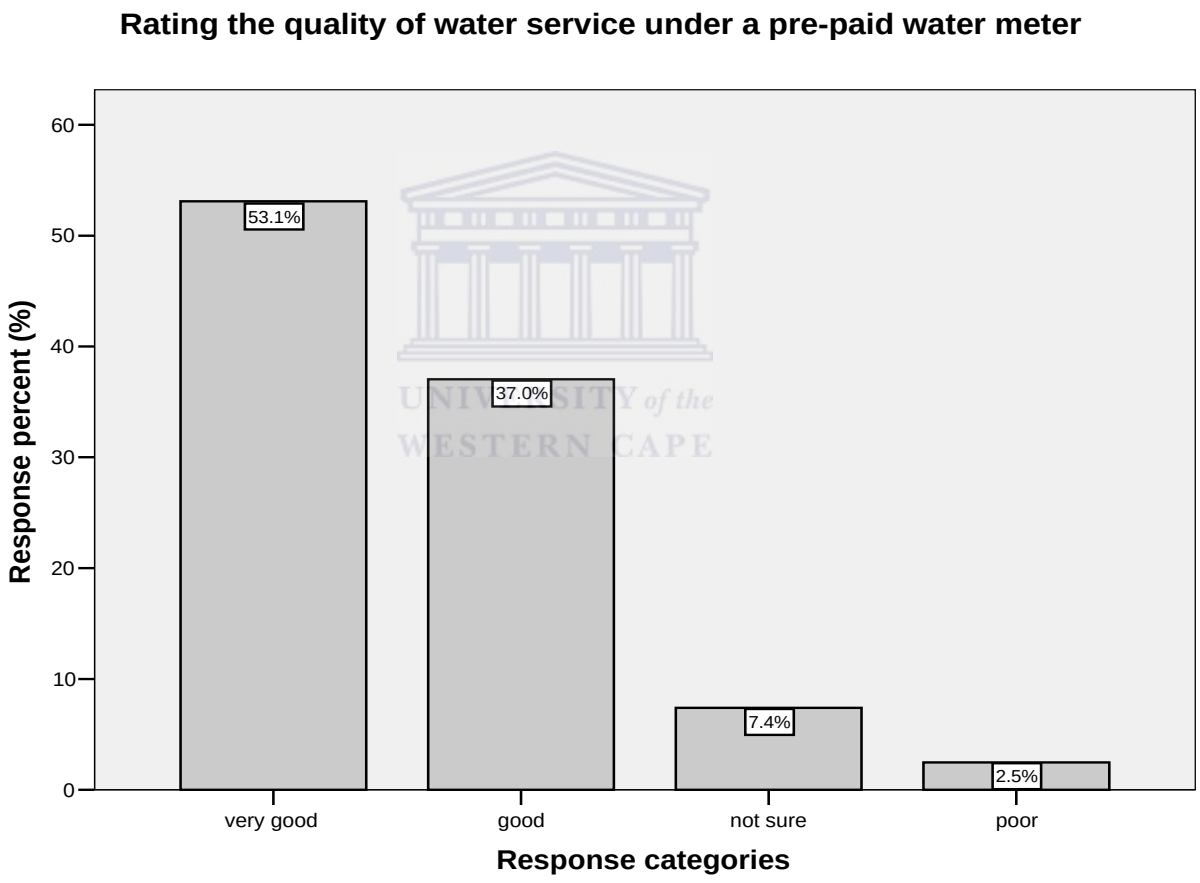
[12] The questionexplored on whether the water users sometimes got water from their neighbours during the time their water supply was disconnected for non-payment. Table 2.8in the Appendix C provide the responses to the item.

anticipate a greater dislike of the technology in the community. On the contrary, most people felt that pre-paid water meters are good. Despite the fact that some households were sometimes cut off for non-payment, disconnection of water may still not explain why the project was abandoned. The reason is that there were provisions for emergency water. In addition, water could be purchased with small amounts of money at nearby vending shop.

4.2.2.2 Quality of services

Figure 8 presents the responses of the household heads to question 6(a) - how the users in Klipheuwel rated the quality of water services under pre-paid water metering.

Figure 8



(N = 81)

The figure shows that 53.1% of the household heads in Klipheuwel rated the water services as very good while 37.0% rated them to be good. A total of 90.1% household heads were certain that water services were good under pre-paid water meters. In contrast, 2.5% considered water services under pre-paid water meters to be poor. The remaining 7.4% were undecided. On

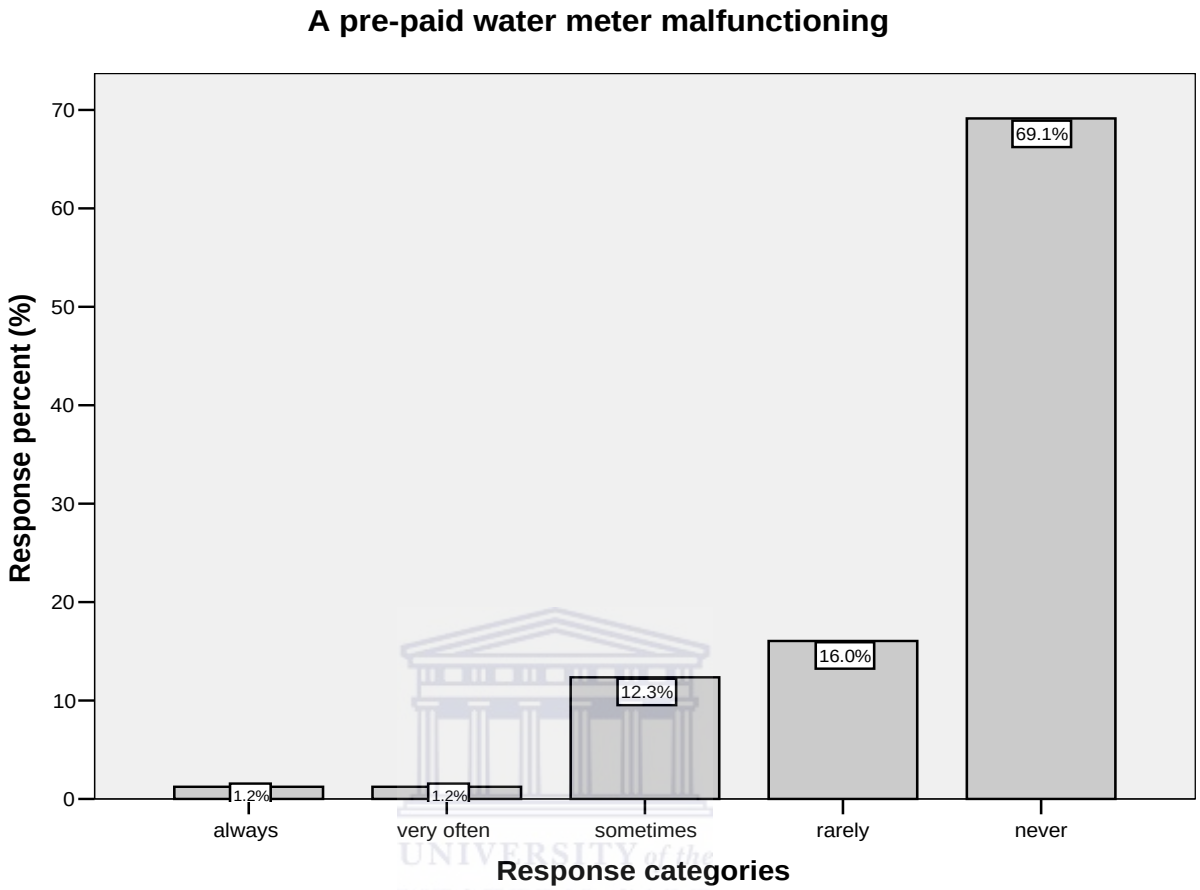
average, most people considered the quality of water services to be either very good or good. This implies that most of the respondents were happy and satisfied with water services under pre-paid water meters. These findings are in agreement with other results pertaining to water services. For instance, most heads of households in Klipheuwel considered that paying for the services was better under pre-paid water metering system[13].

4.2.2.3 Meter failure

Meter failure is cited as one of the main problems of pre-paid metering (Fiil-Flynn and Naidoo, 2004; Tewari and Shah, 2003; Drakeford, 1998). This problem led to the collapse of a pre-paid metering project in Cilliers, located in the Limpopo Province (formerly known as Northern Province) of South Africa (Fiil-Flynn & Naidoo, 2004: 7). Table 4.9 presents information about users experience with regard to the reliability of pre-paid water meters.

[13] Table 2.9 in the Appendix C show that about 80% stated that the system of making payments for water services under pre-paid water meters was good. However Table 2.10 shows that about 28.4% sometimes encountered problems with the opening time of the vending shop in the area.

Figure 9



(N = 81)

The figure above indicates that in Klipheuwel, 69.1% of households never experienced meter failures. In addition, 16.0% of the households rarely experienced meter problems. The households that sometimes experienced problems with the meters constituted 12.3% while the remaining 2.4% claimed that they frequently had problems with the meter. Generally, most water users in Klipheuwel did not encounter problems with pre-paid water meters. However, for those who did experience meter failure, the study further examined whether they perceived the municipality to be efficient in rectifying such faults. The majority of respondents considered the municipality efficient in responding to meter failures[14].

[14] Table 2.11 in the Appendix C shows that 55.6% of the water users stated that the municipality responded well to the problems with the meters. And, 38.3% were not sure possibly because they did not experience meter failure. Only, 6.1% claimed that their response to maintain the meters was poor. Also, Table 2.12 exhibits that most water users never encountered a problem of loosing their credit in the pre-paid water meter.

The FGD revealed that water users did not generally have problems with pre-paid water meters. However, in the initial stages of the project there were a few instances when the meters malfunctioned[15]. Once these problems were rectified, there were no other complaints about pre-paid water meters. Most of the participants stated that they never experienced problems with pre-paid water meters in terms of technical malfunctioning of the meter.

In the analysis, it is more apparent that the Klipheuwel user attitude and experience toward pre-paid water meters were mainly positive. Notwithstanding the fact that the meter could disconnect supply, most water users liked pre-paid water meters. It therefore follows that it was not likely for the community to protest against using pre-paid water meters. The findings, therefore, nullify the hypothesis that users had a negative experience with prepaid water meters. It also nullifies the hypothesis that users had a negative attitude towards pre-paid water meters as claimed by most reports on pre-paid water meters in South Africa. It can therefore be concluded that in Klipheuwel, users attitude and experiences towards pre-paid water meters cannot explain why the technology was abandoned.

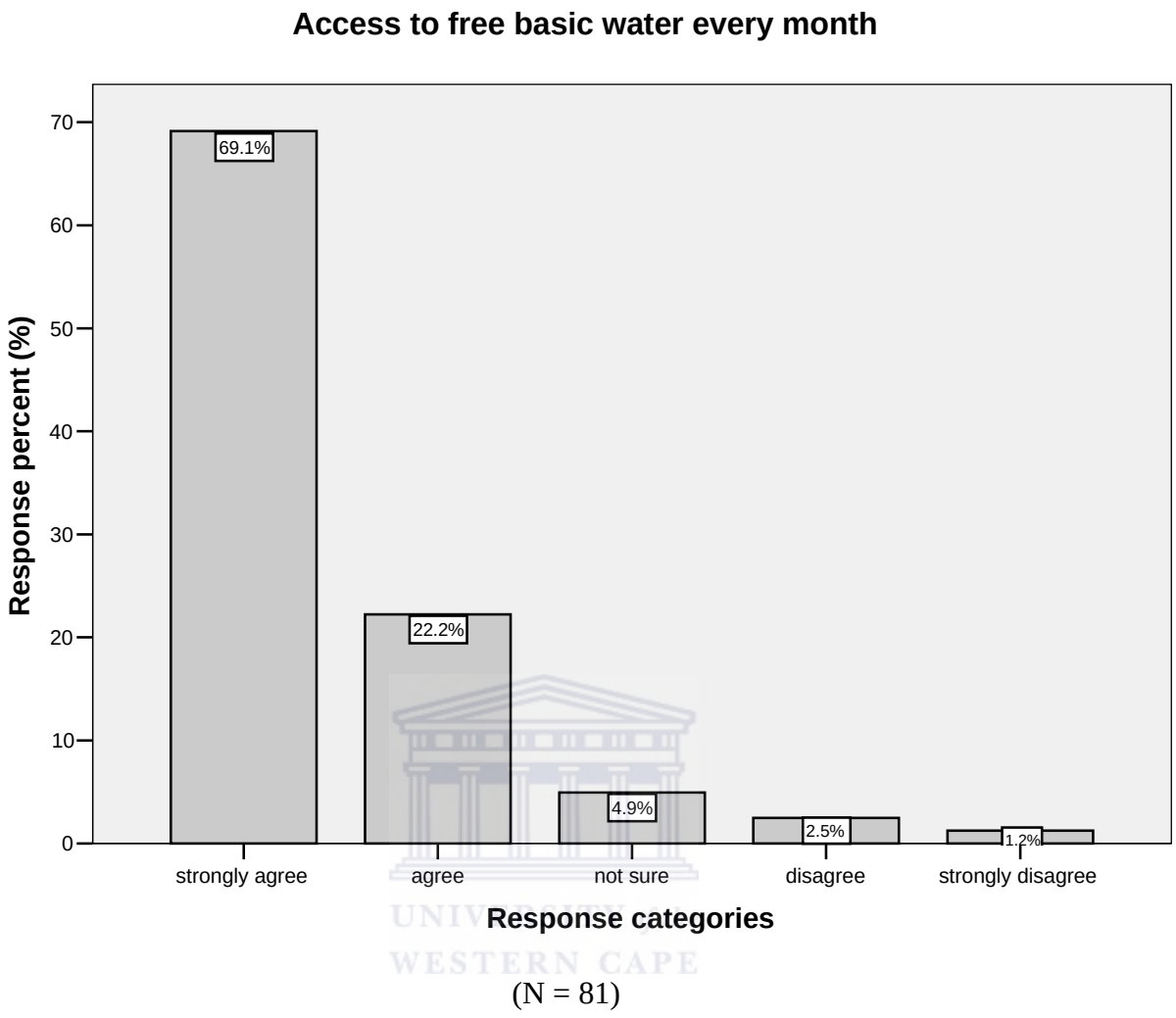
4.3 Access to free basic water

The study also explored the water users' perspectives on the effectiveness of pre-paid meters in administrating free basic water, with the aim of answering the following question: What was the impact of pre-paid water meters on water users' access to free- basic water? Access to free basic water is a very important element for ensuring access and equity principles in water resources management. It also forms part of the application of the basic needs approach in water resources management.

The second research question investigated the impact of pre-paid water meters on water user's access to free- basic water. In answering this research question, seven items were incorporated in the questionnaire. The items were primarily intended to establish whether pre-paid water meters had a positive/promoted or negative/inhibited impact on access to free basic water. Figure 10 presents responses to question 8(a) - how the respondents rated access to free basic water under pre-paid meters.

[15] The common problems stated at the FGD were the breaking of pipes and flashes on the meters. These problems were however unrelated to non-payment for services.

Figure 10



(N = 81)

Figure 10 demonstrates that 91.4% of the household heads agreed that pre-paid water meters allowed access to free basic water every month. Of the stated total, 69.1% strongly agreed while 22.2% agreed. However, 3.7% disagreed that pre-paid water meters ensured access to free basic water (1.2% strongly disagreed and 2.5% just disagreed). The remaining 4.9% of the respondents were not sure. These findings reveal that pre-paid water meters were a very effective water management tool for the administration of free basic water. Similar findings were obtained from question 6(e) in the questionnaire. These findings contradict the study results of the Orange Farm Water Crisis Committee *et al.* (2004) that pre-paid water meters are ineffective in administering the free basic water.

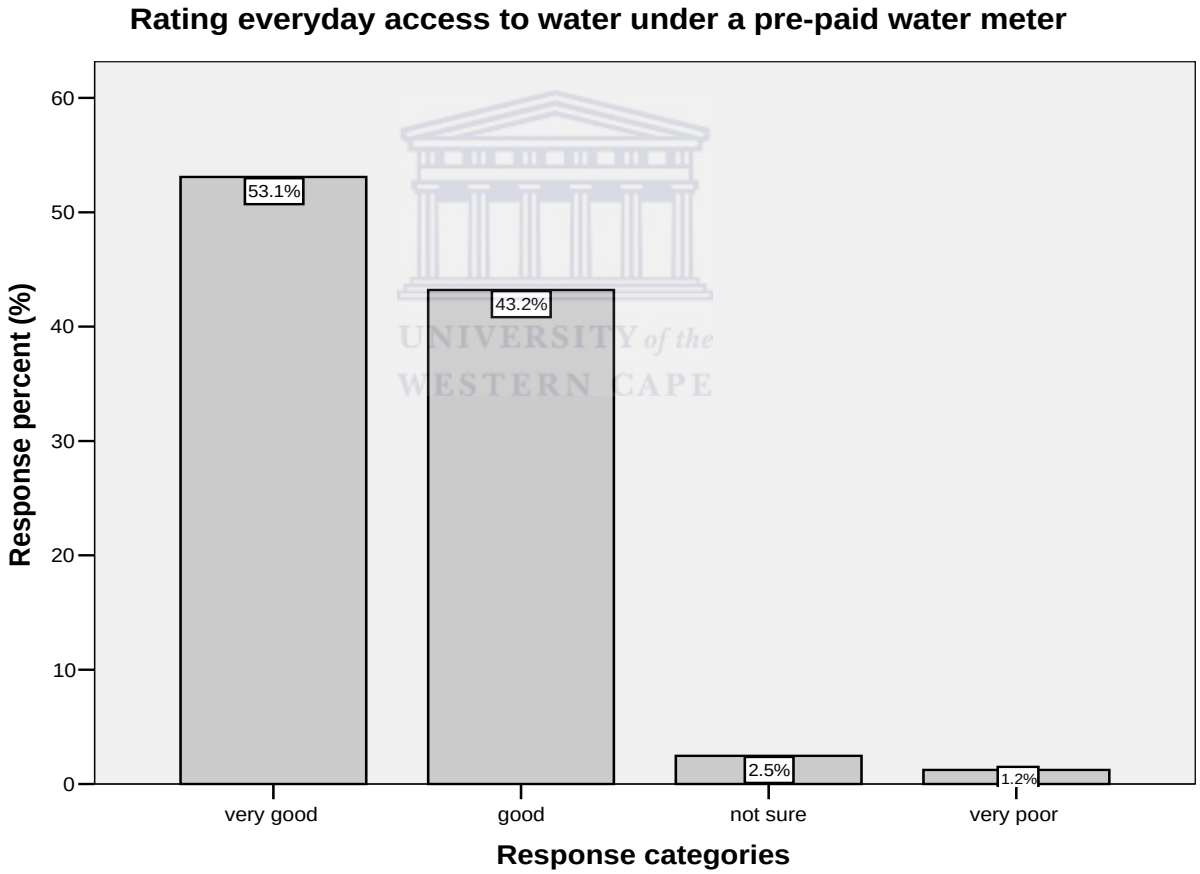
In the FGD, the participants agreed that the possession of pre-paid water meters ensured free basic water on the first day of every month. Complaints to the contrary were rare. The

participants were uncertain as to whether free basic water was also provided under the conventional water meters. It is therefore inappropriate to attribute the abandonment of the project to its failure to provide free basic water. Pre-paid water meters were largely excellent in ensuring equitable access to free basic water.

4.3.1 Influence on water access

Access to water in general could have played a decisive role in determining the duration of the project. Question 6(d) was used to determine how people in Klipheuwel rated pre-paid water meters in terms of ensuring access to water on daily basis, and presented in Figure 11.

Figure 11



(N = 81)

The graph above illustrates that 96.3% of the respondents rated pre-paid water meters to be good in ensuring everyday access to water (53.1% rated them to be very good and 43.2% rated them to be good). Only 1.2% rated the meters to be very poor, while 2.5% were

uncertain. Figure 11 shows that during this study, lack of access to water was not the main problem in Klipheuwel. Therefore, lack of access to water was not a strong reason to abandon the pilot project.

In summary, the findings suggest that pre-paid water meters were very effective in ensuring access to free basic water in Klipheuwel. The meters also ensured access to domestic water on a daily basis. Pre-paid meters therefore satisfy the access criteria of IWRM in Klipheuwel. Explaining the abandonment of the pilot project in terms of denied access to water in general and free basic water is inaccurate.

The meters, however, did not fully meet the requirements of the equity principle. If free basic water was equated to the volume of water required to satisfy the human right to water, then the Klipheuwel project was not successful. It failed to ensure universal access to free basic water. The meters were not effective in ensuring 100% access to free basic water (Figure 10). This suggests that the project had fallen short of the constitutional requirement. Nonetheless, this argument does not explain why the project was disbanded. It makes economic sense to have rectified the few problems with regard access to free basic water, than dissolving the entire project. In short, pre-paid water meters largely had a positive impact on access to water in general, particularly free basic water.

4.4 Paying for water

This section attempts to determine the influence that pre-paid water meters had on behaviour of water users in paying for water services. Payment for water is a very important element in ensuring cost recovery, thereby ensuring the financial sustainability of water services institutions. Non-payment for water is considered detrimental to poor communities (Savenije and Van der Zaag, 2002), and therefore paying for water enhances social sustainability. Sustainable water institutions allow sustained delivery, as well as sustained access to safe water.

4.4.1 Attitude towards paying for water

The study attempted to understand how low-income earners in Klipheuwel perceived paying for water services, and ascertained under question 3 in the questionnaire (Figure 12). The figure indicates that 71.6% of the household heads considered paying for water important

(37.0% considered paying very important while 34.6% considered it important). About 2.5% claimed that this was moderately important, while another 2.5% stated that it was of little importance. However, 23.5% of the household heads considered paying for water unimportant.

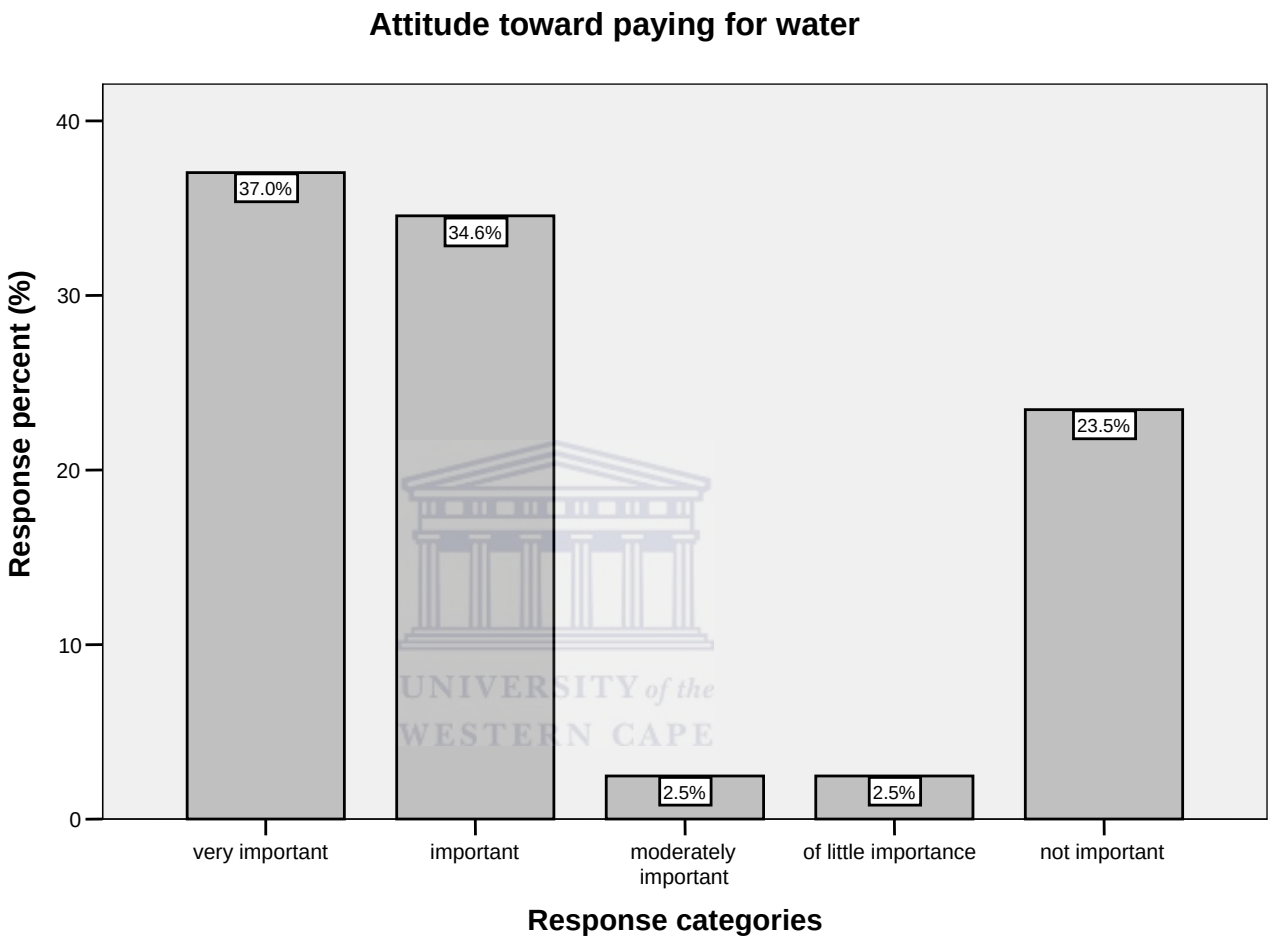


Figure 12

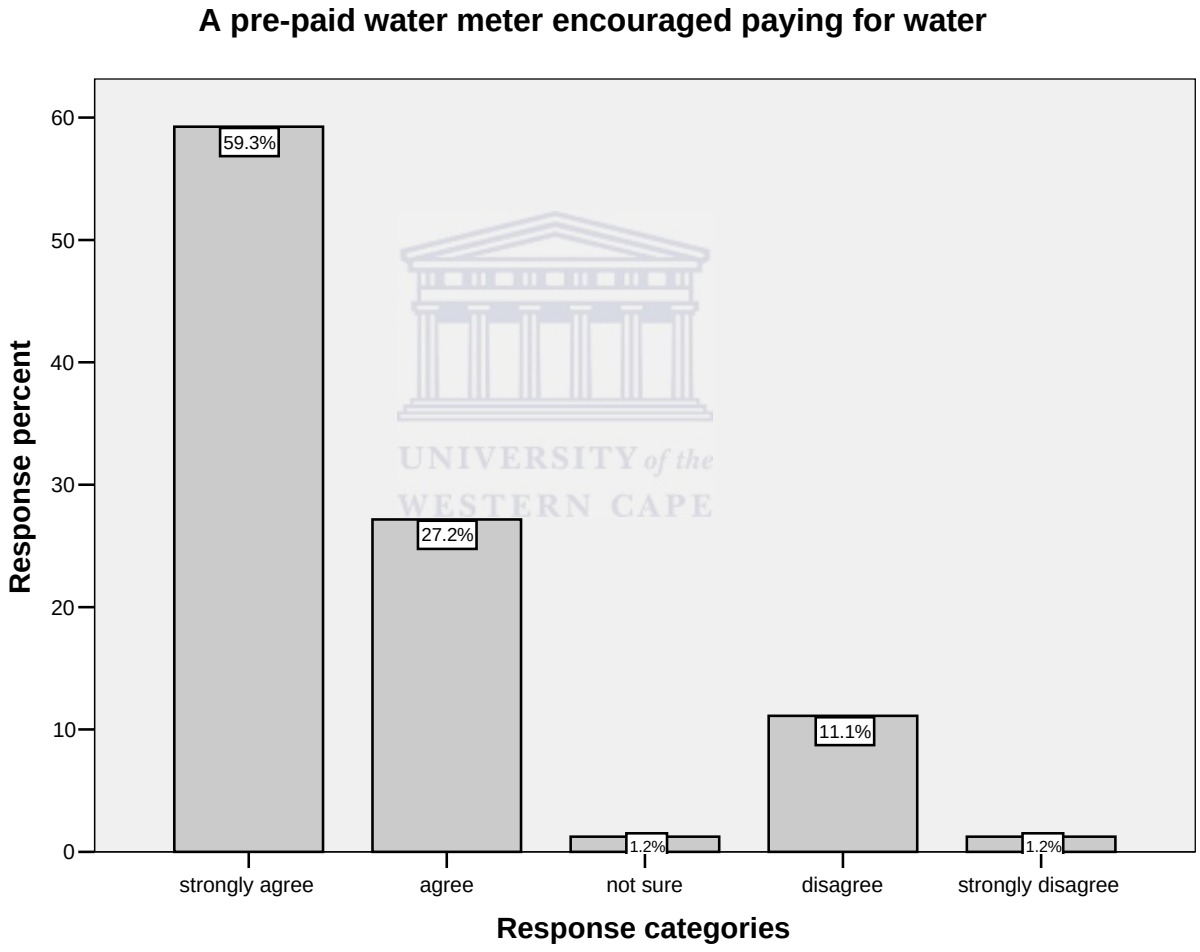
(N = 81)

Having found that a significant proportion of water users thought that paying for water was unimportant, the following section will now determine whether pre-paid water meters altered behaviour with regard payment

4.4.2 Influence on payment

It appears that in Klipheuwel, pre-paid water meters had a positive impact on ensuring that water users paid for services. Figure 13 presents the data generated from question 9(a) - agree or disagree that a pre-paid water meter encouraged payment for water services. Similar results were obtained from the responses to question 6(c).

Figure 13



(N = 81)

Figure 13 shows that pre-paid water meters were efficient in ensuring that water users paid for services. Of those in agreement, 59.3% strongly agreed and 27.2% agreed that pre-paid water meters encouraged payment. In parallel, 1.2% strongly disagreed and 11.1% disagreed that pre-paid water meters encouraged them to pay for water services. Comparison of Figure 12

and 13 shows an interesting discrepancy emerge. In Figure 12, 23.5% stated that paying for water services was unimportant, as opposed to only 13.3% disagreeing that it encouraged payment (Figure 13).

These findings suggest that pre-paid water meters encouraged even the users who viewed paying for water unimportant to pay for the services. The findings agree with the literature that pre-paid water meters are an effective cost recovery device. It is also consistent with the findings from the FGD that pre-paid water meters promoted payment for water. In contrast to pre-paid meters, water users in Klipheuwel had trouble understanding the conventional billing statements. At some houses, municipal meter readers could not access the premises, but the household still received its monthly account, which could either be inflated or understated because of administrative errors[16]. Such misunderstandings discouraged users from paying their bills. These problems were absent with pre-paid water meters as water users were certain about the money they paid for water consumed.

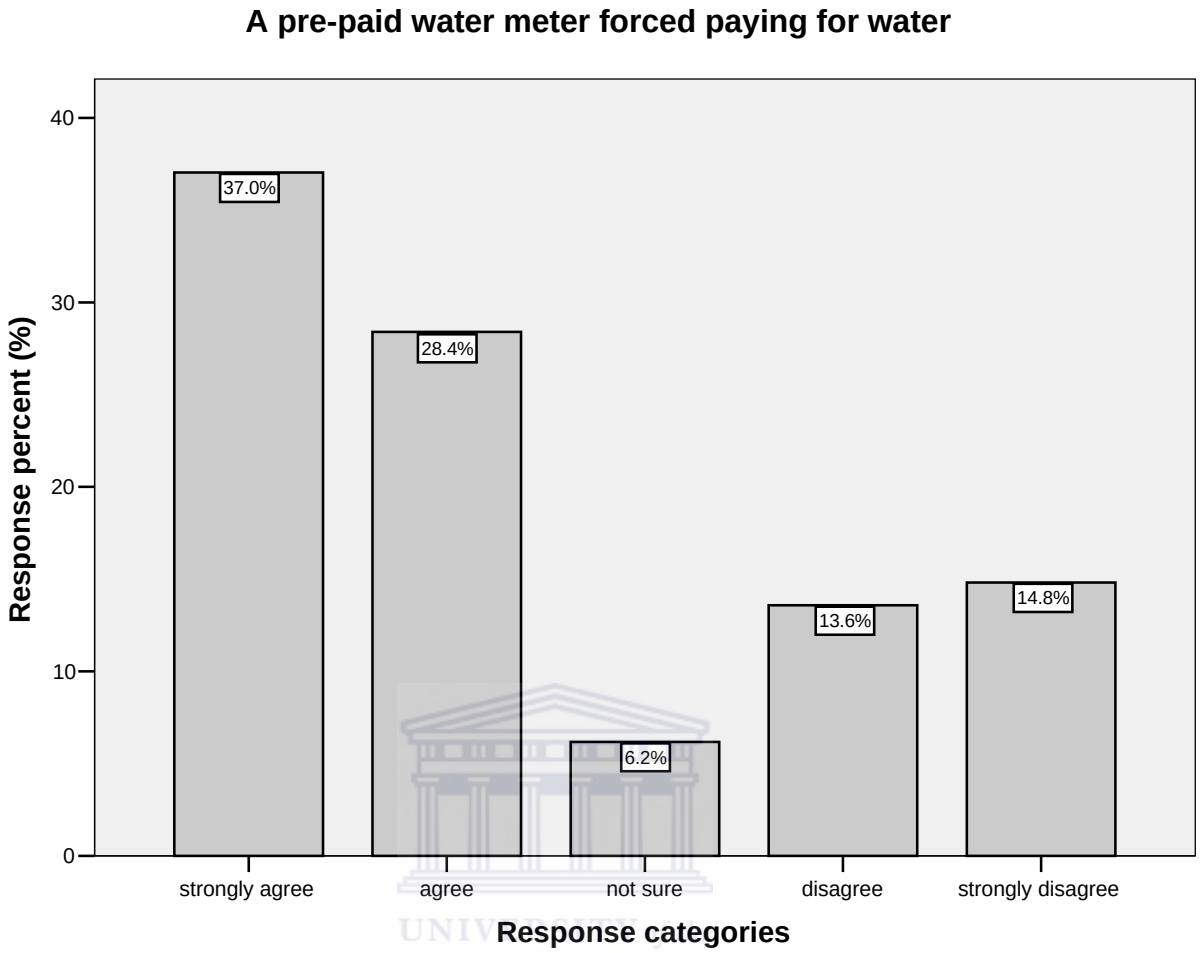
Potential reasons for inducing low-income water users to pay for water are discussed in the subsequent sections.

4.4.2.1 Persuasion

A greater proportion of the household heads stated that pre-paid water meters forced them to pay for water as they were responding to question 9(b). The question was designed to capture information on whether pre-paid water meters forced water users to pay for water or not. Figure 14 shows the percentages and frequency of the responses.

[16] In a FGD, the participant stated that with the account system, computer errors when generating water bills are common. Meter readers also provide inaccurate information because they fail to read the meters.

Figure 14



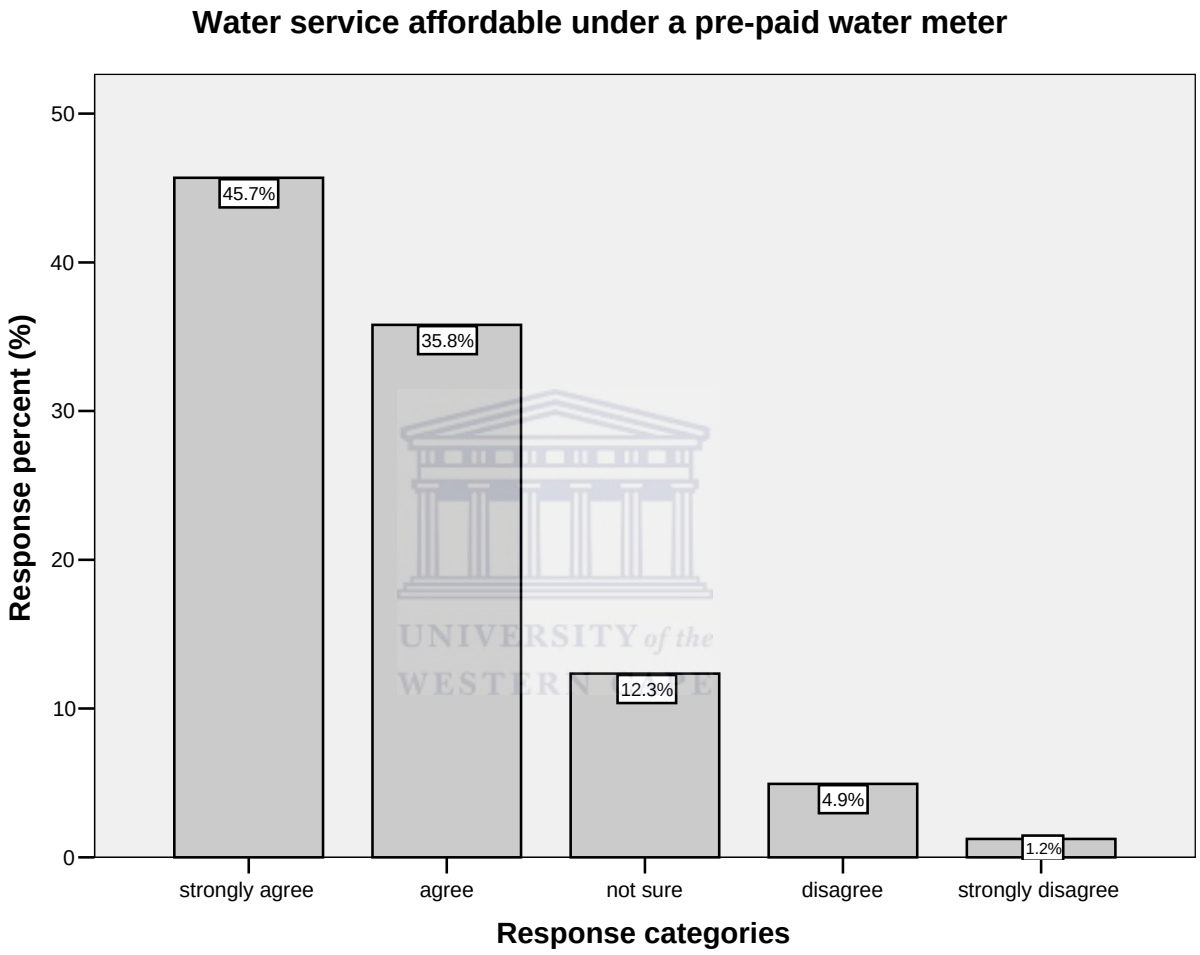
(N = 81)

The figure above shows that most of the water users agreed that using a pre-paid water meter forced them to pay for water. Of those who responded to this question, 35% strongly agreed that pre-paid water meters forced them to pay for water, while 28.4% just agreed. Approximately 65% agreed that a pre-paid water meter forced them to pay for water. In contrast, 13.6% disagreed that pre-paid water meters forced them to pay for water services while 14.8% strongly disagreed. This suggests that pre-paid water meters are persuasive in promoting water users to pay for water. A possible reason for this persuasion may be fear of disconnection.

4.4.2.2 Affordability

The study also investigated the issue of affordability, an important element of payment behaviour, during the pilot project in Klipheuwel. Question 9(c) – examined whether water services are affordable is shown in Figure 15.

Figure 15



(N = 81)

Figure 15 illustrates that most water users (81.5%) found pre-paid water meters affordable. Of this group, 45.7% strongly agreed while 35.8% just agreed. In contrast, 4.9% disagreed and 1.2% strongly disagreed that water services were affordable. This represents 6.1% of the respondents. The remaining 12.3% were not sure about the affordability of the services under pre-paid water meters. This shows that most people felt that water was affordable under pre-payment system.

Generally, all of the participants considered water services affordable under pre-paid water metering in the FGD. For the poor households, pre-paid water meters allowed them to pay less for water. In contrast, the account system used with conventional water meters was viewed to be rigid and expensive. Users who were unable to pay were trapped within water debt that accumulates with additional consumption and interest. In the long term, such bills become difficult for water users to settle[17]. For example, three of the community members in the discussions claimed to have enormous water debt. They were pessimistic about being able to settle the debt because they just couldn't afford. At the time of the discussions, these people were anxious about possible action that could be taken against them by the authorities.

However, the water users in Klipheuwel could pay as little as R5 for water with pre-paid water meters. The burden of the poor users to pay large monthly water bills was removed under this system. One of the participants in the FGD remarked that "there is no such thing as not having a R5 to buy water, but it is out of question to buy R5 electricity". Furthermore, it was easier for the poor to save small amounts of money to pay for water. Pre-paid water meters also prevented entrapment in water debt. Affordability may explain the positive attitude of water users towards pre-paid meters. It also suggests that most water users paid for water services.

In addition to affordability, most water users found pre-paid water metering more convenient[18]. The FGD confirmed these findings, where participants found it more convenient to buy water nearby. This could contribute to the positive attitude of most water users in Klipheuwel. Other cost recovery considerations could also explain why the pilot project was abandoned. For example, the cost of investment far outweighed the rate of return with regard to the recovered costs. This may be true considering that pre-paid water meters are expensive to install and operate. However, this element falls outside the scope of this study, as the primary concern of this section was to establish whether the technology promoted paying for water services.

[17] One participant brought her account, which at the time of the discussions, stood at an unsettled bill of R2400.00. She claimed that she is will not afford to pay it even if they take her to the court.
[18] About 79% of the respondents claimed that it convenient to pay for water under the pre-paid water metering system, while 12.4% stated that it was not convenient (see Table 2.12 in Appendix C)

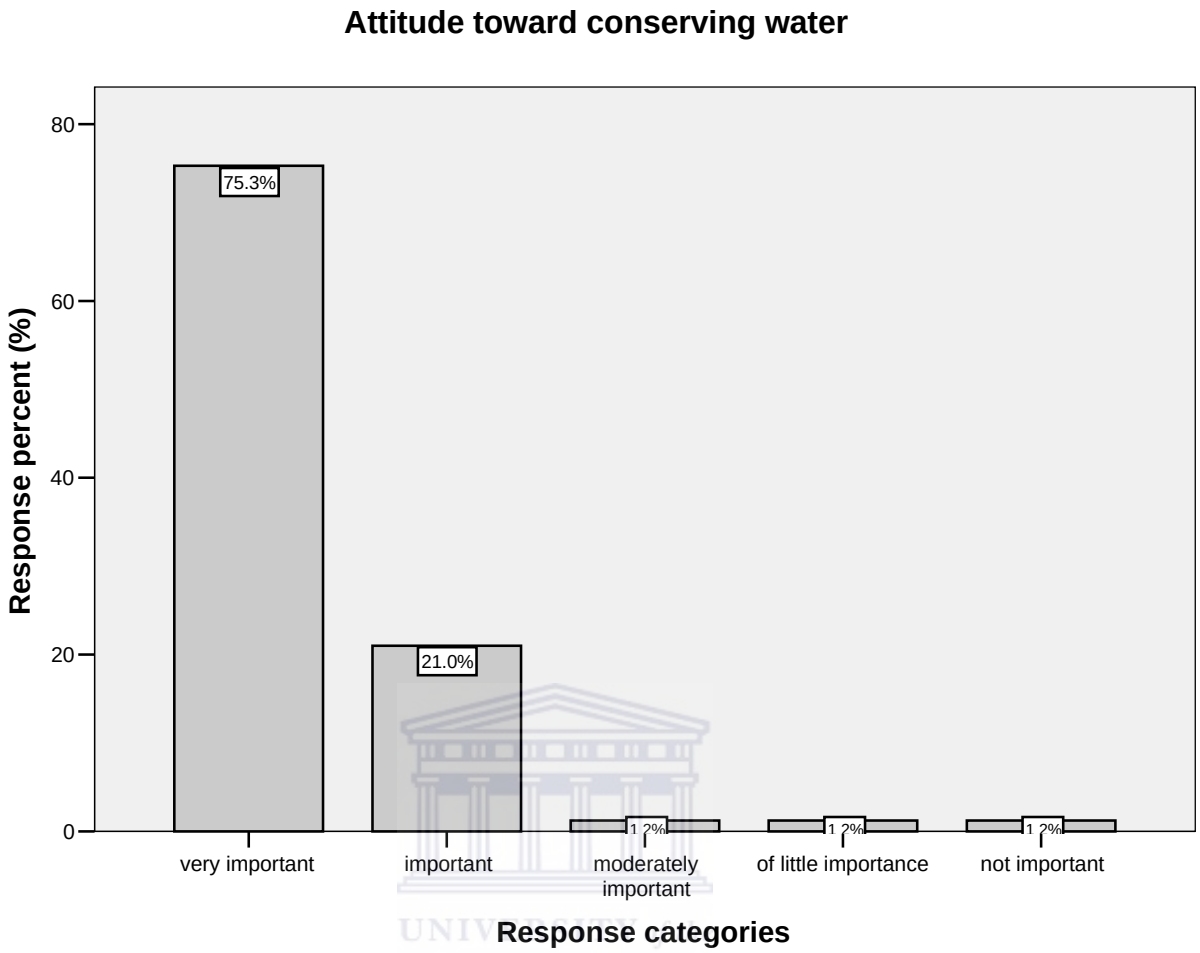
4.5 Water conservation

The literature suggests that using pre-paid water meters can foster a water conservation ethic (McKenzie *et al.*, 2003; Marvin *et al.*, 1999a and 1999b; Hartway *et al.*, 1999). The reason is that water pricing can influence water consumption (Hajispyrou *et al.*, 2002; De Azevedo and Baltar, 2005; Merrifield and Collinge, 1999; Pigram, 1999). The latter being an important element for ensuring ecological sustainability. Some scholars, however, are pessimistic about the influence of water pricing on water demand (Kolokytha *et al.*, 2002; Creedy *et al.*, 1998; Cairncross and Kinnear, 1992). This section will focus on the research question: What was the influence of pre-paid water meters on water conserving behaviour in Klipheuwel? Water conservation is an aspect of both a demand-oriented water management approach, and thus ecological sustainability. Economic instruments such as water tariffs and metering are important in WDM.

4.5.1 Attitude toward water conservation

In the questionnaire, question 4 tried to elicit the attitude of water users toward water conservation and extracted views from the water users on the importance of conserving water (Figure 16 shows the response of household heads).

Figure 16

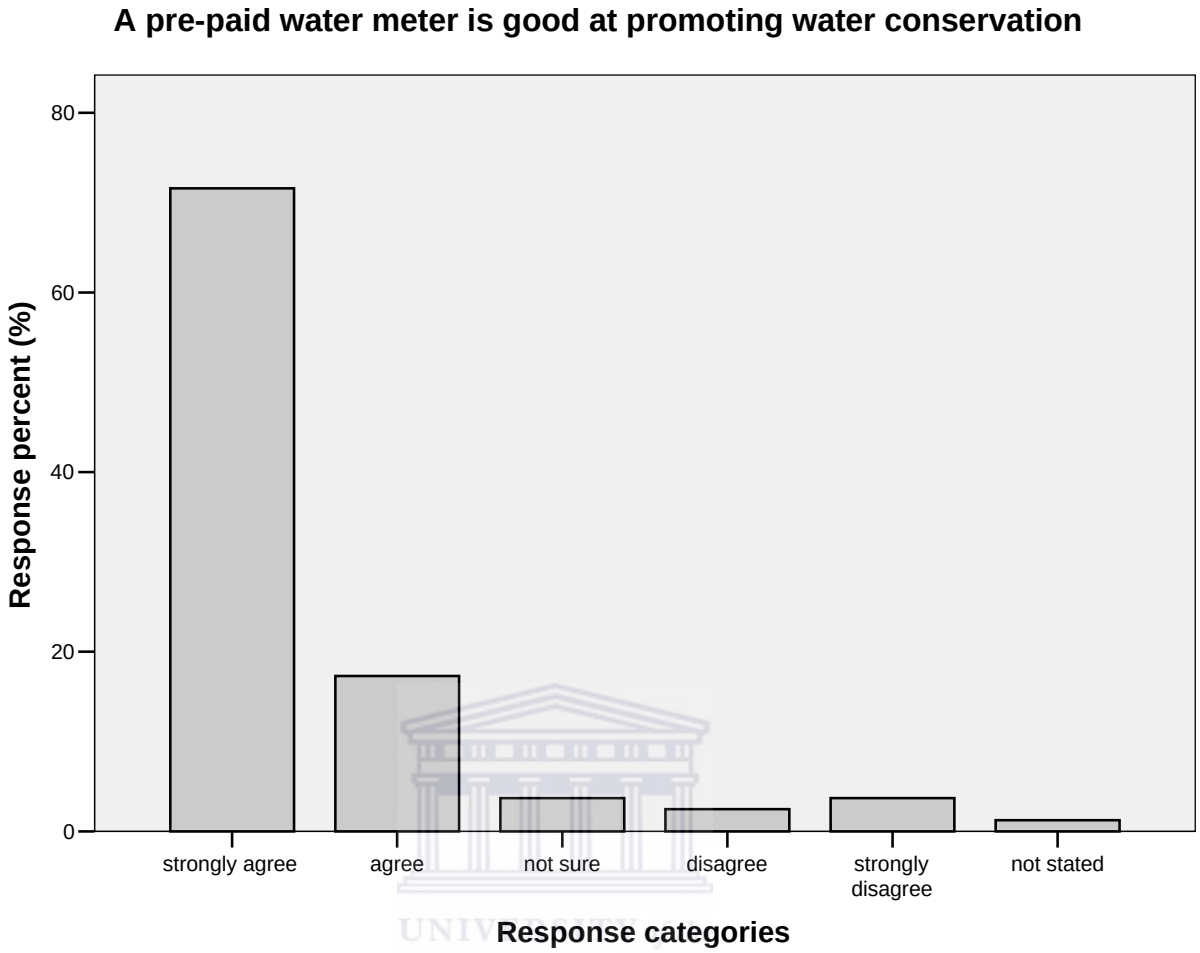


(N = 81)

Figure 16 indicates that the majority of water users (96.3%) in Klipheuwel had a positive attitude to conserving water. Most users (75.3%) chose the value of water as “very important”, and those chose the value of “important” were 21.0%. The remaining respondents stated that conserving water is not important (1.2%), moderately important (1.2%), and of little importance (1.2%).

The results show that pre-paid water meters are a good way of encouraging people to conserve water. Figure 17 displays the information that was captured by question 5(b).

Figure 17



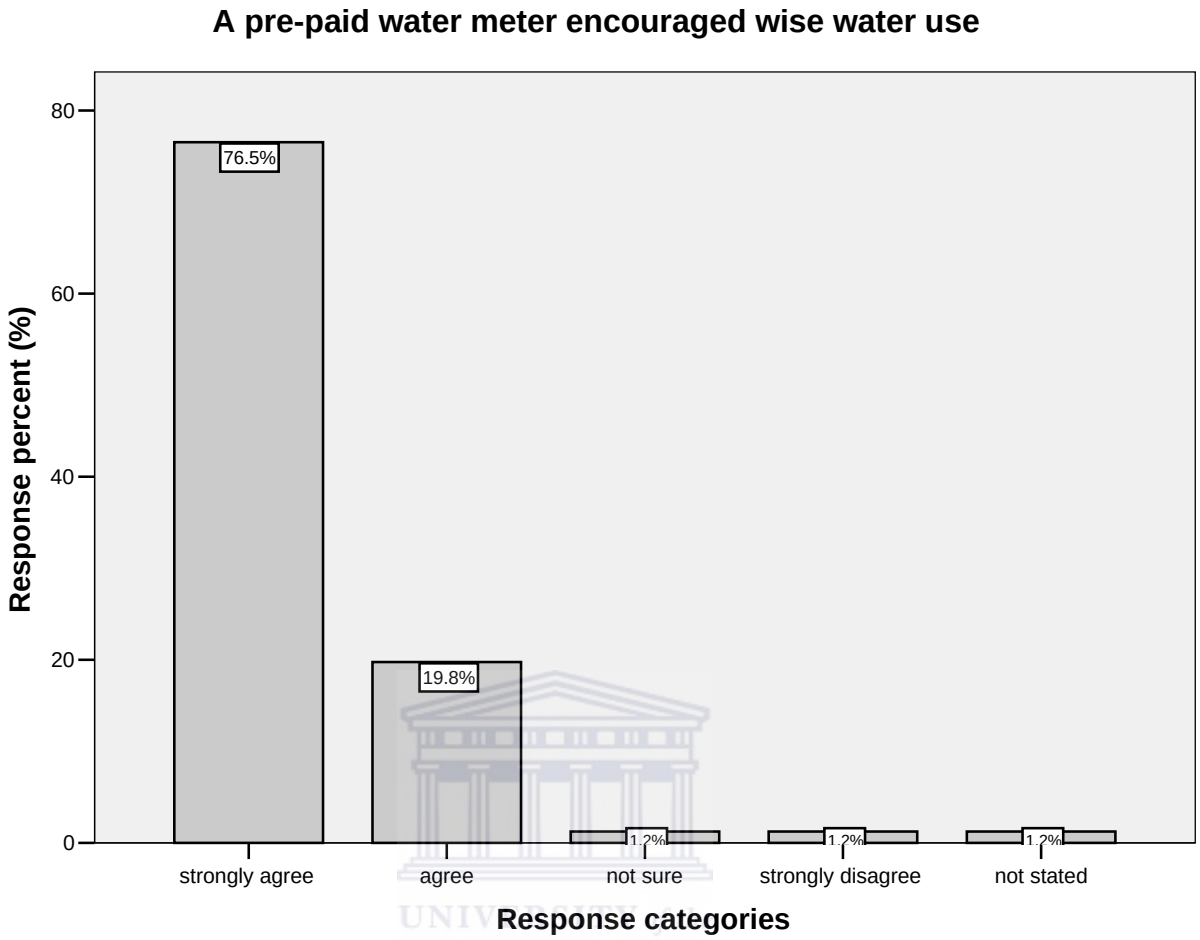
(N = 81)

The results in Figure 17 show that 88.9% confirmed that pre-paid water meters are a good way of promoting water conservation. Only 6.2% disapproved, while the remaining 4.9% respondents were not sure. On comparing Figure 16 and 17, it is evident that more water users saw water conservation as important. Of the users who proclaimed the importance of water conservation, only a few did not endorse that pre-paid water meters were a good way for encouraging it.

4.5.2 Influence on water conservation

Figure 18 below displays the frequencies and percentages of responses to question 10(a). The question was aimed at establishing the degree to which the water users agreed or disagreed that pre-paid water meters encouraged them to use water wisely. In other words, the influence pre-paid water meters had on promoting water conservation.

Figure 18



(N = 81)

The figure indicates that 76.5% of the household heads strongly agreed that pre-paid water meters encouraged them to use water wisely; 19.8% just agreed to the statement. This shows that 96.3% agreed that pre-paid water meters encouraged them to use water wisely. On the contrary, 2.4% disagreed that pre-paid water meters encouraged being water wise. The remaining 1.2% was unsure, while 1.2% did not respond to the question. Generally, the graph suggests that most of the water users in Klipheuwel claimed that the use of pre-paid water meters encouraged them to conserve water.[19]

[19] Similar results were obtained from question 6(f) which enquires as to whether pre-paid water meters promoted households to use water wisely or not (See Table 2.13 in the Appendix C).

A comparison of the results from Figures 16, 17 and 18 leads to the conclusion that pre-paid water metering had a positive impact on water conservation behaviour. Despite the fact that 96.3% of the water users stated that water conservation is important, only 88.9% of them agreed that pre-paid water meters are a good way of promoting water conservation

In support of these findings, the FGD also established that pre-paid water meters promoted water conservation. The participants in the discussions stated that they used their free water more wisely in order to reduce water costs. When used sparingly, they claimed the 6000 litres of free water adequate to meet their water requirements for the month, and therefore did not incur any costs. With conventional water meters, it is difficult to use water with caution – as users are unable to directly monitor the amount of water used monthly. The findings suggest that users in Klipheuwel considered pre-paid water meters to be excellent at promoting water conservation behaviour.

4.6 Summary

In summary, the study reveals that people in Klipheuwel are in favour of pre-paid water meters. They experienced minimal problems in accessing the free basic water during the period of the pilot study. Pre-paid water meters encouraged people to pay for water, as well as use water wisely. The findings suggest that the supposed social problems associated with pre-paid water meters did not apply in Klipheuwel. Instead, most people had a positive experience and attitude toward pre-paid water meters. The findings further suggest that pre-paid water meters met the objective for their implementation - the meters were able to encourage low-income water users to pay for water and water saving behaviour among users.

Pre-paid water meters ensured water access, equity and sustainability - all key principles of IWRM. The collapse of the pre-paid water metering pilot project in Klipheuwel therefore cannot be attributed to the following- people being against its implementation; failure in administering the free basic water component; inability to make users pay for water services; and failure to encourage users to conserve water.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The research attempted to provide a possible explanation for the social factors that triggered the collapse of the pre-paid water metering pilot project in Klipheuwel. It focused on water users' attitude and experience, access to free basic water, paying for water and water conservation. Central management focus areas were issues of water access, equity and sustainability with particular reference to IWRM.

In the preceding chapters, the study was introduced; the literature reviewed; the research methods described; and the study findings analysed and discussed. In this chapter, a conclusion and the recommendations of the study are provided.

5.2. Summary and Conclusions

In this section, the findings from the literature and the empirical study are summarised.

The literature review generally found that pre-paid water meters have been implemented as a management tool. The primary aim of implementing the technology was to promote cost recovery. Pre-paid water meters have primarily targeted low-income water users in order to encourage them to pay for water services.

The cost recovery objective of pre-paid water meters has attracted frustration and opposition from low-income domestic water users who see the technology as a source of increased hardship (Fiil-Flynn and Naidoo, 2004). Pre-paid water metering forces them to make difficult choices about their expenditure on water in relation to other basic amenities. In addition, failure to pay for water services implies no access to water, which in turn has generated social problems associated with lack of access to water. As a result, low-income water users have negative attitude/experience toward/with pre-paid water meters. Social concerns associated with the technology have resulted in the abandonment of pre-paid water

meter projects in the UK (Drakeford, 1998) and in Madlebe, Kwa-Zulu Natal (Deedat and Cottle, 2002).

In South Africa, the introduction of the basic needs approach also generated the need to implement pre-paid water meters. To be specific, the implementation of Free Basic Water Policy has weakened the financial resource base of water services institutions. The policy has increased the need to secure income to fund the supply of basic water. As a result, the recovery of costs associated with the provision of water above the free basic limit has been made a requirement. The policy has also made the metering of water compulsory to ensure equitable access to free basic water. Pre-paid water metering has therefore been implemented with a view of hastening equitable access to free basic water, but also to generate income to sustain the implementation of the policy.

With the current water scarcity problems in South Africa, pre-paid water meters have also been implemented as a WDM tool. Water managers view the technology as a solution to the promotion of water-wise behaviour (see Johannesburg Water, 2006). However, there has been inadequate empirical evidence supporting the argument that proper tariffs and water metering would control domestic demand for water (Savenije and Van der Zaag, 2002).

The findings from the empirical study suggest that most water users in Klipheuwel had a positive experience with pre-paid water meters. In fact, they prefer using pre-paid water meters to the conventional meters (associated with the account system). Findings suggest that it is very unlikely that community experiences and attitudes towards pre-paid water meters influenced the decision to abandon the pilot project.

Pre-paid water meters were also very effective in ensuring access to water in general and access to free basic water in particular. Unlike the literature, which suggests that achieving equitable access is difficult with the use of pre-paid water meters, the empirical findings reveal the contrary. In Klipheuwel, pre-paid water meters safeguarded equitable access to water by dispensing free basic water to each household every month. Moreover, access to water appear more affordable since people could pay as little as R5 for water at a time. Therefore, lack of access to water for the low-income water users is not a legitimate reason for abandoning the pilot project.

Additionally, the empirical study established that the technology was an effective tool for enhancing payment for water services in Klipheuwel. The technology improved cost recovery for the water consumed above the free basic block, thereby contributing toward ensuring financial sustainability of water services institutions. This has therefore also not lead to the abandonment of the project.

Finally, the empirical findings indicate that pre-paid water meters promoted the wise use of water. Contrary to the literature, which states that water pricing has little effect on water consumption for essential domestic water uses, pre-paid water meters in Klipheuwel made people more conscious of their consumption behaviour. This altered behaviour contributed toward efforts that enhance ecological integrity since most water users were influenced to use water wisely. As a water management objective for implementing pre-paid water meters, the technology was more capable of controlling water demand. The failure to promote WDM can not adequately explain the abandonment of the pre-paid water metering project.

In summary, pre-paid water meters in Klipheuwel effectively attained the three ostensibly conflicting water management aims which are promoting equitable access to water, cost recovery and WDM. There is inadequate social information on the Klipheuwel community that suggests that pre-paid water meters failed to achieve the three stated water resources management issue that lead to the abandonment of the project. In addition, the community was not apposed to the technology.

4.4 Recommendations

5.41 For Water Management Practices

In an effort to meet the minimum human water requirements, it is equally vital to consider institutional financial sustainability and ecological integrity. In the application of pre-paid water meters, the following should be considered:

1. The participation of primary beneficiaries at all levels from the on-set to the conclusion of the project;
2. For the low-income water users, pre-paid water meters should be implemented together with a free minimum amount of water, that is sufficient to sustain life;
3. Implement pre-paid water meters among higher income domestic water users for it to effectively operate as a water management tool.

4. For low-income users, the water billing system requires flexibility when making payment for water services;
5. There should be flexibility in the legal framework to incorporate the use of pre-paid technology where cost recovery and WDM are great challenges.

5.4.2 For Further Research

There are a number of areas that require further research with regard to pre-paid water metering technology. These include:

1. Duplication of this survey in other areas to test the validity of the findings in a broader context;
2. Perceptions and attitudes of higher income households toward using pre-paid water meters;
3. Prospects and constraints to the implementation of pre-paid water meters: An evaluation of water legislation and policy.
4. Cost-benefit analysis for using pre-paid technology in the water service sector.

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APPENDICES

APPENDIX A: QUESTIONNAIRE

PART A: Demographic Information.

a. What is the sex of the head of household? Male ☐ Female ☐

b. What does the head of household do to earn a living?

Employed ☐ unemployed ☐ business person ☐ pensioned ☐ casual worker ☐

c. What is the highest level of education for the head of the household?

No education ☐ Primary, ☐ High school ☐ University ☐ Other (Specify)……

d. What is the total monthly income of the household?

Below R800 ☐ R801- R 2,000 ☐ R2, 001-R5, 000 ☐ R5, 001 and above ☐

e. Have your household used a prepaid water meter before Yes ☐ No ☐

If yes, proceed answering the questionnaire, do not complete the questionnaire.

PART B: Pre-paid water metering

Question	Very important	Important	Moderately important	Of little Importance	Not important
1. What do you think about using a prepaid water meter?					
2. What do you think about receiving free basic water?					
3. What do you think about paying for water services?					
4. What do you think about conserving water?					

5. To what extent do you agree or disagree with each of the following statements;

Statement	strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
a. Prepaid water meters are good.					
b. Prepaid water meters are a good way of encouraging people to conserve water.					
c. Prepaid water meter are a good way of making people pay for water services.					
d. I like to use a prepaid water meter at my house.					
f. My household was happy with a prepaid water meter					

6. How do you rate the following about a prepaid water meter?

Statement	Very good	Good	Not sure	Poor	Very poor
a. Water services under a prepaid water meter.					
b. Response of the municipality to solve the problems with your prepaid water meter.					
c. How you paid for water services.					
d. Allowing you to access water everyday.					
e. Allowing you to get free water every month.					
f. Encouraging you to avoid wasting water					
g. Ensuring that you pay for water.					

7. **How frequently did the following happen to your household during the period you were using a prepaid water meter?**

Statement	Always	Very Often	Sometimes	Rarely	Never
a. Running out of water					
b. Having no water for more than 24 hours					
c. Failing to buy water because a shop where the water was bought was closed.					
d. Failing to buy water because the machine for selling credit had problems.					
e. Loosing credit in a prepaid water meter					
f. Getting water from your neighbours					
g. Failing to get free water in a particular month					
h. A prepaid meter failing to work properly					

8. **To what extent do you agree or disagree with each of the following statement about having access to free water during the period your household was using prepaid water meters?**

Statement	Strongly agree	Agree	Not sure	Disagree	Strongly Disagree
a. Prepaid allowed my household to access free water every month.					
b. Prepaid meter had many faults that made my household fail to get free water some months.					
c. Prepaid water meter encouraged my house to beg for water from neighbours.					

9. **To what extent do you agree or disagree with each of the following statement about the way you paid for water services when you were using a prepaid water meter?**

Statement	strongly agree	Agree	Not sure	Disagree	Strongly Disagree
a. Prepaid water meter encouraged my household to pay for water.					
b. Prepaid water meters forced my household to pay for water					
c. Water services were affordable					
d. Paying for water was very convenient.					

10. **How much do you agree with the following statement about the way your household used water under a prepaid water meter?**

Statement	strongly agree	Agree	Not sure	Disagree	Strongly Disagree
a. Prepaid water meter encouraged my household to use water wisely.					
b. Prepaid water meter forced my household to conserve water.					
c. Prepaid water meters are a good way of encouraging water conservation.					
d. With a prepaid water meter, we reduced the water we were using every month.					

APPENDIX B: FOCUS GROUP DISCUSSION GUIDE

1. What do think about the pre-paid water meters?

2. What do you think about how the community thinks about a pre-paid water meter?

3. Why was pre-paid water meters removed?

5. What were the problems you encountered with using a pre-paid water meter?

6 What are the advantages for using pre-paid water meters?

7. Given a chance to use either a pre-paid water meter or a conventional water meter, which one would you choose? Why?

APPENDIX C: TABLES

1. Demographic Characteristics

Table 1.1

Household sex

	Frequency	Percent	Cumulative Percent
Male	51	63.0	63.0
Female	30	37.0	100.0
Total	**81**	**100.0**	

Table 1.2

Household income

	Frequency	Percent	Cumulative Percent
below R800	40	49.4	49.4
R800-R2000	38	46.9	96.3
R2001-R5000	3	3.7	100.0
Total	**81**	**100.0**	

Table 1.3

Family size

	Frequency	Percent	Cumulative Percent
less than 4	22	27.2	27.2
4-8 people	57	70.4	97.5
above 8	2	2.5	100.0
Total	**81**	**100.0**	

Table 1.4

Household occupation

	Frequency	Percent	Cumulative Percent
employed	38	46.9	46.9
unemployed	24	29.6	76.5
business person	4	4.9	81.5
pensioned	7	8.6	90.1
casual worker	8	9.9	100.0
Total	**81**	**100.0**	

2. Attitude and Experiences

Table 2.1

Attitude towards using pre-paid water meter

	Frequency	Percent	Cumulative Percent
very important	54	66.7	66.7
important	21	25.9	92.6
moderately important	1	1.2	93.8
of little importance	1	1.2	95.1
not important	4	4.9	100.0
Total	**81**	**100.0**	

Table 2.2

Pre-paid water meters are good

	Frequency	Percent	Cumulative Percent
strongly agree	51	63.0	63.0
agree	24	29.6	92.6
not sure	1	1.2	93.8
disagree	3	3.7	97.5
strongly disagree	2	2.5	100.0
Total	**81**	**100.0**	

Table 2.3

Household head occupation * Pre-paid water meters are good

% of Total

		Pre-paid water meters are good					
		strongly agree	agree	not sure	disagree	strongly disagree	**Total**
Occupation	employed	24.7%	16.0%	1.2%	2.5%	2.5%	**46.9%**
	unemployed	18.5%	9.9%		1.2%		**29.6%**
	business person	4.9%					**4.9%**
	pensioned	7.4%	1.2%				**8.6%**
	casual worker	7.4%	2.5%				**9.9%**
Total		**63.0%**	**29.6%**	**1.2%**	**3.7%**	**2.5%**	**100.0%**

Table 2.4

Household income * Pre-paid water meters are good

% of Total

		Pre-paid water meters are good					
		strongly agree	agree	not sure	disagree	strongly disagree	**Total**
Income	below R800	29.6%	16.0%	1.2%	2.5%		**49.4%**
	R800-R2000	32.1%	11.1%		1.2%	2.5%	**46.9%**
	R2001-R5000	1.2%	2.5%				**3.7%**
Total		**63.0%**	**29.6%**	**1.2%**	**3.7%**	**2.5%**	**100.0%**

Table 2.5

Prefer to use a pre-paid water meter

	Frequency	Percent	Cumulative Percent
strongly agree	47	58.0	58.0
agree	19	23.5	81.5
not sure	8	9.9	91.4
disagree	3	3.7	95.1
strongly disagree	4	4.9	100.0
Total	**81**	**100.0**	

Table 2.6

Household income * Prefer to use a pre-paid water meter

% of Total

		Prefer to use a pre-paid water meter					
		strongly agree	agree	not sure	disagree	strongly disagree	**Total**
Income	below R800	27.2%	12.3%	7.4%	1.2%	1.2%	**49.4%**
	R800-R2000	29.6%	9.9%	2.5%	1.2%	3.7%	**46.9%**
	R2001-R5000	1.2%	1.2%		1.2%		**3.7%**
Total		**58.0%**	**23.5%**	**9.9%**	**3.7%**	**4.9%**	**100.0%**

Table 2.7

Family size * Prefer to use a pre-paid water meter

% of Total

		Prefer to use a pre-paid water meter					
		strongly agree	agree	not sure	disagree	strongly disagree	**Total**
Size	less than 4	16.0%	6.2%	3.7%		1.2%	**27.2%**
	4-8 people	39.5%	17.3%	6.2%	3.7%	3.7%	**70.4%**
	above 8	2.5%					**2.5%**
Total		**58.0%**	**23.5%**	**9.9%**	**3.7%**	**4.9%**	**100.0%**

Table 2.8

Begging water from neighbours

	Frequency	Percent	Cumulative Percent
always	3	3.7	3.7
very often	4	4.9	8.6
sometimes	12	14.8	23.5
rarely	7	8.6	32.1
never	55	67.9	100.0
Total	**81**	**100.0**	

Table 2.9

How water was paid under pre-paid water meter

	Frequency	Percent	Cumulative Percent
very good	27	33.3	33.3
good	38	46.9	80.2
not sure	6	7.4	87.7
poor	9	11.1	98.8
very poor	1	1.2	100.0
Total	**81**	**100.0**	

Table 2.10

Fail to buy water due to the closure of a vending shop

	Frequency	Percent	Cumulative Percent
always	1	1.2	1.2
very often	4	4.9	6.2
sometimes	18	22.2	28.4
rarely	15	18.5	46.9
never	43	53.1	100.0
Total	**81**	**100.0**	

Table 2.11

Rating of how municipality responded to meter faults

	Frequency	Percent	Cumulative Percent
very good	22	27.2	27.2
good	23	28.4	55.6
not sure	31	38.3	93.8
poor	1	1.2	95.1
very poor	4	4.9	100.0
Total	**81**	**100.0**	

Table 2.12

Disappearance of watercredit in a pre-paid water meter

	Frequency	Percent	Cumulative Percent
very often	2	2.5	2.5
sometimes	6	7.4	9.9
rarely	10	12.3	22.2
never	63	77.8	100.0
Total	**81**	**100.0**	

Table 2.12

Paying for water was very convenient

	Frequency	Percent	Cumulative Percent
strongly agree	45	55.6	55.6
agree	19	23.5	79.0
not sure	6	7.4	86.4
disagree	5	6.2	92.6
strongly disagree	5	6.2	98.8
Not stated	1	1.2	100.0
Total	**81**	**100.0**	

Table 2.13

Encouraging water conservation

	Frequency	Percent	Cumulative Percent
very good	46	56.8	56.8
good	29	35.8	92.6
not sure	2	2.5	95.1
poor	1	1.2	96.3
very poor	3	3.7	100.0
Total	**81**	**100.0**	

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