Managing urban water services through segmentation, service and price differentiation: findings from sub-Saharan Africa

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Managing urban water services through
Segmentation, Service and Price Differentiation:

Findings from Sub-Saharan Africa

by

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A doctoral thesis submitted in partial fulfilment of the requirements
for the award of Doctor of Philosophy of Loughborough University,
January 2002

Civil and Building Engineering Department

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ABSTRACT

Water is life and its provision is vital not only for purposes of sustaining life but also for convenience, health, sanitation and economic well being. The United Nations estimates that over one billion people living in developing countries lack access to safe water, with a substantial proportion of these living in Africa. As a consequence of urbanisation and rapid growth of cities, urban water utilities in developing countries face an enormous challenge in meeting the water requirements of urban dwellers. The challenge is even greater when the prevailing poverty, high levels of debt and declining funding (in form of official development assistance) are taken into account. In particular, Sub-Saharan Africa is facing low levels of water services and water supply coverage.

Under these circumstances, a key objective for water utilities in Sub-Saharan Africa is to provide services to the growing urban population, including the poor, in a financially sustainable manner. To achieve this objective, utility managers need innovative methods of financing and managing urban water services. A systematic approach consisting of market segmentation, service and price differentiation is proposed as a suitable method of managing urban water services in Sub-Saharan Africa. This approach is the subject under investigation in the research, which is reported in this thesis.

Using primarily the case study research methodology but also incorporating surveys, interviews and focus group discussions within the case study, research was carried out to investigate the use of a systematic approach consisting of segmentation, service and price differentiation for managing urban water services in the context of Sub-Saharan Africa. The detailed field research was carried out in Kenya and South Africa, and two case studies were prepared.

Among the key findings was that this approach offers a framework for water utilities to structure their service delivery with appropriate pricing and serve more customers (including people living in informal settlements) at affordable cost, while achieving financial sustainability. The finding leads to the conclusion that segmentation, service and price differentiation is a suitable methodology that utilities can use to improve urban water services in Sub-Saharan Africa.

Key words: Management, urban, water services, marketing, market segmentation, pricing, Sub-Saharan Africa.
ACKNOWLEDGEMENTS

This thesis was prepared using part of the data obtained from a research project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of the DFID. The data used in this thesis is part of that collected by the author, who was the Principal Researcher of the DFID funded research project entitled "Pricing and service differentiation of utility watsan for the poor". The author wishes to thank the DFID for providing financial support for the research.

I wish to thank Mr Kevin Sansom and Mr Ian Smout, the research supervisors for their role and Dr Andrew Cotton, the director of research for his support. Thanks also to members of the PSDP research team for their contribution, and other colleagues at the Water, Engineering and Development Centre (WEDC), Loughborough University for their encouragement. The views expressed in this thesis are those of the author and do not necessarily reflect the views of WEDC or the organisations that collaborated in the research.

Thanks also to the management and staff of Durban Metro Water and Waste (DMWW) who facilitated the study, and Interface Africa, who assisted in organising and facilitating focus group discussions in Durban and Mpumalanga, in the Republic of South Africa. The residents of Cato Crest in Durban provided information through questionnaires and focus group discussions without which the study would not have been successful.

I wish to thank the management and staff of National Water Conservation and Pipeline Corporation (NWCPC) in Kenya, who facilitated the study in Kenya, and all the enumerators for their useful contribution in the fieldwork. Thanks also to the management and staff of Mombasa Municipal Council and the facilitators who facilitated focus group discussions in informal settlements. The residents of various segments in Mombasa provided information through questionnaires and focus group discussions without which the study would not have been successful.
I pursued the PhD research when I was already a married family man and after gaining considerable professional experience in industry. I could not have successfully carried out the research and other professional tasks, or completed writing this thesis, were it not for the understanding, encouragement, and support of my loving wife and children. I am therefore grateful to my loving wife, Catherine Njiru; my lovely children, Denis, Carol and Brenda Njiru; and the entire family, for having coped with my frequent absence from home and long working hours. Lastly but not least, I thank God for the gift of life and for keeping me in excellent health that enabled me to travel extensively and work long hours.
DEDICATION

This thesis is dedicated to the memory of my mother, Naomi, whose untimely, sad death occurred on 18th May 1998. Her wishes for my success in continued postgraduate studies have continued to be a source of strength and inspiration. Her memory will forever continue to propel me to aim for the highest possible professional achievement. May the Almighty God rest her soul in eternal peace.
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<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>BOOT</td>
<td>Build-Own-Operate-Transfer</td>
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<tr>
<td>Coverage</td>
<td>Number of households connected to water supply system divided by the number of households, expressed as a percentage</td>
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<tr>
<td>Customers</td>
<td>Consumers or direct users, with whom a water utility has a supplier-customer relationship</td>
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<tr>
<td>Developing countries</td>
<td>Low income countries with a GNP per capita of US$755 or less in 1999</td>
</tr>
<tr>
<td>Developed countries</td>
<td>High income countries with a GNP per capita of US$9266 or more in 1999</td>
</tr>
<tr>
<td>DMWW</td>
<td>Durban Metro Water &amp; Waste Corporation</td>
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<tr>
<td>ESAs</td>
<td>External support agencies</td>
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<tr>
<td>NWCPC</td>
<td>National Water Conservation &amp; Pipeline Corporation</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
</tr>
<tr>
<td>O &amp; M</td>
<td>Operations and Maintenance</td>
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<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
</tr>
<tr>
<td>Operators</td>
<td>Used in place of “Service providers”. Operators are public or private organisations responsible for providing water services. Water utilities are also used to refer to operators or service providers</td>
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<tr>
<td>PSP</td>
<td>Private Sector Participation</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>The term used to refer to African countries that lie south of the Sahara, and excludes the middle income north African countries</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>WEDC</td>
<td>Water, Engineering and Development Centre at Loughborough University</td>
</tr>
<tr>
<td>WUP</td>
<td>Water Utility Partnerships</td>
</tr>
<tr>
<td>WSP</td>
<td>Water and Sanitation Programme</td>
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<tr>
<td>Water Utility</td>
<td>Public, private or combined organisations who manage water supply services</td>
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CHAPTER 1: Introduction

1.1 Chapter outline

The purpose of this chapter is to explain what the thesis is about. A brief background to the research problem and its context is provided. Key challenges facing water utility managers in developing countries and current approaches are summarised. The way forward is proposed, leading to the basis of the research. The aims and objectives of the research are provided and the research methodology stated. The main research findings are summarised and a guide to the structure of the thesis provided.

1.2 Background

Water is life and its provision is vital not only for purposes of sustaining life but also for convenience, health, sanitation and economic well being. Despite concerted international effort and publicity made in the last two decades to increase coverage of improved water services, the number of people without improved water services continue to increase. The recent global water supply and sanitation assessment found that at the beginning of 2000, one-sixth (1.1 billion people) of the world's population was without access to improved water supply and two-fifths (2.4 billion people) lacked access to improved sanitation. The majority of these people live in Asia and Africa, where two out of five Africans lack improved water supply (WHO/UNICEF, 2000). This situation broadly reflects on the management of water services in developing countries.

The health hazards of poor water supply and sanitation, as well as the health benefits of improved water supply and sanitation, have been well documented (Esray et al, 1990). Poor water supply and sanitation have a high health toll, whereas improving water and sanitation brings valuable benefits to both social and economic development (WHO/UNICEF, 2000). Improved management of water, and also increased and sustainable access to water supply and sanitation contributes to the three main elements of the International Development Targets stated as economic well-being, human development and environmental sustainability (DFID, 2001).
Globally, the importance of improving the management of water services is reflected by the international effort to increase service delivery and coverage. The international development target for water supply coverage is to reduce by one-half the proportion of people without sustainable access to adequate quantities of affordable and safe water by 2015, and to provide water, sanitation, and hygiene for all by 2025 (DFID, 2001). These targets were developed by the Water Supply and Sanitation Collaborative Council (WSSCC) as part of the process leading up to the Second World Water Forum (The Hague, 17–22 March 2000), and were endorsed by the Second World Water Forum and in the United Nations Millennium Declaration. Immense effort and investment is required to achieve these targets: Effective and efficient management of water services is considered necessary to support global effort and investment in the sector.

1.2.1 The challenge of managing urban water services in developing countries

Provision of water and sanitation services to people living in developing countries is a challenging task. The task is even greater in urban areas of developing countries, as a consequence of urbanisation and rapid growth of cities. Urban water utilities face an enormous challenge in meeting the water requirements of urban dwellers. A look at demographic figures and trends demonstrate the magnitude of this problem.

The world population was estimated to be over 6 billion in 2000 of which 79% lived in developing countries and 21% in developed countries. The world population is projected to be over 7 billion in 2015 with 82% living in developing countries and 18% in developed countries. Of the 4.6 billion people in developing countries in 1999, 39% lived in urban areas. The urban population in developing countries is rising rapidly and is estimated to constitute over 48% of the total population (projected at 5.8 billion) by 2015 (UNDP, 2000 and 2001). There will be enormous strains on existing services, and substantial further service provision will be needed to meet the population increase and address the backlog (WHO/UNICEF, 2000).

The challenge of providing water and sanitation services in low and lower middle income countries is compounded by poverty and population growth.
The urban populations of Africa, Asia, Latin America and the Caribbean are expected to increase dramatically. The African urban population is expected to more than double over the next 25 years, while that of Asia will almost double. The greatest increase in population will be in urban areas. Projected urban population growth, especially in Africa and Asia, suggests that urban services will face great challenges over the coming decades to meet fast-growing needs.

A recent World Bank study reported that African cities are growing exponentially at an average of over 5 percent per annum and over 9 percent per annum in some cities (Colligon and Vezina, 2000). Residential population growth is occurring by an increase in density of existing settlements and expansion at the peri-urban fringe, referred to as informal settlements. Many informal settlements are located within city boundaries. They lack water supply infrastructure, despite being home to substantial proportions of the total urban population. It is estimated that up to 57% of the urban population in Africa are not served by piped water supply (WHO/UNICEF, 2000). The costs of providing conventional water services in informal settlements (slums) are prohibitive.

Almost one-third of the global population without access to improved water supply live in Africa. In addition, Africa has the lowest percentage coverage for improved water supply, with only 62% of the country’s population having access. The African population is expected to increase by 65% over the next 25 years. This represents a huge challenge to services in the region. To achieve the year 2015 goal for urban water supply coverage-halving the percentage of those without access-an additional 210 million people over the next 15 years will have to be provided with improved water services (WHO/UNICEF, 2000). In particular, Sub-Saharan African countries face a growing imbalance between the demands for services required by population growth and rapid urbanisation, and the financial resources they are able to mobilise. Infrastructure deficiencies have adversely affected economic development and are particularly acute in urban centres where large concentrations of poor households live in slums and squatter (informal) settlements (IBRD, World Bank, 2000).

Vickridge (in Smith (Ed), 1995) states that “developing countries are by definition poor”. In addition to poverty, the challenge of managing water services in developing
countries has been compounded by debt. By trying to pay back the money they owe to richer countries, developing countries no longer have enough resources to spend on vital services such as health, education, water and sanitation (DFID, 1997). Over 1.2 billion people in developing countries are income poor (UNDP, 2000). Levels of debt are high and official development assistance (ODA) reduced by 24% between 1992 and 1998 (UNDP, 2000). The ODA received by developing countries reduced from 1.4% of GDP in 1990 to 0.6% of GDP in 1999, a reduction of 57%. Although the net foreign direct investment flows to developing countries increased from 0.9% of GDP in 1990 to 2.9% of GDP in 1999, most of the investment was in sectors other than water and sanitation. The total debt service increased from 4% of GDP in 1999 to 5.8% in 1999. The total debt service as a percentage of exports of goods and services also increased from 18.7% to 22.3 % (UNDP, 2001). These figures show that developing countries face an uphill task in financing and managing water and sanitation services to the growing population.

1.2.2 Current management approaches

Over the last two decades, many countries in Sub-Saharan Africa embraced water sector reforms to different extents in an attempt to meet the challenges of managing water services. The reforms involved formation of new institutions and departments such as state or regional corporations, boards or authorities, with the aim of improving institutional autonomy and hence management of water services. Other institutional reforms in the sector include decentralisation of management, with management responsibility being delegated from the central government (direct government management) to local authorities (municipal council management). In some smaller urban areas, management has been delegated to local communities (community management), but these have limited capacity to manage urban water services.

In the more recent past, innovative management approaches introduced in an attempt to cope with the rising water demand include demand responsive approaches and private sector participation (PSP). Both the formal and the informal private sector have participated in management of water services to different extents and through different PSP models. In some countries where state water corporations, boards or
authorities have been managing urban water services, these public utilities are now delegating management responsibility to the private sector through contracting out.

There is increasing acceptance that the private sector (formal and informal) has a role in improving performance and providing services to the poor. Many countries now appreciate the need for water and sanitation institutions (water utilities) to have management autonomy. The necessary legal and legislative reforms have yet to be put in place. In most of Sub-Saharan Africa, there is pressure from stakeholders for the water sector to reform.

There is increasing acceptance of the need for those who benefit from water projects to meet the costs of service provision. There is also increasing acceptance of the need for assessment of demand using willingness to pay studies. There is apparent need for practical holistic approaches of achieving service improvements in a financially sustainable manner.

Existing approaches in management of water services have not resulted in substantial improvement in services or coverage. Although some of these approaches in management have resulted to some improvements in water services to existing customers, little if any improvements have been made in increasing coverage and improving services to potential customers who are presently not served.

Many water utilities in Sub-Saharan Africa use conventional supply-led, engineering administration approach to manage urban water services. The justification given for the wide use of this approach is that water and sanitation services are "public merit goods" in that they meet basic needs with general benefits for all in terms of public health. This approach is further reflected in water pricing policies. The recent Global Water Supply Assessment found that more than half of the developing countries charge a water tariff that is less than the unit cost of production of the water. The study analysed available information and concluded that water tariffs do not cover the full cost of the services provided (WHO/UNICEF, 2000). This is not justified because water and sanitation can also be described as "private goods" with excludable benefits that are desired for convenience and for commercial/industrial use as a basic resource.
This approach does not meet the needs of low-income groups who live in areas not covered by conventional water supply infrastructure due to lack of funds.

Performance standards for many water utilities in Sub-Saharan Africa are low. Vickridge (1998) observes that operations and maintenance of existing infrastructure in developing countries is often neglected, resulting to reduced performance. Service levels are low and customer services are poor. Levels of unaccounted for water are as high as 59% in some utilities, and bill collection efficiencies are as low as 62% in some (WUP, 2000). Operational efficiencies are low and levels of coverage are as low as 40% in some cities.

1.2.3 Summary of challenges facing urban water utilities

Indications are that the water supply and sanitation sector will face enormous challenges over the coming decades. Four major challenges facing the water supply and sanitation sector in the years to come have been stated as (WHO/UNICEF, 2000):

- Keeping pace with a net population growth of more than a billion people over the next 15 years;
- Closing the coverage and service gap;
- Ensuring sustainability of existing and new services; and
- Improving the quality of services.

The key issues for African water utilities include the following:

- Improving performance of urban water systems;
- Coping with increasing water demand (caused largely by rising urban population);
- Lack of finance for investment in new infrastructure (caused by various factors such as the declining official development assistance, poverty and high debt levels, rising population and rising water demand in Sub-Saharan Africa);
- Provision of water services to the poor (problem exacerbated by the rising population of the urban poor without basic water services);
- Cost recovery (caused by factors such as low tariffs, poor billing and revenue collection strategies);
- Private sector participation; and
• Reducing unaccounted for water (as a result of leakage, illegal connections, meter reading errors).

Considering the above scenario, it is unlikely that water utilities in developing countries can meet the above challenges, and in particular keep up with the water requirements of the rising urban population using conventional (supply driven) management approaches.

1.2.4 The proposed way forward

Vickridge (in Smith (Ed.), 1995) makes the point that although there is great need for new projects in developing countries, there is also lack of funds from the normal sources expected in the developed countries. Adoption of innovative methods of financing and managing infrastructure projects is key to meeting the challenge of providing infrastructure services to the growing population in developing countries (Merna and Njiru, 1998). Faced with the above challenges and the rising numbers of people without access to improved water services, a key objective for managers of water utilities in developing countries is to provide services to the rising urban population, including the poor, in a financially sustainable manner. To achieve this objective, water utility managers need innovative methods of managing water services. There is need for water utilities to look for holistic and innovative approaches to improve services to existing and potential customers (including the urban poor), hence this research on market segmentation, service and price differentiation.

The rationale of market segmentation, service and price differentiation is that a service cannot be all things to all people. Groups or segments of customers could be singled out for a particular service, their needs determined, and a service concept developed. Customers’ water requirements and conditions differ from one neighbourhood to the next. A water utility might not have resources to provide uniform conventional services to customers whose requirements and willingness to pay are so different. The utility could offer a range of service levels at different prices, hence service differentiation and pricing with due regard to customers’ water requirements, ability and willingness to pay. It is necessary to investigate how water
utilities can apply this principle to improve water services to existing and potential customers in a financially sustainable manner.

1.2.4 The research

In this research, a systematic approach consisting of market segmentation, service and price differentiation is explored to investigate its suitability as a method of managing urban water services in Sub-Saharan Africa.

1.3 Aims and objectives (Hypothesis)

The research is designed to help water utilities in Sub-Saharan Africa achieve the twin objectives of improving urban water services while also achieving financial sustainability. The proposed method is to categorise customers into segments and provision of different appropriately priced levels of service that correspond to the water requirements of respective customer segments, taking into account their willingness to pay.

The central focus of the research is to investigate how urban water services in Sub-Saharan Africa could be improved by following a systematic and flexible approach consisting of market segmentation, service and price differentiation. The aim of this approach is to provide improved water services to all customer groups, including the poor, and enable the utilities to achieve financial sustainability. A key aspect of the research is the structuring of service delivery to provide water at appropriate service levels through feasible service options that meet the different needs of existing and potential customers (including low-income groups) at a price that they are willing to pay.

In particular, this research aims to investigate how water utilities in the context of Sub-Saharan Africa can apply market segmentation, service and price differentiation

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1 "Achieving financial sustainability" in the thesis is taken to mean that the water utility has met its financial objectives such as meeting the full costs of providing services.
to improve water services to existing and potential customers in a financially sustainable manner.

The research hypothesis is that within similar representative conditions of this study, *market segmentation, service and price differentiation is an appropriate strategy that urban water utilities in Sub-Saharan Africa could use to improve water services to existing and potential customers, and achieve financial sustainability.*

Chapter 3 details further the objectives, hypothesis and research questions governing the thesis.

### 1.3 Research methodology

The overall research design selected for this research is a case study. The case study methodology was selected because it was the most appropriate research strategy for the key research question under investigation. Kumar (1999) has described the case study method as an approach to studying a social phenomenon through analysis of an individual case. All data relevant to the case is gathered and organised in terms of the case. Remenyi et al (1998) agrees with this view and states that the case study “provides a rich multi-dimensional picture of the situation being studied. The case study can illustrate relationships, corporate-political issues and other patterns of influence in the particular context being researched.”

Yin (1994) defined case study research as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used”. From a research strategy point of view, the case study is particularly valuable in answering who, why and how questions in management research (Remenyi et al, 1998). Thus the case study methodology is well suited to the issue under investigation in this research.

The type of research question under investigation is one that can benefit from the use of a survey within a case study. It was therefore decided that survey techniques are
also to be used within the framework of case study research, to collect and analyse preliminary data and thus enable a focused and detailed study (Yin, 1994). It was also decided to undertake two case studies in two cities of Sub-Saharan Africa, one in South Africa (Durban) and the other in Kenya (Mombasa).

1.4 Main findings

The findings from the research show that the market segmentation, service and price differentiation approach has the potential to enable water utilities to improve services to both existing and potential customers. The utility can potentially extend services to un-served areas, meet the requirements of the customers (including the poor) and improve cost recovery. Appropriate pricing is however a key ingredient for success of this approach. The main finding is that by using the market segmentation, service and price differentiation methodology, urban water utilities can improve water services to customers and potential customers and achieve financial sustainability. The research offers a methodology that utilities can use to structure their service delivery to provide water at appropriate service levels through feasible service options that meet the different needs of existing and potential customers, at a price that they are willing to pay. This research contributes to advancement of knowledge on management of urban water services in Sub-Saharan Africa, which may also be applicable to similar regions of the developing world.

1.5 Thesis structure

The thesis is structured in such a way as to present a logical order to the investigation, findings and conclusions. Chapter 1 provides the background to the problem and introduces the subject, scope and context of the thesis. Published and grey literature on management of urban water services is detailed in chapter 2. The relevant theory and the case for applying marketing and economics concepts in the management of urban water services in Sub-Saharan Africa is also presented in chapter 2. Details of research design and methodology are provided and methods for data gathering are established in chapter 3. Presentation and analysis of field research carried out in Durban and Mombasa is reported in the form of case studies in chapter 4 (Durban
case study) and chapters 5 and 6 (Mombasa case study). Chapter 7 concludes the thesis with a review of objectives followed by a synthesis of recommendations arising from the research.

Each chapter begins with a brief outline of contents, and concludes with a short summary of key points. The structure of the chapters included in the thesis is represented graphically in figure 1.1.
Chapter 1: Introduction to the Thesis

Chapter 2: Literature review

Chapter 3: Research Hypothesis, Design and Methodology

Chapter 4: Durban Case Study on MSSPD

Chapter 5 & 6: Mombasa Case Study on MSSPD

Chapter 7: Conclusions and recommendations

References

Appendices
CHAPTER 2: Literature Review

2.1 Chapter outline

This chapter builds on the background provided in section 1.2 of the first chapter, provides justification for the research and a stepping stone for research data. The first section provides an introduction to the literature on the subject. This is followed by an overview of the current situation on management of water services in Sub-Saharan Africa. Information on the existing situation is presented based on exploratory field research and review of both published and grew literature on Sub-Saharan Africa. Once the basic problems and existing management approaches are explained, the need for research on holistic management approaches in the urban water sub-sector is brought out. In particular, the remaining sections of the chapter are developed around the guiding hypothesis.

The chapter also includes literature from economics and marketing as it helps provide the theoretical background to the proposed solution to the problem. The theoretical basis of the concepts of market segmentation, service and price differentiation (MSSPD) is presented, and their application in the water sector explored. Recent relevant research work on management of water services is presented, including demand responsive approaches, commercialisation and private sector participation. A summary of the main points from the literature review is presented at the end of the chapter, identifying the information gap and setting the stage for the research.

2.2 Introduction to the literature review

The framework used to review literature for this research is classified into three main categories as follows (Ali, 1997):

- Local literature on the subject;
- Published literature on the subject; and
- Published literature that may be applicable to the subject.

The first category of literature is the local literature relevant to management of urban water services, which consists of a variety of project reports and studies produced by
consultants for government ministries and water utilities. Such literature, though largely unpublished, is useful in aiding understanding of the subject under study, and provided a useful source of information for this research. This literature is referred to as “grey literature” in this thesis.

The second category of literature is the published literature on management of water services. This literature is available (with a focus on developing countries), though not specific on managing urban water services, and not on Sub-Saharan Africa. Most of this literature is weak as a theoretical base for advancing and developing arguments in the subject under study. The main sources of this literature are multilateral and bilateral development agencies including the World Bank and NGOs. Although the literature is somewhat influenced by the development agenda of these agencies, a number of interesting ideas are theorised and shaped so as to develop viable solutions to the research problem under study.

The third category consists of published literature from a number of disciplines such as engineering, economics, finance, marketing and sociology. This literature is usually well grounded in theory and is widely available. Such literature is, however, not directly focused on management of water services, but may be applicable to management of urban water services in the context of developing countries.

The above three categories of literature do not directly address the challenge of managing urban water services in Sub-Saharan Africa, in a holistic manner. Indeed, there is no single body of literature that directly addresses this subject comprehensively, in the context of Sub-Saharan Africa. Most of the literature is however helpful in explaining various separate practices and approaches, that together can contribute to solution of the research problem. There are several missing links in the research problem that are not discussed by any of the above three categories. In particular there is a gap in literature on holistic approaches incorporating social, economic, financial and technical considerations in the solution of the problem of managing urban water services in the context of Sub-Saharan Africa. This research is devoted to exploring the application of such a holistic approach.
2.3 Review of management challenges facing urban water utilities in Sub-Saharan Africa

Africa is a highly heterogeneous continent with countries varying significantly in terms of culture, size, wealth, political structures, availability of natural resources and the level of development. This variability results in a wide range of experiences with provision of water supply services. The variability also has an impact on the management of water services across the countries. The key management challenges facing water utilities in Sub-Saharan Africa include:

1. Low coverage;
2. Low levels of service for those already served;
3. Provision of water services to the urban poor;
4. Rising water demand;
5. Poverty and insufficient funding of the water sector;
6. Cost recovery; and
7. High unaccounted for water.

2.3.1 Coverage

Water coverage refers to the proportion of the population with access to improved potable (safe) water sources. Development of the water sector in Africa has not kept up with population growth, and many water systems are not managed in a sustainable manner. As a result the proportion of people with access to an improved safe water source (coverage) is declining, and only 62 percent of the population has access to safe water, the lowest regional coverage of all continents (WSP 2001, and WUP 2001). Although the water coverage in urban areas is higher than that in the rural areas, it is estimated that up to 57% of the urban population in Africa are not served by piped water supply (WHO/UNICEF, 2000).

In most countries of Sub-Saharan Africa, water coverage is low, and this is a major concern of both the national governments and international donors (WUP, 2000). The critical constraints to service coverage have been stated as (WHO/UNICEF, 2000):

- Institutional problems;
• Inadequate human resources;
• Lack of sector co-ordination;
• Lack of political commitment;
• Insufficient community involvement;
• Poor water quality;
• Insufficient information and communication; and
• Lack of hygiene education.

While these constraints have contributed to low levels of coverage, coverage in the urban water sector has not significantly increased where these constraints have been reduced. This means that other constraints exist that require innovative approaches to service delivery.

Recent studies (WHO/UNICEF, 2000) show that Africa has the lowest water supply and sanitation coverage of any region in the world, although individual countries vary in terms of the level of coverage. More than 1 in 3 Africans do not have access to improved water supply or to sanitation facilities and the level of coverage for water supply in the year 2000 was only 62%. The absolute number of persons without these services is increasing. It is projected that unless major improvements in financing and management are made, the absolute number will double between now and the year 2020 from 200 million to 400 million. A high proportion of these people will be living in informal urban settlements and peri-urban areas (WUP, 2001). Low coverage is therefore a big challenge facing water utility managers in Sub-Saharan Africa. Holistic management approaches are required if the level of coverage is to be increased and sustained.

2.3.2 Coping with rising population and increasing water requirements

Apart from low coverage, another challenge facing water utilities is rapid growth of the urban population in Sub-Saharan Africa. Recent studies (UNDP 2000 and 2001) show that the African urban population is expected to more than double over the next 25 years. Vickridge (in Smith (Ed), 1995) states that in the past, much of the developing world’s population was in the rural areas but this is now changing, and population in urban areas is growing faster than in the rural areas. In particular,
African cities are growing exponentially at an average of over 5 percent per annum and over 9 percent per annum in some cities (Colligon and Vezina, 2000). Residential population growth is occurring by an increase in density of existing settlements and expansion at the peri-urban fringe, referred to as informal settlements. Many informal settlements are located within city boundaries. They lack water supply infrastructure, despite being home to substantial proportions of the total urban population.

The rapid rise in population will translate into increasing requirement for water services at a time when coverage is already low. This means that urban water utility managers will face greater challenges over the coming decades to meet fast-growing needs. Innovative and holistic approaches are required to meet this need in a financially sustainable manner.

2.3.3 Low levels of service (quality of service provision)

Another key challenge for many water utilities is how to improve the low levels of performance, seen in the form of low quality of water services for those already (reportedly) served. In many utilities, performance standards are generally low and need to be improved. Even in countries where coverage is at a relatively high level, the quality of service and general performance is low. The main problems relate to (WUP, 2001):

- Low quality of the drinking water provided;
- Inadequate operation and maintenance of the water supply infrastructure, which results in potential coverage levels being lower than they could otherwise be; and
- Lack of security of the supply provided.

Evidence of low performance standards in many cities of Sub-Saharan Africa, is seen in terms of:

- High levels of unaccounted for water;
- Frequent disruptions in service (water shortages) and resultant customer complaints;
- High levels of outstanding revenue (debt) caused by poor revenue collection, that leads to lack of funds to finance operations and maintenance;
- Declining capacity of the water systems;
• Illegal connections;
• Large numbers of personnel per connection (or population served); and
• Large proportion of customers billed on the basis of estimated consumption, even
  where meters have been installed (due to irregular reading of meters and broken
down meters), hence inaccurate billing and resultant billing complaints.

According to the recent global assessment by the Water Supply and Sanitation
Collaborative Council, the main constraints in water supply services are
(WHO/UNICEF, 2000):
• Funding limitations;
• Insufficiently trained professional personnel;
• Inadequate cost recovery; and
• Inadequate operation and maintenance.

While some of these constraints are valid, it has been observed that water utilities
with sufficiently trained professional personnel have not substantially increased water
coverage or service levels. An example is the National Water and Sewerage
Corporation (NWSC) in Uganda, where most of the management personnel have been
trained to postgraduate level but service levels and coverage is still low.

The factors identified above and others lead to a vicious cycle of poor services to
customers, reluctance of customers to pay for poor and inadequate services, lack of
funds for maintenance and further deterioration of services to customers. The cycle is
illustrated in figure 2.1.
Figure 2.1: The vicious cycle of under-funded and poorly managed water services, causing low level of service

Figure 2.1 also demonstrates the rationale for water utilities to raise finance (from users) to meet operations and maintenance expenses and for investment in new infrastructure.

In order to meet the needs of the rising urban population, and to improve the quality of service to current water users, greater efficiency in the management of existing systems is required. Private sector participation (PSP) can substantially improve the financing and management of water services (Merna and Njiru, 1998). The next section considers provision of services to the urban poor, while PSP is discussed in section 2.4.4.

2.3.4 Provision of water services to the urban poor

Provision of water services to the rising number of the poor is another challenge facing water utility managers in Sub-Saharan Africa. Most of the people living in Sub-Saharan Africa are poor. The percentage of the population below the income poverty line of US $1 per day is as high as 72% in some countries (Chad) in Sub-Saharan Africa (UNDP, 2001). The population of the urban poor without basic water services is rising. By 1999, the percentage of the population not using improved water sources was reported to be as high as 76% in some countries (Ethiopia) in the region
(UNDP, 2001). As the crisis of urban poverty deepens, provision of water services to the urban poor remains among the most serious challenges facing urban water utilities in Sub-Saharan Africa. This view is supported by Marvin et al (2001) who have stated that the key challenge facing policy makers and utility managers is to construct water networks that promote affordable services for the urban poor. It is not clear how this might be done.

Approaches that have been considered to have potential in serving the poor include decentralised management of services, where the poor living in urban settlements participate in solutions aimed at improving their water services. For instance in many urban areas of Sub-Saharan Africa, small-scale independent private providers (SSIPs), Non-Governmental and Community-Based Organisations (NGOs and CBOs) have played a leading role in service provision to the poor where utility services have been inadequate. Their insights and experience in serving the poor, and their potential contribution as experienced partners for the utility should be recognised (WUP, 2001).

At the level of the utility and local government, there is a need to find ways to stimulate and interact with community level initiatives and the informal sector. This is however not at all easy. In his study of the official and private informal practices in solid waste management, Ali (1997) found that there were major constraints to integration, partly because of the attitudes of municipal managers. He found that municipal managers felt that top-down approaches are appropriate to improve the city waste management and so the community initiatives and the private informal activities could not be integrated with the official system. Ali (1997) concluded that the informal activities address the felt needs of the community effectively. Perhaps the lessons learnt from research on solid waste management services in low-income areas can inform strategies on management of urban water services in similar low-income areas. There may, however, be some exceptions to this, partly due to the attitudes of managers towards community initiatives and private informal activities.

At the level of state or national government there is still a need to seek ways of setting incentives so that serving the poor is not only a priority but also achievable, supported by adequate financial and human resources. At the international level, provision of
water and sanitation services to the poor has been put at the top of developmental and political agenda. The setting up of programs such as the Water and Sanitation Program (WSP) of the World Bank and Poverty Reduction Programs in many countries are examples of international initiatives aimed at addressing the crisis. These initiatives have not yet come up with a holistic approach to the solution of the crisis.

Improvement in management of urban water services should consider the needs of the poor, as these are often overlooked in the design of various programmes whether by the public or the private sector. The needs of the poor can best be served through the following processes (WUP, 2001):

- Recognise that the poor are legitimate and significant stakeholders in the business of water, and often pay far more than the rich per cubic metre of water consumed;
- Take stock of the reality on the ground for the poor and learn about the systems by which their needs are met. Such systems may remain as credible alternatives to the utility, but may need legal recognition, regulation and management support;
- Take note that the poor are willing and have the capacity to pay for services that are adapted to their needs; and
- Plan, from the beginning, to identify ways to ensure that the needs of the poor are reflected in the design, implementation, and follow-up to the water sector reform process. The direct participation of the poor in the design, implementation and monitoring of the reform is the most effective way to protect their interests.

WUP (2001) further states that it is important for water sector reform policies and laws in each country to include a definition of the poor and, where appropriate, to provide regulations and guidelines for meeting their needs. These policies should accommodate other service providers where they are more effective than the utility. It is however doubtful whether legislation, regulation and guidelines can by themselves ensure that water services are provided to all including the poor in a sustainable manner.

Alaerts et al (1993) states that despite their poverty in absolute terms, the urban poor generally value water supplies sufficiently to be willing to pay at least the operating
and maintenance costs of the required infrastructure. The “poor” people are usually willing and able to pay reasonable amounts, as can be deduced from the observation that they buy water from (informal) water vendors, paying 5-30 times the subsidised utility price (Alaerts et al, 1993). This has been observed in several cities in Sub-Saharan Africa including Dar es Salaam, Nairobi, Kisumu and Mombasa.

The need for increased capacity to deliver appropriate and sustained services is urgent. It is necessary for urban water utilities to plan new approaches and engage a wider array of players, including local communities themselves. In particular water utilities should employ holistic and innovative approaches to serve the urban poor. Increased participation of communities and both the formal and informal private sector creates opportunities for efficiency and innovation, but needs to be managed to retain a focus on poverty alleviation. Technical, institutional and management innovations should be developed, improved and implemented as a way of responding to this crisis.

This research on market segmentation, service and price differentiation (MSSPD) hopes to develop such an approach.

2.3.5 Poverty and insufficient funding of the water sector

Water utility managers in Sub-Saharan Africa operate in an environment characterised by widespread general poverty and insufficient funding of the water sector. Most countries in Sub-Saharan Africa are poor. Recent studies (UNDP, 2001) show that the percentage of population living below the income poverty line of $1 a day is between 72.8% (in Mali) and 26.5% (in Kenya). In addition, most countries in Sub-Saharan Africa are highly indebted with unsustainable levels of debt. The total debt service for Sub-Saharan Africa in 1999, as a percentage of exports of goods and services was 14.3%. The national and local government budgets for development of the water sector have been dwindling. Even the official development assistance (ODA) received by developing countries (from the developed world) has decreased from 1.4% to 0.6% of GDP between 1990 and 1999 respectively (UNDP, 2001).
Africa’s urban problems have been worsened by the economic policies adopted by many governments during the 1980s and 1990s, largely at the urging of the World Bank and International Monetary Fund (East African Standard, 2001). The initial privatisation programmes often led to reduced formal sector employment, as did trade liberalisation, which contributed to the failure of many local businesses unable to compete with cheap imports. Without steady jobs, many residents have been unable to afford adequate shelter and infrastructure services. People live in unserved informal settlements because they do not have employment to enable them live in more decent shelter, in areas that have access to services. On top of this, the budgetary stringency that came with structural adjustment programmes further eroded the capacities of municipal authorities to maintain and finance essential services, such as roads, waste collection, electricity and water systems (East African Standard, 2001). This situation is likely to get worse.

As mentioned above, the level of coverage is low and water supply infrastructure is non-existent in many urban neighbourhoods. Considering that water supply infrastructure is largely capital intensive, the costs of providing conventional water services to the growing urban population in unserved areas such as informal settlements (slums) are prohibitive. Governments in most countries of Sub-Saharan Africa do not have sufficient public funds to meet the financial requirements of the water sector. The general lack of finance for investment in new infrastructure is due to factors such as poverty, unsustainable high levels of national debt and declining official development assistance. These factors as well as uncertain political situation tend to increase perceived project risks, and this further reduces the potential for foreign direct investment by the international private sector (Mema and Njiru, 1998).

On a global level, there is a substantial financing shortfall across the whole water sector of both capital investment and investment for the operation and maintenance of existing infrastructure. So the challenge of insufficient funding has two aspects: how to find enough money for capital investment to reach all the currently unserved people, and how to raise enough money to cover operation and maintenance, and eventual replacement (DFID 2001). One way of meeting this challenge is for water utilities to adopt methodologies that produce financially sustainable projects.
Under these conditions, governments must consider what financial, technical and managerial resources should be brought to bear on the problem from the private as well as the public sector, and to consider how best to encourage appropriate partnerships between all stakeholders. Policy makers should therefore look beyond limited government budgets to consider the whole range of resources that could be mobilised through approaches such as PSP for sustained development of the water sector. Under appropriate conditions, shortfalls in public financing of infrastructure projects can be met by the private sector (Merna and Njiru, 1998). The public funding shortfall for water services in Sub-Saharan Africa can also be partly met through private sector participation (PSP). PSP is discussed in section 2.4.4 and the next section looks at cost recovery.

2.3.6 Cost recovery

Problems of insufficient funding noted in section 2.3.5 above can be minimised by recovering the investment cost from the users. Although governments in most countries in Sub-Saharan Africa now appreciate the need to recover costs from the users, cost recovery is still a big challenge for most water utilities. Often users (referred to in this thesis as customers) are unwilling or unable to pay for water because their levels of service are poor, or because the payment systems are not appropriate or do not function. That in turn means that the income of the water utilities is too low to maintain or improve the system, leading to a downward spiral of decline shown in figure 2.2 (DFID, 2001).

Figure 2.2: A downward spiral of decline caused by low cost recovery (DFID, 2001)
Figure 2.2 also demonstrates the rationale for water utilities to recover costs from customers and use the income to invest in improvement of services to existing and new (potential) customers. The improved services to customers can lead to increased cost recovery. The utility can then raise finance to meet operations and maintenance expenses and for investment in new infrastructure to meet the requirements of existing and potential customers.

For water utilities facing the situation described in figure 2.2, the challenge is to reverse the downward spiral. One of the causes of the downward spiral is inappropriate pricing policy. Governments often prevail upon water utilities (service providers) to set water tariffs that do not cover the costs of water services. Water utilities also frequently fail to bill their customers, and therefore recover only a small proportion of the water that is sold. A way in which water utilities can reverse the downward spiral (shown in figure 2.2) is to set prices (water tariffs) to recover full costs, billing and collecting the revenue from users, and then investing the money raised in operation and maintenance to provide better service standards. In order to do this, water utility managers need to know the level of services (also referred to as service options) that customers want and are willing to pay (WTP) for. Willingness to pay (WTP) is the maximum amount of money that customers are willing to pay for a given service level, and is obtained from WTP studies. WTP studies are therefore useful in informing the pricing policy, since an appropriate pricing policy is necessary for effective cost recovery. Further discussion on pricing urban water services (including WTP) is presented in section 2.7.

Besides getting the pricing policy right, it is necessary to bill correctly and collect the revenue from water sold. Collecting revenue is a substantial challenge for many water utilities in Sub-Saharan Africa. Billing and bill collection efficiencies are typically low and the proportion of uncollected bills or outstanding revenue is typically high, even where tariffs are low. Global transitions in the water sector (which include an increased focus on demand management and private sector participation) mean that new approaches towards cost recovery are needed if sustainable management of water services is to be achieved.
A method often used to improve cost recovery is the pre-payment system, where users pay for the water before they consume it. Pre-payment may comprise the following different payment systems (Marvin et al, 2001):

- Pre-payment meter, where a token or card based volumetric system is used. Water is paid for before it is consumed;
- Pre-payment device: a token or card based system that provides access to a non-metered water supply for a limited period; and
- Pre-payment credit: a system in which users pay for water before it is consumed, the water resources may be measured or non-metered.

International agencies, utility companies and meter manufacturers support prepayment technologies to reduce non-payment and indebtedness, to facilitate cost recovery and to accelerate private sector participation in the provision of water services (World Bank, 1994).

The failure of billing and revenue collection or payment systems means that the relationship between users and providers in many developing countries has broken down, making pre-payment significant (Marvin et al, 2001). Marvin et al (2001) further states that prepayment technologies can be used by utilities to distance themselves from the high costs of dealing with debt and disconnection. Prepayment is potentially a way of coping with unexpected bills and a tool that can be used in training people in water management strategies. These factors have a knock-on effect for demand management. Credit-based metering and pay-as-you-go mechanisms could ensure that vulnerable users do not get disconnected. This can be particularly important in times of rising tariffs, hyperinflation and economic crisis (Marvin et al, 2001).

Apart from South Africa, few countries in Sub-Saharan Africa have experience in using prepayment systems. Experience in the use of prepayment systems show that although they have several advantages, they also have significant disadvantages as shown in box 2.1.
Box 2.1: Advantages and disadvantages of prepayment systems

**Potential advantages**
- Cost recovery is guaranteed since customers pay before collecting water
- It is relatively easy to change tariffs, as the system is computerised
- Being computerised, it is relatively easy to monitor the water system and obtain information on parameters such as pressure, that can be an indicator for leakage in the system and also water use
- It is relatively easy to establish how tariff changes affects water consumption
- The smart card option can be programmed to give credits to individual customers, and this can be applied to effect subsidies or free water for some specified minimum consumption, or block tariffs

**Potential disadvantages**
- The system is relatively expensive, with high costs of installation
- The system is high tech and requires specialised maintenance, which might not be forthcoming in some cities of Sub-Saharan Africa
- The system has low reliability, despite its requirement for specialised maintenance support
- The system requires reliable power supply for proper operation, with a 24 hour supply for the main computer; this may not be available in some areas
- Significant training is required for operators in order to provide back-up support for this system
- The system can be perceived by some communities as unfriendly and top-down
- The system typically requires high pressure in the distribution network, and only operates at a pressure of at least 10 bars. This is difficult to maintain in many water distribution networks.
- The cost of upgrading the system is high, and there is low or no potential for extensions
- Being high tech, the system undermines opportunity to create local employment that is necessary for poverty reduction
- The system is not completely fool-proof and can be tempered with relatively easily

Source: Adapted by author from discussions with Deverill, 2001

Given the high incidence of poverty in Sub-Saharan Africa, it has been assumed that the ability to pay for water services is a primary constraint on improvements in water services. In particular, the low-income urban communities are assumed to be either unable or unwilling to pay for improved water services. This is however not the case, as shown by results of willingness to pay studies presented in Chapter 6. Exploratory research shows that the main types of consumers who experience problems with payment for water are public users (government agencies such as schools, hospitals, army, navy, air force and the police). In the case of the public sector, it is unlikely that 'inability to pay' is the main reason for non-payment. The reason is likely to be that
many countries face budgetary constraints on the amount of national public finance that is available to fund water consumption by public users.

In the recent past, governments in Sub-Saharan Africa could not allow tariff increases for political reasons, and some countries had a “free water” policy. The “free water” policy gradually changed to “cost sharing”, where users were charged nominal amounts (low tariffs) as a way of contributing towards operation and maintenance costs. The low water tariffs have been maintained in many countries for political reasons, and this has contributed to deterioration of water services. This is now changing and governments in most countries of Sub-Saharan Africa now appreciate the need to improve cost recovery, and are increasingly being responsive to tariff reviews by water utilities.

Today, a number of countries in Sub-Saharan Africa have “full cost recovery” as the official water pricing policy in urban areas. Water utility managers now need innovative approaches for revenue collection, to enable improvements in water services to customers and thus benefit from the changing political environment. In this research, the problem of cost recovery is addressed in a holistic manner, by considering the different levels of service that customers in different market segments want, and the amount of money that they (customers) are willing to pay for the selected services. The utility can then provide service options that people want and are willing to pay for, and at a price that can enable the utility to be financially sustainable.

2.3.7 High unaccounted for water (UFW)

Reduction of the high levels of unaccounted for water to acceptable levels is one of the biggest challenges facing water utility managers in Sub-Saharan Africa.

(Except where other sources have been indicated, much of the material in this section has been obtained from a journal paper by the author, Njiru (2000) entitled “Reducing unaccounted for water in water distribution systems”, based on related research work.)
Unaccounted for water (UFW) may be defined as the water that is collected and put into a water supply system but is not accounted for. UFW represents water that has been collected, treated and then transported using expensive water supply infrastructure, chemicals, energy and staff but let to get out of the distribution system for no benefit at all to the utility. UFW may be viewed as the difference between the water produced and the water sold or legitimately consumed. It is the difference between the amount of water put into a supply system and that, which is billed to consumers. UFW is money lost and it is often expressed as a percentage of water produced (Njiru, 2000).

**Typical values of UFW**

UFW is often taken as a measure of the efficiency of a water supply system. Efficient water systems have low (below 15%) UFW. The level of UFW considered “normal” is 15-20% with inefficiently managed systems having high levels of UFW (50-60% and sometimes even higher). UFW in many of the cities of developing countries is high, with Metro Manila and Dhaka quoted at 60% and 50% respectively, Jakarta in 1992 at 54%, Delhi and Seoul at 40%, Hong Kong, China at 34% and Jordan at 59% (UN, 1998).

In Sub-Saharan Africa, UFW levels are also high. UFW in Malindi and Nairobi (both in Kenya) was 40% and 50% respectively, in 1998. UFW in Kaduna city (Nigeria) was estimated at 44% in 1997 (Ambinjah, 1998). UFW for urban water utilities in Tanzania (average for Urban Water and Sewerage Authorities) was estimated in 1998 at 52% (Njau, 1998). UFW for Dar es Salaam in Tanzania was reported to be 60% in 1998 (Mutalemwa, 1998).

Rates of UFW vary from system to system, but evaluation of findings confirms that in most water supply systems in Sub-Saharan Africa, UFW is unduly high. The level of UFW in Sub-Saharan Africa is not sustainable, considering that the region has low service coverage. The need to improve management of urban water services is evident. It is however possible to reduce UFW levels in urban water systems. In 1989, Singapore's UFW of about 10 percent ranked the lowest in the world (UN, 1998).
Constituents of UFW

UFW comprises of two main categories: commercial (also known as revenue or administrative) losses and physical (or technical) losses.

From the author's experience, commercial losses are due to:

- Non-metering (where flat rates do not cover costs);
- Incorrect billing such as unbilled or under-billed consumption resulting from faulty metering especially under-metering (due to inaccuracies in measurements, outright theft and inadequate database of connected properties);
- Illegal connections and unknown use (domestic, commercial, agricultural, industrial);
- Legal but uncharged connections (Fire-fighting, unmetered public fountains and stand-posts);
- Overdue payment of bills; and
- Treatment works losses, transmission and distribution mains cleaning and flushing.

In order to determine and control commercial losses, non-metered connections should be discouraged. Levying a high tariff for flat rate connections can do this. Illegal connections should be identified and regularised, thus incorporating them in the billing system.

Physical (technical) losses or water actually lost through leaks often constitute a large proportion of UFW. Physical (technical) losses generally consist of (Brandon, 1984):

- Transmission losses;
- Losses due to service reservoir leakage and overflows;
- Losses in the distribution network;
- Losses in the service pipes or connection; and
- Losses and wastage on a customers' premises (especially high where billing is on flat rate).
Determination of UFW

It is difficult to accurately determine the level of UFW and so UFW figures are often estimates. In order to assess the UFW it is necessary to know both supply (amount produced) and billing (amount sold). Metering is an important aspect of controlling a water supply system and facilitates accurate determination of supply, consumption and UFW. Although metering is expensive, it has enormous benefits in control of water systems as well as facilitating accuracy and fairness in billing. In systems where consumption is not metered, UFW cannot be measured accurately; estimates can, however, be made from zones or night flow metering and routine inspections for leaks.

Why reduce UFW?

In any country, water resources are not infinite and neither are financial resources. As stated above, the urban population in Sub-Saharan Africa is rising rapidly, leading to a continuing increase in demand for water. With the rise in the cost of collection, treatment and transportation of water to users, and the huge investment required for development of new water supply systems, it is prudent to conserve the available water by reducing UFW. UFW is a drain on the existing system both physically and financially.

Efficient management of a water supply system will improve customer service, increase revenue, reduce health hazard and increase the useful life of the system with postponement of expansion. It can result in an increase in water coverage with minimal additional investment on the existing water supply infrastructure. It is an aspect of demand management that has enormous benefits. Reduction of UFW is therefore a logical and prudent objective of any water manager. It is even more important in Sub-Saharan Africa where lack of financial resources has resulted to lack of potable water to a large proportion of the growing urban population.

Reduction of UFW in urban water supply systems has the potential to improve water supply to the urban poor through increased coverage or improved service levels with the resultant health and socio-economic benefits. Potential benefits are not only to the water users but also to water utilities and countries as a whole. Benefits include improved health and well-being, social, economic and financial advantages.
As stated above, UFW is money lost. A water utility that has a high value of UFW is unlikely to be financially sound. Money that is lost by a water utility is potentially that which could have been used to improve services, and possibly extend services to the urban poor. UFW impacts negatively to the users, the utility, the city and the country in general. The negative impacts are essentially in terms of benefits not realised.

To successfully reduce UFW, it is necessary to understand its causes. In general, the reasons for high levels of UFW include:

- poor engineering, construction, and maintenance;
- poorly managed metering, billing, or revenue collection;
- poor customer relations; and
- Illegal connections and theft.

These problems are especially challenging in cities of Sub-Saharan Africa. In order to effectively reduce UFW, each water utility should first understand the composition of its UFW then formulate strategies to deal with the above general causes of high UFW.

UFW is often taken as a measure of the efficiency of a water supply system. Together with continuous service and good quality water, a low rate of UFW is one of the best overall indicators that a water supply system is efficient. Reducing UFW involves determination of the magnitude of UFW, an understanding of its causes and setting up of programmes to prevent, detect and control different constituents of UFW. Poor engineering, construction, and maintenance usually results in leakage, which is one of the most documented components of UFW. Reduction of this component of UFW requires good engineering design, construction, operation and maintenance practices.

In many urban areas, administrative (commercial) losses are more significant than technical losses, and so reduction of UFW is even more challenging. Experience in Mombasa and Nairobi (Kenya) show that administrative losses are consistently higher than physical losses. Elsewhere, Singapore, which probably has the lowest UFW in the world, reported administrative losses of 7 percent and physical losses of 4 percent in 1991 (UN, 1998).

In the author's experience in Sub-Saharan Africa, illegal connections constitute a substantial proportion of UFW in many cities. Visual observation can identify many
illegal connections while more comprehensive "discovery" of illegal connections may be evident by use of "block mapping" programs. Once detected, illegal connections should be regularised by having the connections registered and entered in the billing system of the utility's database. These seemingly simple actions have often failed to be carried out in many cities due to lack of effective legal recourse or inept management by the utility.

Efficient management of water distribution systems leads to reduction of UFW. It is recommended that every water utility or agency should set up a strategy for reducing UFW that reflects the special circumstances in each city regarding the composition of UFW. Emphasis should be placed on the component of UFW that contributes most to UFW in order to realise the greatest benefits.

From the foregoing, reduction of UFW is an important aspect of managing urban water services. Considering the challenges discussed here, it is prudent for water utility managers to reduce UFW. To achieve low levels of UFW in cities of Sub-Saharan Africa requires substantial management support to operations and maintenance including cost recovery management systems. Njiru (2000) provides approaches that can lead to reduction of UFW, and this subject will therefore not be discussed further in this research.

2.3.8 Need to improve management of urban water services

In order to meet the above challenges, there is urgent need to improve management of water services in Sub-Saharan Africa. Indeed, exploratory research shows that there is consensus across the African countries on the need to improve management of water services. Over the last decade, most African governments have recognised the need to embark on reforms to address the problems of managing water services. A recent regional conference held in Kampala (Uganda) during February 2001, drawing participants from the main stakeholders in the African water sector, concluded that there was urgent need for reforms to improve the management of the water sector in the region. The author participated in this conference that was organised by the Water Utility Partnership (WUP), assisted by an organising committee composed of the
World Bank Institute, the African Development Bank, the Streams of Knowledge Coalition of resource centres, and the Uganda government.

Ministers (from several African countries) present during the conference indicated that the agenda of reform is politically very demanding. Politicians understand the need for reform, but need realistic proposals that they can explain to the people. It was apparent at the conference that although the need for reform is widely acknowledged, it is not clear how to take this forward.

The main objectives of reform in the water sector are also the same as those that have emerged in other state-controlled industries. The main expected benefits of reform, stated as the objectives of reform in many African countries, are as follows (WUP, 2000):

- Increased access to safe drinking water and sanitation services;
- Enhanced economic efficiency (in the public and private sectors);
- Improved quality of service;
- Generation of financing for necessary investments;
- Improved resource management; and
- Reduction in the negative impact of service provision on the environment.

As much of the reform in the water sector in Africa is at an early stage (in many countries it is only at the stage of being implemented), it is not known for sure whether these reforms will deliver the expected benefits. It can be stated however that while the reforms might result in achievement of some of the expected benefits, the challenges discussed above call for holistic approaches that have not been specified yet.

Several management approaches are being adopted in varying degrees by countries in Sub-Saharan Africa in a bid to cope with the rising water requirements. The next section looks at some of the key management approaches.
2.4 Review of key management approaches

In an attempt to improve the management of urban water services, several key institutional and management approaches have been employed in recent years. The key approaches include:

1. Institutional reforms and setting up of new institutions, including corporatisation with commercialisation;
2. Decentralisation (and commercialisation) from central to local government (municipal management);
3. Community management; and

Each of these institutional and management approaches is discussed in the following sections.

2.4.1 Institutional reforms and setting up of new institutions

As with the rest of infrastructure services, management of the water sector has traditionally been the preserve of the public sector. Direct public management is the institutional model where a large government ministry or department carries out most of the roles and activities of the water sector. Up to the late 70s and 80s, the water sector in many countries of Sub-Saharan Africa was under direct public sector management. Under this management model, governments undertook a variety of roles in the water sector, often all in the same ministry. The main responsibilities can be categorised as follows:

- Policy design;
- Development and implementation of sector plans and reforms;
- Regulation of service providers (both public and private operators);
- Asset owners; and
- Service providers.

Although these responsibilities and roles are all important in improving water services, the one that affects management of water services most directly is arguably service provision. Many governments in Sub-Saharan Africa have realised that their
performance particularly as service providers has been dismal and a hindrance to improvement of water services. Governments have made public statements about water and sanitation services being a priority. A number of countries have complemented this with policy decisions and strategies for implementing change, and have undertaken institutional reforms in the water sector.

Some of the most widespread reforms in the water sector involve setting up of new institutions to manage water services. In the recent past, responsibility for provision of water services has gradually moved from government departments to public water corporations, companies, authorities or boards, which are known in Sub-Saharan Africa under the generic name of parastatals. Public water and sewerage companies, corporations, boards or authorities are usually 100% owned by the government, and have an independent Board of Directors responsible for policy decisions. Blokland et al (1999) refers to this type of organisation as a corporatised utility. The corporatised utility describes a management model whereby a direct public utility operates as a quasi-corporation (Blokland et al 1999). This management option is common in Sub-Saharan Africa, in countries such as Nigeria, Ghana, Kenya, Uganda, Tanzania, Zambia, Lesotho and Swaziland.

In some cases, the corporatised utilities operate on a nation-wide scale such as the National Water and Sewerage Corporation (NWSC) in Uganda, the National Water Conservation and Pipeline Corporation (NWCPC) in Kenya and the Ghana Water Supply and Sewerage Corporation (GWSC) in Ghana. In other cases, the corporations cover state or provincial territories such as the boards in Malawi and Nigeria (Blokland et al, 1999).

The corporations are supposed to operate commercially, and are expected to generate all their revenue for operation and maintenance, and build up reserves for replacement of assets. The corporations can borrow funds for capital development projects. There are also instances when the Government can borrow from multilateral development banks at low interest rates then on-lend the borrowed funds to the corporation.

The author's experience in Sub-Saharan Africa is that in general, there have been considerable improvements in the management of water services where corporations
have been formed. Njau (1998) states that formation of 18 Urban Water and Sewerage Authorities (UWSAs) in Tanzania in 1997 resulted in substantial improvements in the management of urban water services in Tanzania. There has been mixed success in commercialisation of water services, the main problem being lack of autonomy and negative political interference in the operation of the corporations as observed in Swaziland (Bhembe, 1999), Lesotho (Lerotholi, 1999) and Kenya.

The effectiveness of water and sanitation institutions depends on a clear policy framework, which provides them with their mandate as an institution. In the absence of a clear policy on service provision, and the required level of autonomy, these institutions cannot deliver services as required. Many water institutions (or utilities) in Sub-Saharan Africa are indeed not delivering services as required. In his study of water utilities in India and Uganda, Franceys (1994) concluded that the major problem of urban water supply was institutional inadequacy linked to lack of finance.

Public corporations generally lack the level of autonomy that would enable them operate commercially. The author has personal experience of problems associated with lack of autonomy while implementing commercial management of urban water services in Kenya. Governments in Sub-Saharan Africa have retained enormous control, with government ministries either being responsible for, or influencing the appointment of directors and senior management staff of public corporations, boards, companies and authorities. It has also been difficult to get water tariff reviews approved by the central government, who tend to prefer keeping tariffs so low that they do not cover the costs of provision. Under these circumstances, many public corporations, boards, companies and authorities have been unable to deal with most of the challenges discussed in section 2.3.

2.4.2 Decentralisation from central to local government (municipal management)

Apart from setting up new institutions to manage water services, many governments have also decentralised the management of service delivery from central to local government. Management of water services at the level of local government is commonly referred to as the municipal management institutional model.
The Municipal management model is where the municipal/town council manages the water supply system as part of its administrative activities. This is usually done by creating a department or section within the council structure that is responsible for managing water services in the city or town. This model is common in many countries of Sub-Saharan Africa, perhaps because it fits well within the local government structure and also with the global move towards democratisation. In addition, delegating decision-making authority from the central government to municipalities has the potential to strengthen the role of municipalities. Many governments that are keen on decentralisation of water and sanitation services are continuously embracing the role of Municipal authorities as the providers of water supply services.

A common problem with municipal management of water services is the lack of resources despite legal authority having been delegated from the central government. This is often compounded if revenue from water sales is not controlled by the water department but is used to finance other municipal council services. Another problem with this model is bureaucracy due to unnecessary layers of administration, where all transactions have to be approved by the town clerk or mayor.

Even where a water department is established within the municipal council, the head of the department is responsible to the town clerk. The lack of autonomy is a key problem associated with municipal management of water services. Perhaps the biggest problem with municipal management is political interference by local politicians who constitute the council. These problems are evident in many towns under municipal management such as Nairobi and Kisumu in Kenya and Soroti in Uganda. In his study on management of water and sanitation services in Soroti and Bushenyi/Ishaka towns in Uganda, Eyatu (2000) noted several weaknesses of the municipal management model. In particular, the towns under the municipal management structure do not generate enough revenue to meet their operation and maintenance costs, leave alone capital development. Political interference in decision making is also common (Eyatu, 2000).

The water and sanitation departments of the councils do not usually have the required level of autonomy to enable them substantially improve water services to customers and extend services to unserved areas. Several towns under municipal management
are now moving towards private sector participation, either through management contracts (as in Uganda) or by incorporating water companies (as in Kenya). In addition, other towns are also moving towards community management in an attempt to further decentralise management of water services. The next section considers community management while private sector participation is considered in section 2.4.4.

2.4.3 Community management

There are a number of instances where governments are decentralising management of water services from central and local government to communities, the thinking being that community management will result in an improvement of water services.

The community management model, sometimes also referred to as co-operative management association, relies mainly on the users of the water supply system for its management. Under this management option, a Water Board as in Senegal, Water User Association as in Uganda, or Water and Sanitation Committee as in Niger perform executive functions. Most of the community-managed systems rely on local and central government for technical support in case of major breakdowns (Eyatu, 2000). In some cases, the water committees employ technical personnel to maintain the system or rely on the private sector to carry out maintenance activities (WASH 1993).

There are several examples where communities have managed water systems with varying degrees of success. Community management tends to be successful where a coherent “community” exists. Among the factors that promote a coherent “community” are (Batchelor and Scott, 2001):

- Existence of strong social relationships between members;
- Many members may be linked through family ties;
- People tend to share common goals and priorities, for instance most people are farmers;
- Traditional social structures may still exist, such as village chiefs and elders;
- Everybody knows what is going on; and
A high degree of accountability can be enforced. Social conditions in urban contexts tend to be quite different, leading to a diverse population, making it much more difficult to identify a "community" that can manage water and sanitation services. In most urban areas, for instance (Batchelor and Scott, 2001):

- Low-income neighbourhoods often have a high proportion of migrants;
- Communities are too big for effective accountability; and
- Certain towns have high transient population.

Due to these factors, feasibility of community management in urban areas is doubtful. Community management of water services in the context of urban areas has been reported to have been tried and "failed" or "limping" in Uganda, and "failed" in Zambia (Sansom et al, 2001a). It is doubtful whether the community management approach by itself offers the means for water utility managers to meet the challenges discussed in section 2.3.

Experience in Sub-Saharan Africa shows that in the urban areas, there is considerable potential for success if utilities could engage and form beneficial exchange relationships with the informal private sector, such as the small-scale independent water providers (SSIPs). Where a community is relatively cohesive and community spirit exists, utilities can also form beneficial exchange relationships with communities with community management playing a part in improvement of water services. In the urban context, both the formal and informal private sector has considerably more chances of success than communities. Private sector participation (PSP) is considered in the next section.

2.4.4 Private sector participation (PSP)

Private sector participation (PSP) is a form of privatisation often used in infrastructure services. Gayle and Goodrich (1990) have defined privatisation as the process of reducing the roles of government while increasing those of the private sector in management activities or asset ownership. Privatisation, strictly speaking, involves the sale (divestiture) of public assets to private sector firms (Blokland et al, 1999).
Privatisation and capital market development are key to reform and development since they mitigate the distortions that follow from flawed strategies and promote economic growth through several different but complementary channels (McLindon 1996). Privatisation plays a pivotal role in economic reform, and it enables a government to shift its portfolio of economic interventions out of areas of the economy in which the private sector is able to operate more efficiently and productively. This frees resources for those areas that are the basic responsibilities of government. Studies have shown that privatisation improves the competitiveness and efficiency of enterprises, which promotes economic growth (McLindon, 1996). This is the theoretical basis of the increasing use of PSP in the water sector.

PSP is the involvement of the private sector in an otherwise public sector domain such as provision of infrastructure services. In the recent past, the term “Public-Private Partnership” (PPP) is increasingly being used interchangeably with PSP. PPP is essentially the same as PSP but with an emphasis on the partnership necessary for success, where PSP results in a win-win situation. A well-structured PSP contract can be considered to be a PPP, in the sense that all partners contribute to and share the benefits from the contractual relationship.

Experience has shown that the main catalyst for the increasing interest in PSP is the proven record of poor performance and mismanagement that characterises most publicly owned and operated water utilities (Janssens 1999). Janssens (1999) acknowledges that there are a few well-managed public utilities too, but states that they seem to be the exceptions that confirm the rule. He further states that the second consideration for involving the private sector is the insufficiency of public funds to meet the increasing investment needs of the water sector. The two main objectives of PSP are thus, to ensure improved management and higher efficiency, and to acquire the capital needed for investment (Janssens, 1999). PSP can therefore potentially help countries in Sub-Saharan Africa meet at least two of the major challenges discussed in section 2.3.

In the context of Sub-Saharan Africa, PSP has the potential to improve the management and financial sustainability of urban water services (Merna and Njiru, 1998). The main advantages of PSP are that it introduces private sector incentives and
management skills, and acts as a catalyst for change (Sansom and Franceys, 1997). There is considerable research evidence from case studies conducted in Africa, Asia and Latin America that private sector participation in its various forms (such as contracting out through service and management contracts, leases and concessions) is improving water services (Sansom et al, 2002). PSP has increasingly been considered to be the way forward in improving the management of urban water services in Sub-Saharan Africa.

Many countries have tried to directly tackle the apparent inefficiency of public operators with varying degree of success, and are now looking for ways to enable private companies to undertake responsibilities for service provision in the sector. The current thinking in many countries of Sub-Saharan Africa, which has largely been influenced by the international donor community, is that governments and government agencies should be facilitators not providers of urban water services. The PSP option has been pursued in recent years, with the expectation that experienced private operators will be able to provide a better quality of service to a larger number of customers and at a reasonable cost. The issue under discussion in the water sector is no longer a question of whether and when to involve the private sector, but how.

The basic types of privatisation include (McLindon, 1996):

1. Liquidation;
2. Contracting out (using service and management contracts);
3. Leasing (using leases or concessions);
4. Deregulation and demonopolisation;
5. Management -employee buyouts;
6. Trade sales;
7. Public share sales (Divestiture);
8. Mass privatisation; and
9. BOOT technique (e.g. for infrastructure that is required but not yet built).

Privatisation through liquidation, deregulation, management employee buyouts, trade sales and mass privatisation are not considered applicable to the water sector. Privatisation through public share sales (divestiture) was undertaken in England and
Wales in 1989, and this has not been undertaken anywhere else. In the water sector, the main contractual arrangements for PSP are considered to be:

1. Service contracts;
2. Management contracts;
3. Lease contracts; and
4. Concession contracts.

The most common PSP options are briefly outlined here.

**Service contracts**

In a service contract, a government-owned entity enters into a contract with a private firm for the provision of specific services. Examples of services that private operators are contracted to undertake include operation and maintenance tasks, such as installing or reading meters, billing and revenue collection, repairing pipes, or operating production facilities. The public sector remains as the asset owner and is responsible for the provision of water services to customers. The public authority retains overall responsibility for operation and maintenance of the system, except for the specific services contracted. The government entity bears all of the commercial risk and must finance fixed assets as well as working capital. The private operator would be provided with a specified compensation fee for undertaking this work. Compensation may be on a time basis; on a lump sum, cost-plus, or fixed-fee basis; or it may be proportional to some physical parameters. Service contracts typically run for short periods, from six months to about two years or more.

In a service contract, the benefits of PSP emerge from the use of expert skills to undertake core tasks, and the potential for these tasks to be carried out in a more efficient manner. Service contracts are somewhat similar to traditional consultancy and construction contracts widely used for implementation of infrastructure projects. The contracts do not provide for adequate sharing of commercial risk.

**Management contracts**

In a management contract, the public authority transfers to a private company the entire operation and maintenance function of the water supply service, through a management contract. The public sector remains as the asset owner and receives the revenues earned from water sales. This arrangement is similar to a service contract,
except that the private company assumes overall responsibility for operation and maintenance of the system, with the freedom to make day-to-day management decisions but without assuming the commercial risks. The duration of management contracts is generally about five years.

In return for carrying out the specified activities, the private operator is paid a fixed fee, which may be linked to performance of the operator. Compensation is usually proportional to physical parameters. A profit-sharing arrangement, under which the private firm would bear a small part of the commercial risk, is possible but not usually accepted by private firms.

The PSP benefits that emerge under these arrangements again relate to the use of experienced companies with skills to undertake core operations and maintenance tasks, and the ability of these companies to undertake these activities in a more efficient manner. Management contracts, like service contracts, do not provide for any capital investment in the project.

**Lease contracts**

In a lease contract, the public sector remains as the owner of the assets, which are leased to a private company for operation and maintenance. The private operator leases the assets and takes on the responsibility for operating and maintaining them. In a lease contract, the private operator acquires the right to the revenue stream from the operation of the assets. The private company collects its revenues directly from customers and pays a rental fee to the public sector (government) for use of the assets. The fee is usually a proportion of total revenues and is supposed to cover the administrative and investment costs of the public entity that owns the assets. As in a management contract, enhancement expenditure tends to remain the responsibility of the public sector.

Unlike in a management contract (with or without profit sharing), the financial risk for operation and maintenance is borne entirely by the lessee. The lessee must finance working capital and replacement of components with a short economic life, but not extensions to the fixed assets. The equipment must be returned to the public authority in good repair at the end of the contract. The lessee retains a portion of tariff revenues
as compensation and pays the remainder to the public authority as a rental fee. The portion retained by the lessee is established in the lease contract as a result of competitive bidding or negotiation, and it may be adjusted regularly to reflect changing cost conditions or re-negotiated at a specified time during contract execution. The public authority or a regulatory body usually specifies the tariff level and the rental fee.

The efficiency benefits of PSP tend to be greater under this arrangement, as the private operator is able to pass cost savings on to customers, and to benefit from returns earned as a result of greater efficiency. As the private operator has more control over service provision, there is also more scope for the firm to take local conditions and customer preferences into account. The duration of lease contracts is usually from six to ten years, with the possibility of renewal for up to twenty years.

This type of contract is suitable where there is adequate capacity of infrastructure but inefficient public sector management. Where there is insufficient infrastructure capacity, a lease contract would not solve the existing water problems, unless accompanied by public sector investment. A lease contract could also be successfully applied immediately after public financing of a project when capital investment has eliminated the deficit in demand.

Concession contracts
The concession contract arrangement goes further than the lease contract in that the concessionaire must also finance investment costs. The public sector remains as the asset owner, but a private operator is given the right to use the assets for a fixed period of time. The concession therefore provides the private operator with responsibility for enhancement investment as well as for the operation and maintenance of the assets. The performance and conduct of the private operator is then governed by a concession contract that sets out the conditions of service provision, including performance targets, arrangements for capital investment, mechanisms for adjusting tariffs, and arrangements for arbitrating disputes (Merna and Smith, 1996).
In a concession contract, compensation is through tariff revenues, part of which may have to be turned over to the public authority if it has contributed to capital costs. Concession contracts are usually for a longer period than service, management or lease contracts in order to allow the private firm (concessionaire or the promoter) to recoup capital costs. Concession contracts are typically 15–30 years in length, although they include provisions for more frequent renegotiation of particular elements, notably the tariff formula, to reflect changing operational circumstances.

There are several possible variations in the use of BOO (T) and concession contracts to suit specific situations.

**BOT contracts**

In Build Own Transfer (BOT) contracts, the public sector retains ownership of all existing assets, and is responsible for the provision of water services to customers. A private operator is given responsibility for financing and constructing a specific infrastructure facility (or group of facilities). The private operator operates and maintains the facilities for a specified period of time following construction, and it is then returned to the state for a nominal cost. The private operator is remunerated for its capital and operating expenditure by retaining the whole revenue stream obtained from the operation of the facility during the period of the contract. There are variations on the BOT model, including the build, own and operate (BOO) arrangement, where assets remain indefinitely with the private partner; and design, build and operate (DBO) arrangements, where there is shared responsibility for capital investment (Merna and Smith, 1996).

**Privatisation**

In privatisation, the assets and the right to provide water and/or sanitation services are sold in their entirety to private operators. The privatisation can involve the flotation of the company on a stock exchange, or the sale of the company to one private operator. This extreme form of PSP has not been favoured in Africa, where the retention of assets by the public sector has been a dominant feature of any reform. Slight variations on full-scale privatisation have been explored—for example; partial privatisation could involve the sale of the service company while the government retains ownership of an asset-holding company. There are also situations where
companies are partially privatised, with a fixed proportion of the company shares (usually slightly more than 50%) being sold to the private sector and the state retaining ownership of the other share.

Concerns on the use of PSP

In many African countries there have been serious concerns about the introduction of PSP. These tend to relate to (WUP, 2000):

- The impact on the employees of the public utility company and the potential for labour unrest. Countries where PSP has been introduced, and proved successful at delivering benefits, demonstrate that concerns relating to the impact on the public bodies involved are generally outweighed by the improvements which can be made;

- The loss of government control over a politically and publicly sensitive sector. This tends to be overcome through government retention of the assets; and

- The potential increases in water prices and implications for the poor.

It has been argued that the concern about increases in water prices is best dealt with through a social welfare system. A counter-argument is that in some countries, the selling on of water at an inflated rate occurs owing to the lack of proper water provision for the majority of the population (due to failure of public sector utilities), with the poor paying exorbitant amounts to water vendors. For example, in Côte d'Ivoire, it was found in the early 1980s that some water was being sold on at a charge of 750 CFA/m³, while the domestic rate at that time was 286/CFA m³ (WUP 2000). The author's experience in Mombasa is that people living in informal settlements pay up to 5 times the utility's average tariff rate. Mashauri (1998) reported that in Dar es Salaam, Tanzania, poor quality water was resold at between 4 and 10 times the utility's average tariff rate.

PSP requires political will and that legal and legislative reforms be addressed for effective regulation of the sector. Private operators are more willing to participate in the water sector if there is an assurance that the utility company will be able to earn a return on its activities. This requires commitment from the government, political and social stability, and evidence of support for cost recovery in the regulation of tariffs.
The possibility of political unrest is particularly likely to dissuade international operators from becoming involved. The organisation of the public sector's involvement in the water sector influences, and is influenced by, the extent of PSP.

Selection of PSP option

Today, the current issues in many countries is no longer whether or not to privatise; it is how to privatise or involve the private sector. Selection of the PSP option will vary with the existing local circumstances and the problems that the PSP option is intended to address.

Contracting out of services using service and management contracts are two of the most common forms of PSP being used in the water and sanitation sector in developing countries today (Sansom et al, 2002). In Sub-Saharan Africa, the most frequent arrangements are lease and management contracts and, in some cases, a combination of the two is used. In addition, several leases and management contracts have concession-like performance incentives. The range of PSP options is expanding and, in countries where PSP has already been introduced, alternative forms are being experimented with. In some countries there is a move towards PSP arrangements with increased private involvement. For example, in Senegal the established system operator has now taken on partial responsibility for some investments (WUP, 2000).

It should be appreciated that the problems and constraints affecting delivery of urban water services are varied and numerous, but may be categorised into four main areas:

- Political;
- Institutional;
- Economic; and
- Social.

These problems should be analysed and discussed openly with all stakeholders during the selection of the PSP option. It should be noted that PSP is only a means to an end. The end is *improving performance in water services*, and particularly to meet the challenges discussed in section 2.3. Once the PSP option has been selected, preparations are made and the PSP option can then be implemented. Thorough
preparations for PSP should be undertaken to ensure that the end is achieved and sustained.

**Overview of PSP in the water sector**

Many governments and external support agencies believe that the way forward for the water sector is through some form of PSP (Sansom et al, 2002). There is no general consensus regarding which PSP option is ideal for which country. Water utilities in Sub-Saharan Africa have attempted to improve water services through institutional development and decentralisation with varying success. Many countries are approaching selection of PSP in a step-by-step basis, starting with the relatively simple service and management contracts and moving on to the more complex lease and concession contracts. The diagram below (Figure 2.3) demonstrates the range of PSP options available in the water sector, many of which are variations of those described above. Blokland et al (1999) has placed the above contractual arrangements in the entire spectrum of the basic organisational structures in the water sector shown as Figure 2.3.

Figure 2.3: Basic modes of water sector organisations

Source: Blokland et al (1999)
Meeting the water challenges in sub-Saharan Africa through PSP

The private sector has increasingly been accepted as having a role to play in performance improvement and provision of urban water services. PSP options largely solve the problems of institutional and management autonomy encountered by public water utilities. Various PSP options are in use in several countries in Sub-Saharan Africa, while other countries are in the process of selecting PSP options.

An example of recent selection and implementation of a PSP contract is Johannesburg, where a management contract was put in place in April 2001. The Johannesburg management contract is an example of the potential benefits of clear policies and good preparation for PSP. The Johannesburg management contract provides a good example of innovative ways of combining contracting out options with necessary institutional changes for the purposes of improving urban water services (Sansom et al, 2002).

Examples of countries currently selecting PSP options include Angola, Chad, Djibouti, Ghana, Guinea Bissau, Mali, Uganda, Kenya and Tanzania. These countries are currently considering proposals for PSP and, in particular, are examining alternative forms of PSP that could be introduced (WUP, 2000).

The potential benefits of introducing PSP are significant, especially where PSP is introduced as part of a coherent package of reform, incorporating changes to the provision of water and sanitation services and to the public bodies involved with the sector. The recent WUP study (2000) cited the following specific examples in Africa:

- Private operators provide immediate technical and managerial expertise to the sector. Private-sector involvement has potential to result in significant transfer of skills;
- Experiences worldwide demonstrate that private operators have been able to improve operating efficiency in a relatively short period of time;
- Private operators, particularly if operating at the local level, have been able to consider and meet the needs of consumers directly;
• In some cases, private operators have been able to provide required financing for capital investment projects, although in Africa this has been limited; and
• Improved tariff regimes, notably an emphasis on cost recovery and cost effectiveness, and more efficient revenue collection processes have allowed for a reduction in subsidies in some countries. The need for subsidy tends to remain in the early years of PSP, as phased increases in charges are introduced. In Senegal, cost-recovery targets for SDE aim to increase the rate from 95% to 97% within three years, while coverage rates have improved from 75% to 77% in four years. It is important to note that PSP in Senegal has resulted in only a modest increase in coverage, from 75% to 77% in four years.

Where PSP has been used, increases in management efficiency have been reported and customer services have improved. The level of service for those who are already served by the water utilities has been reported as having improved. For example in Guinea, PSP has resulted in increases in investment, which has helped lead to improvements in the availability of services as well as in service quality (WUP, 2000). The movement towards PSP has helped several countries in receiving funds from international donors including the World Bank. In countries where the formal private sector has not yet been used, the informal private sector is already in use. The informal private sector has particularly been effective in providing water services to the poor in informal settlements who are currently not served directly by utilities (Colligon and Vezina, 2000).

The exploratory research and review of water services in the cities where PSP has been implemented show that although improvements in services have been made, a lot remains to be done to improve coverage. Even after adopting PSP, the outstanding problem in Sub-Saharan Africa has been how utilities can extend water services to the urban poor and thus substantially increase coverage, in a financially sustainable manner. There is need for a holistic approach to improve service delivery to all, while meeting the financial objectives of the water utilities. The next section examines the case for a holistic approach to meeting the urban water challenges.
2.4.5 The case for a holistic approach to meeting urban water challenges

The key management approaches discussed in section 2.4 have largely not succeeded in meeting the urban water challenges (discussed in section 2.3) that are restated here:

1. Low coverage;
2. Low levels of service for those already served;
3. Provision of water services to the urban poor;
4. Rising water demand;
5. Poverty and insufficient funding of the water sector;
6. Cost recovery; and
7. High unaccounted for water.

These issues are traditionally addressed from an engineering or technical viewpoint that largely ends up addressing primarily the supply side of the problem. Water supply systems are typically designed to meet "standard" water requirements where the "water demand" is the key parameter that informs the design of the water supply infrastructure (Brandon, 1984). Issues of cost recovery are usually considered last if at all, and water consumers rarely (if ever) inform the design process. Economic principles are only usually employed after the design has been completed, to compare alternative designs or carry out cost benefit analysis. The supply side has not kept pace with the demand side, and socio-economic issues such as poverty and cost recovery continue to adversely affect the management of water utilities. There is an apparent lack of a holistic approach or methodology of meeting the challenges restated above. This is the knowledge gap in management of urban water services that this research aims to fill.

The use of supply led engineering approach to provision of water services has been justified on the basis that water is a public good that must be provided to the population by public or private water utilities for public health purposes. Franceys (1994) makes the point that the population does not only use improved water just for health benefits but for convenience as well. He argues that people using water for convenience are often willing to pay. Issues of convenience and willingness to pay imply perceptions of value, and these concepts are the realm of marketing and economics. Despite this, marketing principles are usually never applied, nor do they
inform, the design process for water supply infrastructure. Franceys (1994) argues that since even low-income consumers are willing to pay for the service they want, engineers should no longer use the supply driven or product approach but should instead use the market based or demand driven approach. The market based approach enables customers to show their demand through their willingness to pay for different levels of service.

Marketing principles and concepts offer an alternative and holistic approach that has potential to meet the challenges discussed in section 2.3. The next section examines marketing theory and concepts, which are the basis of the proposed holistic approach to meeting urban water challenges.

2.5 Marketing concepts and their relevance to the water sector

2.5.1 Marketing definitions

There are several ways of looking at marketing (Jones, 1989):

- As a business philosophy;
- As a management process; and
- As a set of tools (called the marketing mix) used to manipulate demand.

Marketing has been defined as “the management process responsible for identifying, anticipating and satisfying customer requirements profitably” (Jones 1989). Marketing is increasingly being conceptualised or viewed as an organisational philosophy, an approach to, or a way of, doing business (Wilson and Gilligan, 1997). Companies run according to this philosophy are said to be marketing-orientated. A truly marketing-orientated business believes that its sole function is to create and retain customers. The whole business, its personnel and its technical systems become geared to providing customer satisfaction and, in doing so, earning a profit or achieving the stated financial and other objectives of the organisation.
Marketing can also be viewed as a management process. Wilson and Gilligan (1997) define marketing as the management process for identifying, anticipating, and satisfying customer requirements profitably. Marketing typically involves the following steps (Wilson and Gilligan, 1997):

- Investigating customer demand for a class of products or services
- Identifying a group of customers whose requirements could be better satisfied
- Developing a service or product to meet that demand
- Pricing the product at a level that the market will bear and which will return a profit
- Making the product or service available through channels accessible to the customer
- Promoting the product or service so that a desired unit or revenue volume of demand is achieved

These steps constitute a holistic and potentially useful approach to solution of problems facing the urban water sector in Sub-Saharan Africa. Based upon careful analysis of alternative opportunities, and organisational strengths and weaknesses, marketing plans are compiled, implemented and controlled to achieve these marketing objectives (Jones, 1989).

Marketing as a set of tools

Another perspective on marketing is to view it as a set of tools used to manipulate demand. One such tool is the “marketing mix”, sometimes referred to as the 7p’s of marketing - product, price, promotion, place, people, presence and process - which are aspects to be reviewed in order to respond adequately to demand (Wilson and Gilligan, 1997). The marketer is seen as mixing these variables to achieve a targeted volume of demand. The marketing manager is analogous to a demand manager or a utility manager. The concept of the marketing mix was originally developed in the context of manufactured goods but has recently been extended into services. The use of this set of tools has potential to improve urban water services.
Kotler (1997) has defined marketing as a social and managerial process by which individuals and groups obtain what they need and want through creating, offering and exchanging products of value with others in the market. He further states that marketing means working with markets to actualise potential exchanges for the purpose of satisfying needs and wants. Kotler’s (1997) definition of marketing rests on the following core concepts: needs, wants and demands; products (goods, services and ideas); value, cost and satisfaction; exchange and transactions; relationships and networks; markets; marketers and prospects. Kotler (1997) states that marketing starts with human needs and wants. People need food, air, water, clothing and shelter to survive. Beyond this people have a strong desire for recreation, education and other services. Kotler (1997) considers it important to distinguish among needs, wants and demands, which he defines as follows:

- A human need is a state of deprivation of some basic satisfaction. People require food, clothing, shelter, safety, belonging, and esteem. These needs are not created by society or by marketers. They exist in the very texture of human biology and the human condition.

- Wants are desires for specific satisfiers of needs. These desires have been illustrated by way of examples such as that where an American needs food and wants a hamburger, french fries and a coke. In another society (or market segment) these needs might be satisfied differently. Although people’s needs are few, their wants are many. Social forces and institutions such as churches, schools, families and business corporations continually shape human wants.

- Demands are wants for specific products that are backed by an ability and willingness to buy them. Wants become demands when supported by purchasing power. For instance, many people want a Mercedes but only a few are able and willing to buy one. Organisations should therefore measure not only how many people want their product but, more importantly, how many would actually be able and willing to buy one.

These concepts are relevant and can be usefully applied in management of urban water services.
Kotler (1997) states that people satisfy their needs and wants with products, which he defines as follows: A product (or offering or solution) is anything that can be offered to satisfy a need or want. A product or offering can consist of as many as three components: physical goods, services, and ideas. The importance of physical products lies not so much in owning them as in obtaining the services they render. For instance we buy a car because it supplies a transportation service; we buy a microwave oven because it supplies a cooking service. Thus physical products are really vehicles that deliver services to us. Manufacturers often make the mistake of paying more attention to their physical products than to the services produced by those products. They see themselves as selling a product rather than providing a solution to a need. Utility managers in Sub-Saharan Africa (most of whom are engineers) see themselves as producers and suppliers of a product (water), hence the supply driven approach to water provision and management.

Kotler’s view of marketing is similar to the increasingly popular view among professionals and other stakeholders in the sector, who regard water to be both a social and an economic good (Winpenny, 1994). Water services may be viewed as services rather than just commodities. Starting from the view that water is life, it follows that provision of a certain amount of water service would satisfy the basic need for water. Above this basic level of water service, people may want a certain different or superior level of water service. The need can be represented by the social good while the want can be represented by the economic good. In the context of the urban water sector, water utilities are manufacturers and distributors of water services. They should pay more attention to the services provided by the water.

*Marketing as an organisational process*

Farnham and Horton (1996) have defined marketing as an organisational process designed to understand the needs of customers and then satisfy them whilst achieving the goals of the organisation. This definition of marketing is relevant to the urban water sector. The definition implies that water utility managers should understand the needs of their existing and potential customers and satisfy them while meeting their (utility’s) objectives.
Marketer

Kotler (1997) has defined a marketer as someone seeking one or more prospects who might engage in an exchange of value. He has stated that marketers do not create needs, needs pre-exist marketers. Because a product provides a solution to a need, it is just a means of packaging a service. Thus a marketer's job is to sell the benefits or services built into a physical product rather than the product itself. Marketers along with other societal influences, influence wants. Marketers might promote the idea that a Mercedes would satisfy a person's need for social status. They do not, however, create the need for social status. Marketers influence demand by making the product appropriate, attractive, affordable and easily available to target consumers.

The implication of this view of marketing to the urban water sector is that utility managers should for instance, find it relatively easy to sell good quality water to potential customers who are currently not served by the utility. In this context, water utility managers are marketers of water services, and they should seek to serve more customers and target them through market segmentation, service and price differentiation.

Marketing Management

Kotler (1997) defines marketing management as the conscious effort to achieve desired exchange outcomes with target markets. It is the process of planning and executing the conception, pricing, promotion and distribution of goods, services and ideas to create exchanges with target groups that satisfy customer and organisational objectives. This definition recognises that marketing management is a process involving analysis, planning, implementation and control; that it covers goods, services and ideas; that it rests on the notion of exchange; and that the goal is to produce satisfaction for the parties involved. Marketing management is essentially demand management; its task is to influence the level, timing and composition of demand.

This view of marketing is applicable to the urban water sector in Sub-Saharan Africa, where utility managers need to manage the rising water demand.
Value, Cost and Satisfaction

*Value* is the consumer's estimate of the product's overall capacity to satisfy his or her needs. DeRose (1994) defines *value* as the *satisfaction* of customer requirements at the lowest possible *cost* of acquisition, ownership, and use. Since consumers have varying water requirements depending on their circumstances, these concepts imply market segmentation, service and price differentiation in order to meet customer requirements.

Exchange and Transactions

There are four ways in which people can obtain products (De Rose, 1994):

- Self-production, such as people relieving hunger through hunting, fishing or fruit gathering. In this case there is no market and no marketing.
- Coercion, such as hungry people wresting or stealing food from others. No benefit is offered to the others except that of not being harmed.
- Begging, such as hungry people approaching others and begging for food. They have nothing tangible to offer (except gratitude, which is not tangible).
- Exchange, such as hungry people offering a resource in return for food. Resources used in exchange are money, goods, or services.

Marketing emerges when people decide to satisfy needs and wants through exchange.

Kotler (1997) defines *exchange* as the act of obtaining a desired product from someone by offering something in return. He states that for exchange potential to exist, five conditions must be satisfied:

- There are at least two parties;
- Each party has something that might be of value to the other party;
- Each party is capable of communication and delivery;
- Each party is free to accept or reject the exchange offer; and
- Each party believes it is appropriate or desirable to deal with the other party.

The concept of exchange is applicable to the urban water sector. Whether exchange actually takes place depends on whether the two parties can agree on terms of exchange that will leave them both better off (or at least not worse off) than they were before the exchange. In this context, exchange does not take place where illegal water
connections are prevalent. Exchange is frequently described as a value-creating process because exchange normally leaves both parties better off. The concept of exchange leads to the concept of a market.

**Markets**

Markets consist of all the potential customers sharing a particular need or want who might be willing and able to engage in exchange to satisfy that need or want (Kotler, 1997). The size of the market depends on the number of people who exhibit the need or want, have the resources that interest others, and are willing and able to offer these resources in exchange for what they want. The urban water sector in Sub-Saharan Africa meets this definition of a market. Indeed, the water market in the urban water sector is enormous and growing rapidly. It is the water utilities that are not meeting the requirements of the water market.

Marketing is increasingly being conceptualised or viewed as an organisational philosophy, an approach to, or a way of, doing business (Wilson and Gilligan, 1997). The above definitions of marketing and marketing concepts imply that ongoing communication with existing and potential customers is required to check the effectiveness of efforts to identify, anticipate and satisfy customer requirements. While different water utilities might have different financial objectives, all utilities need to generate sufficient funds for future investment and to meet the challenges discussed in section 2.3. Marketing theory provides the basis of a holistic approach to meeting the challenges facing the urban water sector in Sub-Saharan Africa. The next section examines application of marketing techniques in the water sector.

**2.5.2 Application of marketing concepts in the water sector**

Farnham and Horton (1996) states that marketing ideas originally arose as a consequence of the need for firms in fast-moving consumer goods markets to compete with each other. The appeal of marketing in this context was that those firms who better understand and find ways of responding to the needs of their customers will be more effective in their chosen markets and be more likely to achieve commercial success. The marketing approach has spread from the fast-moving consumer goods
markets to cover consumer durables, services, business-to-business markets and also not-for-profit organisations in the public services (Farnham and Horton, 1996).

Farnham and Horton (1996) have examined the question of whether or not marketing is appropriate for public services and have quoted several references in this discussion (Walsh, 1994; Butler and Collins, 1995; Foxall, 1986; Hadley and Young, 1990; and Hanagan, 1992). This discussion is relevant to the provision of water services because water is often taken to be both a social service (hence a public service) and also an economic good (hence commercialisation). There is no general agreement among authors regarding the question “Can true marketing orientation be achieved by any organisation that is not fully subject to the market disciplines of competition?”

It is not intended to examine further the conceptual issue of marketing orientation in public services in greater depth. Several researchers have recently investigated marketing of water and sanitation services. Kayaga (1997) examined the possible application of marketing orientation at the National Water and Sewerage Corporation (NWSC), a water utility in Uganda. He concluded that NWSC should change its present organisational culture that is supply-driven and adopt a demand-driven approach that is market orientated.

A utility with a marketing orientated philosophy would have its entire operations, its personnel and its technical systems, being geared to providing improved customer satisfaction and to contribute towards meeting its financial objectives. Market segmentation, service differentiation and appropriate pricing are key to achieving these objectives. Market segmentation is discussed in section 2.6.1 while service and price differentiation is discussed in section 2.6.2.

Considering water to be both a social and an economic good (Winpenny 1994), utilities need to operate on commercial principles in order to achieve sustainability. The water utility’s objective that could embrace both the “social good” and “economic good” considerations is as follows:

*To supply basic needs water for health to all (only a predetermined modest amount of provision required) and to provide a customer service of larger quantities and more convenient delivery to those who are willing to pay the cost.*
When a water utility is managed as a commercial organisation, the goals are likely to be related to profits, whilst the organisation's goals may be expressed in other terms if the utility is managed as a public service organisation. In either case, the marketing process has to operate within constraints. When considering whether marketing techniques are applicable in the water sector, the question to ask should be: "Can a water utility make effective use of marketing techniques in pursuit of its objectives?" This is a relevant question for this research, and is an objective of the literature review.

Marketing means working with markets to actualise potential exchanges for the purpose of satisfying human needs and wants. Marketers seek to elicit a behavioural response from another party. Thus marketing is not limited to consumer goods; it is also widely used to sell ideas and social programs. As stated above, people satisfy their needs and wants with products, which may consist of physical goods, services and ideas. Water services may be seen as both physical goods (water for drinking) and a service (water for convenience and sanitation). Service also encompasses many aspects such as customer service, billing, payment methods, operations and maintenance.

A certain amount of water is necessary for purposes of satisfying the basic human need, which is mainly drinking and cooking. Above the basic need, people desire to have a certain level of convenience. For instance many people would rather have their own water connection (individual connection) than share with their neighbours (as in a yard connection), or share with many other people (as in drawing water from a water kiosk). This is a matter of desire or want and not an absolute need because the basic need can be satisfied by collecting water from a shared stand-post near the house, or a water kiosk in the neighbourhood. Just as many people want a Mercedes but only a few are able and willing to buy one, many people want a water service in their houses (individual connections) at full pressure 24 hours per day but not everybody in Sub-Saharan Africa is able and willing to pay for one. People may have different priorities (unsatisfied needs for other products or services) rather than have and pay for the highest possible level of water service. Moreover water utilities may not be able to provide such a service to all those who want them (possibly due to capacity constraints).
The concepts and principles of marketing outlined above are largely applicable to water services in both developed and developing countries.

2.5.3 Relevance of marketing concepts in developed countries.

In developed countries such as the UK, water utilities are generally able to provide every customer with a 24-hour service at full pressure. The service options are generally limited to supply with or without meters and payment options (Wilkes, 2001). For instance, marketing of water services by Severn Trent Water (a regional water utility that serves over 8 million customers in the Midlands region of England) involves marketing of these two options. Service differentiation at Severn Trent is limited to provision of water with or without meters. Most of the customers living in relatively new properties (constructed after 1989) are metered whereas those living in properties constructed prior to 1989 are billed on the basis of rateable value of their properties. The utility, like many water companies in England and Wales is commercially managed and is financially sustainable with substantial returns on investment (Severn Trent, 1999, 2000 and 2001). The utility is customer orientated with an effective and functioning customer care department.

2.5.4 Relevance of marketing in the urban water sector in Sub-Saharan Africa

Relevance of marketing in the urban water sector in Sub-Saharan Africa is evidenced by existence of active water markets especially in cities that experience water shortages. A casual observation of the water situation in many African cities reveals that a thriving water market exists. Whereas the official water utility has the legal mandate to supply water to all customers in the city, other suppliers operate in the city as well. Evidence of the existence of a water market and the competition faced by water utilities is seen in form of:

- Illegal connections to the water utility's distribution network;
- Private water vendors (handcarts, wheelbarrows, water tankers etc);
- Individual and/or private water sources such as wells and boreholes; and
- Other non-utility water sources such as springs.
Active water markets have been observed in several cities such as Karachi (Black, 1999) and by the author in Kampala, Dar Es Salaam, Mombasa, Nairobi, Mbabane, Maseru, Manzini and Durban. The author made these observations during field visits to Sub-Saharan Africa as part of this research.

Despite the evidence of active water markets, many water utility managers have not changed their management approach to match the physical realities resulting from insufficient water supply infrastructure. Good opportunities exist for the utility to capture more of the water market served by non-utility sources, through market segmentation, service and price differentiation (MSSPD), and other marketing techniques. The following section examines how to market urban water services and use the MSSPD approach.

2.6 Marketing urban water services

Progressive customer orientated water utilities appreciate the crucial importance of the customer as the reason why the utility exists. The key to marketing of water services is to know the customer and then build beneficial exchange relationships with existing and potential customers. A useful approach to achieve this is to use the concept of “Customer Value Chain” (Sage, 2000).

The concept of the “Customer Value Chain” is to know, target, sell and service. In the context of the water sector, the customer value chain involves developing customer knowledge through market segmentation, service differentiation, service promotion and service provision. This entails the following (Sansom et al, 2000):

- **Know** and understand the different customer and potential customer groups, including their attitudes, practices, perceptions, preferences and their willingness to pay for improved service options. Key methods for getting to know water users are through questionnaire surveys, focus group discussions, customer consultative committees and local observation.

- **Target** specific market segments with appropriate service options at sustainable water charges that consumers are willing to pay for. Options could include house
connections, yard taps and water kiosks, with or without storage tanks, at appropriate price levels. Other options that can be offered are payment options (such as take-and-pay, weekly, monthly, by post, at a bank, or at a local office including flexible payment systems) and shared management options (private and community management).

- **Sell** options using suitable promotion techniques. This will require careful planning and implementation particularly when dealing with groups who use alternative water supplies or if they have unauthorised pipe connections and do not currently pay.

- **Services** provided to a good quality standard that requires utilities to adopt a programme of continual organisational improvement, centred on existing and potential customers. In addition, effective collaboration between different departments within a utility (such as customer relations, billing, operation and maintenance and financial management) can enable the resolution of most customer complaints and enhance customer satisfaction.

The key to understanding existing and potential customers is market segmentation.

### 2.6.1 Market segmentation

Segmentation is the process of identifying groups of customers with enough characteristics in common to make possible the design and presentation of a product or service each group needs (Heskett, 1986). By identifying a segment's special needs, the service provider can then design services to meet them better and in a financially sustainable manner. Application of this consideration in the water sector leads to the concept of service and price differentiation that is discussed in section 2.6.2.

A market may be segmented according to demographic dimensions such as age, income, house type, education level, family size and location, and each criterion may have different relevance to a particular business (Heskett, 1986). The criteria for market segmentation is based on the belief that "people with broadly similar economic, social and lifestyle characteristics tend to congregate in particular neighbourhoods and exhibit similar patterns of purchasing behaviour and outlook"
(Wilson & Gilligan, 1997). Selection of criteria for market segmentation in the water sector should consider factors such as:

- Is market segmentation feasible and practical using the selected criteria?
- Will the segments be substantial enough for meaningful service differentiation?
- Will the segments be adequately unique to be distinguished from each other?
- Will the segments be adequately stable so that their present and future characteristics can be predicted with a sufficient degree of confidence?

While developing the criteria for market segmentation, it is important to ensure that each market segment has adequate similar characteristics for which viable water service options can be provided by the utility. It is necessary to consider the options to be marketed while selecting criteria for market segmentation.

Utilities wishing to carry out market segmentation would need to carry out social mapping of their cities in order to obtain knowledge and confirm information on their existing and potential customer base.

Segmentation using demographic criteria in developing countries poses a great challenge because data is often unavailable. Geographical location is a relatively easy criterion to adopt, but it is often unsuitable in the context of developing countries. This is mainly because enormous differences in needs and circumstances of users often exist in the same geographical location. For instance, it is common to find an informal settlement in the same location as an affluent neighbourhood. A suitable and practical criterion is the type of dwelling, which often defines a household.

Type of dwelling as criteria for market segmentation

In Sub-Saharan African cities, the types of dwelling that people live in are generally a reflection of their socio-economic status. For instance, the people who live in unplanned informal settlements or slums are generally the very poor (although poor people also live in other types of dwellings), while those in well planned residential estates tend to be the more affluent in the population. The type of dwelling is therefore a convenient method that a water utility could use to segment the water
market. In the urban context, a dwelling often defines a household, which is an appropriate unit for the utility to form a beneficial relationship.

The use of type of dwellings as criteria for market segmentation is relatively easy to implement in the field since all dwellings can easily fit into one of the specified market segments. This categorisation also readily fits into income groups that make up specific market segments. Another advantage of this type of segmentation is that viable technical and management options for water provision can be provided to suit different market segments on the basis of type of dwelling.

Other criteria for market segmentation in the water sector include population density, geographical location, and income. Segmentation using income as criterion may not be practical because it is difficult to measure income in Sub-Saharan Africa, where a large informal sector exists. Utilities can however use proxies for income such as population density, type of infrastructure available in an area and house type. In such a case, market segmentation can be carried out by dividing the city into suitable income areas that correspond to market segments (such as low, middle, and high income). In other cases, it may be more appropriate to use more than one criterion for segmentation in order to obtain segments that meet certain criteria.

Market segmentation enables the utility to know and understand its existing and potential customers, and this facilitates service and price differentiation of its water services. The next section considers service and price differentiation.

2.6.2 Service and price differentiation

The concept of service and price differentiation is derived from the principles of marketing. Kotler (1997) defines marketing as a tool that enables an organisation to balance the aspects of product, price, service characteristics and promotion. Service differentiation is the act of designing sets of meaningful differences in a service, with the aim of distinguishing one service from another (Kotler, 1997). In the context of the water sector the product remains essentially the same while service may be differentiated by varying service attributes that determine levels of service such as method of delivery, pressure and duration of supply.
In Sub-Saharan African cities, needs and conditions differ from one customer group or market segment to the next. People also experience substantially different water services specific to their market segment. By segmenting the market into segments, the utility can develop feasible service options that are then offered to existing and potential customers in respective market segments, and at prices that each market segment is willing to pay, with the utility meeting its financial objectives. This is the essence of service and price differentiation that is under investigation in this research.

Market segmentation provides a basis for water utilities to structure service delivery and pricing policy to suit the special needs of each customer group. Suitable options for improved services need to be developed bearing in mind the different needs and demands of these groups or market segments. Though the product delivered to all segments in the water market would be similar (good quality potable water that meets the necessary standards), the method of delivery, and hence the service would be different (hence service differentiation) to suit the segment’s special requirements and willingness to pay. This is reflected in the service concept.

Service can be differentiated in terms of characteristics such as quality and quantity. Lovelock (1992) has defined the concept of service quality as follows:

“Quality is the degree of excellence intended, and the control of variability in achieving that excellence, in meeting the customer’s requirements”.

This definition of quality is useful as it incorporates the following three components: design quality, or the intended degree of excellence; conformance quality, or the minimising of variance from the intended design; and fitness of design, or the extent to which the product/service meets the customer’s requirements. Customer’s requirements usually take two forms: basic substantive needs and peripheral needs. To satisfy substantive needs, water utilities provide water in the same way as restaurants provide food and airlines provide transportation. The second category, “peripheral needs” goes beyond the needs met at the substantive level. The service attributes that meet these needs surround and complete the substantive service. For water utilities, peripheral service attributes would for instance consist of providing water at the desired pressure, frequency and reliability. It therefore follows that
service differentiation is the method that can enable water utilities to meet the different requirements of different customer segments.

In many urban areas of developing countries, water utilities are usually unable to provide a 24-hour service at full pressure to customers. Service delivery is often characterised by water shortages, intermittent supply at low pressure or no water at all. Sometimes water is available for a few hours at odd times when customers may be at work or asleep. Such water utilities do not provide quality service to customers. Lovelock (1992) has cited several cases where improvements in service quality resulted to enhancement of customers' perception of the value of the service. In the cases cited by Lovelock (1992), customers were willing to pay a premium for the increased service quality.

In areas where the water utility is unable to provide a 24-hour water service, there is scope to increase quality of service by providing substantive and some peripheral service attributes using appropriate technical and management options. This could result in an increase in service quality and thus enhance customer's perception of the value of the water service. This has the potential to increase customer’s willingness to pay for the services and thus maximise the water utility’s income from the service provision and hence improving prospects of financial sustainability.

Marketing of different water supply options has, therefore, more scope in developing countries than in developed countries. By segmenting customers, water utilities can then provide existing and potential customers with service options that customers desire, at the location and time that they want to use them, and at the price they are willing to pay. This can result in customer satisfaction and improved revenue to the water utility. Application of this marketing approach in the urban water sector will be investigated in the research.

Heskett (1986) supports this marketing approach when he states that:

“A service enterprise can successfully be fashioned and developed by targeting a segment of the market, developing a concept to conveniently serve some of the needs of the segment, developing an operating strategy that allows financing for the
enterprise and designing then building a service delivery system”. Heskett (1986) summarises the basic elements of a strategic service vision as:

- a targeted market;
- a well defined service concept;
- a focused operating strategy; and
- a well designed service delivery system.

The targeted market segment

A service cannot be all things to all people. Groups or segments of customers should be singled out for a particular service, their needs determined, and a service concept developed that provides a competitive advantage for the server in the eyes of those to be served. Application of this principle logically leads to market segmentation.

The rationale of service and price differentiation in the urban water sector in Sub-Saharan Africa is that needs and conditions differ substantially from one neighbourhood to the next. It may not be realistic for the water utility to provide a uniform service to customers whose needs, wants and willingness to pay are so different. Through market segmentation, service and price differentiation (MSSPD), a water utility can offer a range of service levels at different prices, with due regard to customers’ ability and willingness to pay.

It is, perhaps, this approach to service delivery that has made small scale informal private water operators (commonly known as water vendors) flourish in many areas where the official water utility has failed to provide services. The small-scale informal private water vendors tend to be customer-driven, financially viable and ready to apply innovative technologies (such as handcarts, bicycles, wheelbarrows for transporting water) and marketing methods. They provide appropriate solutions in appropriate places, assume all investment risks and reach both the rich and the poor segments of customers. They charge market prices, cover costs and respect willingness to pay. The main problem is that they often overcharge their customers during times of water scarcity.
Water utilities could perhaps borrow a leaf from these small-scale entrepreneurs (water vendors), who have managed to fill market niches by developing innovative technologies and using marketing practices.

**Selecting the target**

The selection of a particular market segment as a target for the design, delivery, and marketing of a particular service may depend, among other factors on (Heskett, 1986):

- The size of the segment;
- The needs of the segment;
- The extent to which these needs are being met (or more important, not being met); and
- The capabilities of the proposed service for meeting such needs.

In order for a water utility to meet the needs of a market segment in a sustainable manner, the segment must be attractive in business terms. The least attractive segment for a water utility appears to be the very poor households who live in informal settlements. If the utility wants to deliver a basic service at low cost, it will look for customers valuing low prices. It is important to consider the rate of growth in available margins (whether through increasing total sales or increasing the margin on each sale), and the relative sensitivity of that segment’s members to the “design” as opposed to the price of a service. The rate of growth in available margins suggests the profit potential in the segment. For an informal settlement, there is potential for the utility to provide the basic water service in collaboration with small scale informal operators or the community where applicable. Such collaboration or partnership can result in win-win situation for all stakeholders.

Segments whose members value some elements of design over price are less sensitive to price. Such segments include affluent segments, such as households living in large bungalows and maisonneutes in neighbourhoods that value aspects such as high water pressure and reliability with little consideration to price. Such segments offer an attractive, high margin target to the operator able to deliver a service designed to meet these customers’ needs better than its competition. If desired, the more affluent
segments can also subsidise the poorer segments so that the operator is able to meet the water requirements of all.

The concept of service and price differentiation has potential to be successfully applied by water utilities operating in Sub-Saharan African cities. The existence of active water markets in many cities, with the small scale private informal water operators thriving, is perhaps due to the inability of many water utilities to serve customers efficiently and effectively. The author observed this situation in several cities in Sub-Saharan Africa including Mombasa, Dar Es Salaam and Nairobi.

The well defined service concept
A service concept describes the way an organisation would like its services to be perceived by its customers and employees, and by its shareholders and lenders as well (Heskett, 1986). A successful firm ought to carefully phrase and communicate the response to customers, employees and others. If communicated to customers, a service concept can help potential customers evaluate and select alternative services. And when communicated to employees, a service concept can focus attention on the importance of certain aspects of the server's work. A water utility can, for instance win potential customers by communicating (promoting) the concept that it provides “good quality potable water at low cost”. If a utility sends messages to potential customers that are consistent with its service concept, customers should form desired perceptions of the product or service. This concept can be usefully applied by water utilities.

The focused operating strategy
An operating strategy that sets forth the way the service concept will be achieved is the product of many decisions about operations, financing, marketing, human resources and control (Heskett, 1986). Heskett (1986) adds that the most successful firms are those that have identified those elements of strategic importance and have concentrated their efforts, investments and control on them. These firms effectively deliver results promised in the service concept while achieving internal goals associated with people, costs, and profits. Sometimes the development of an effective operating strategy provides the key that unlocks the barrier to successful performance in an entire industry. Heskett (1986) further states that focused operating strategies are
found at the heart of successful operations in all service industries. This concept is applicable to water utilities, as they can be considered to be both manufacturers and distributors of services.

The well designed service delivery system

For a water utility, the condition of the water supply infrastructure is an important consideration in the design of the service concept that can be supported by the entire water delivery system, using the selected operating strategy. Heskett (1986) makes the point that an ingenious operating strategy intended to provide a service aimed at a particular market segment is useless if the delivery system does not work. Systems that deliver successfully consist of well thought out jobs for people with the capabilities and attitudes necessary for their successful performance; equipment, facilities, and carefully developed procedures aimed at a common set of clearly defined objectives.

Operations and maintenance is clearly an important aspect of the service delivery system. The delivery systems should provide sufficient capacity to meet the most commonly experienced levels of demand efficiently. The delivery systems insure that standards for service quality are met and that services perceived by customers are differentiated from the competition. Development of service options for a water utility ought to carefully consider the capability of the water supply infrastructure, its operations and maintenance. In addition to infrastructure, another key aspect of service and price differentiation is customer care.

Customer care

Customer care is concerned with customer satisfaction, that is putting the customer first, anticipating needs and problems, tailoring products and services to meet needs, and establishing customer relationships (Glynn and Barnes, 1996). Utilities need to focus on service delivery systems, the environment, and especially the need to manage their employees so as to provide an efficient and caring service. Progressive water utilities are implementing customer care programmes, with expenditure viewed as long-term investment for future growth and successful financial performance.
Glynn and Barnes (1996) states that successful customer care strategies require substantial investments of time, money and the need to:

- Research and understand customer needs and expectations at all stages in the service delivery process. To identify the key components of customer care/service quality.
- Develop enlightened personnel policies. Research and understand employee needs and expectations. Structure training programmes to meet these needs; motivate employees towards commitment to the organisation and its objectives; understand customer needs and the needs/wants of other employees; and provide product/service knowledge, personal and communication skills. Reward appropriately.
- Develop products/services to meet customer needs. Also develop systems and procedures that are customer and employee-focused, responsive, flexible and reliable, and a suitable delivery environment.
- Make best use of technology in products/services, systems and environment to ensure speed, accuracy and efficiency.
- Pay attention to potential failure points and service recovery procedures which become integral to employee training- in other words, empowering employees to exercise responsibility, judgement and creativity in responding to customers' problems.
- Management commitment to customer care and the creation of an appropriate culture. The organisational culture may require change towards employee orientation to the utility and everyone’s orientation to the external customer. This change starts at the top; the customer care process must begin with senior management commitment to employees and customers, ideally with strong and visible leaders.

These aspects are particularly relevant to urban water utilities in Sub-Saharan Africa.

2.6.3 Rationale for market segmentation, service and price differentiation in the water sector

The market segmentation, service and price differentiation (MSSPD) approach is consistent with the concept of managing water as an economic as well as a social
good that should be managed at the lowest possible level. The approach can be seen as a direct extension of the Dublin principles. The Dublin Principles were the result of an international conference on water and the environment held in Dublin, Ireland in 1992, soon after the end of the international water decade (1981-1990). The Dublin principles have become a common basis of an international consensus on development in the water sector (WELL, 1998). The four Dublin Principles are described in box 2.2:

Box 2.2: The Dublin Principles, January 1992

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment
Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or groundwater aquifer.

2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

3. Women play a central part in the provision, management and safeguarding of water
This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

4. Water has an economic value in all its competing uses and should be recognised as an economic good
Within this principle, it is vital to recognise first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognise the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

The Dublin Statement, January 1992

Management of water as an economic good requires that utility managers should let their existing and potential customers inform key investment decisions. The MSSPD methodology can allow users to select the level of service, technology, and location of
facilities that best fit their needs with a clear understanding of the prices that provision of the services will attract. This approach is consistent with the demand responsive approach (DRA).

**Demand responsive approach (DRA).**

Webster (1998) describes the demand responsive approach (DRA) as an integrated approach to water service delivery that takes into account the technical, social, financial and institutional factors. The demand responsive approach (DRA) is an approach that attempts to respond to expressed demand for a service. The 1999 international electronic conference on the Demand Responsive Approach (DRA) (http://www.oneworld.org/thinktank/water/drarep.htm) showed that there is consensus among practitioners that DRA plays a critical role in promotion of sustainability of water services. This approach was developed from experiences in the last decade.

Cairncross (1992) states that one of the lessons that emerged from the international drinking water and sanitation decade was that progress and continuing success in the water sector depend on responding to consumer demand. In particular, water supply systems that did not have peoples' demand had problems of under-use, poor maintenance and poor cost recovery (White, 1997). Review of many water and sanitation projects show that projects are often unsustainable because they were planned and implemented without responding to the demand expressed by the customer (Breslin 1999). Many international organisations and practitioners now consider demand responsive approaches as the way forward in delivering water services to the growing population in developing countries. This demand is demonstrated by willingness to pay (WTP) for a specified service option or level of service.

Although demand responsiveness is acknowledged as a huge step forward in promoting sustainability of water services, research on application of DRA approach has been done mainly in the rural water sector where it has been shown to be feasible (Webster 1999, Bos 2000 and Deverill et al 2001). The next section considers application of DRA principles in the urban water sector.
DRA in the urban water sector

DRA success in the rural water sector has been attributed mainly to community management of rural water projects. (Community management was discussed in section 2.4.3). Application of DRA in the urban water sector is considered to be doubtful mainly because in urban areas, population is often transient and "organised communities" are rare. In the urban sector, community management is limited and water services are managed by public or private utilities. Although research on DRA approaches has not been done in the urban context, it is likely that some of its principles can be usefully applied in the urban context, with appropriate modification. With utility management, the concept that appears promising in the urban water sector is market segmentation, service and price differentiation that also encompasses principles of DRA.

Application of market segmentation, service and price differentiation (MSSPD) in the urban water sector

Commercial orientation is the degree to which actions in an institution are driven by cost effectiveness and operating efficiency. The performance of an organisation should be guided and disciplined by a strategy to achieve financial self-sufficiency at an appropriate stage of growth. This commercial orientation can be viewed at both operational and policy levels, and can be usefully applied in the urban water sector. A practical mechanism for its application is market segmentation, service and price differentiation (MSSPD).

MSSPD provides a flexible means of meeting different water requirements at varying costs to the users. The concept also enables a water utility to respond to demonstrated demand by existing and potential customers. In addition, service and price differentiation has the benefits associated with demand responsive approaches that have been shown to be effective in improving water services in rural areas of South Africa (Webster, 1999). The emphasis in demand-driven approaches would be on making decisions based on customer preferences as far as system types and siting were concerned; and on the expression of the customer's willingness to pay for a given service level.
Service and price differentiation is a form of marketing and a useful tool that can enable a utility to balance the aspects of product, price, service characteristics and promotion. It is a useful management approach that has the potential to enable water utilities to structure and market water service options at appropriate service levels to meet the needs of customers, including low-income groups. The rationale is that water utilities can use marketing concepts to find out the service level and tariffs that the low-income consumers are willing to pay. These consumers can therefore avoid the need to rely on alternative sources such as expensive vendors and polluted water sources.

Water utilities are not used to marketing products, but rather to setting service delivery targets and working to reach them. Black (1999) states that unlike bureaucracies markets cannot be made to function according to a predetermined administrative plan. He argues that any programme looking to cater to, or develop, a consumer market around water and sanitation facilities would have to be flexible enough to allow for a process of learning and growth. He further states that subsidy need not be eliminated entirely, especially for initial construction but it should not be at a level that precludes local market development. Black (1999) argues that a water utility should provide a menu of options that matched the potential market in terms of price, appeal and technology.

Market segmentation, service and price differentiation (MSSPD) is a holistic approach with potential to improve urban water services in Sub-Saharan Africa. The utilities can benefit by structuring their service provision and implementing an appropriate pricing policy in order to optimise customer services and achieve financial sustainability. This approach has been investigated in this research through case studies in Durban and Mombasa that are presented in chapters four and five respectively.

2.6.4 How can water utilities conduct their marketing activities?

Information on how water utilities in Sub-Saharan Africa or elsewhere can conduct marketing activities was not found in the literature. Recent research on management of urban water services has concentrated on methods of determining households'
water demand, demand management and customer orientation and the debate on whether or not water should be considered a social or economic good.

Franceys (1994) states that the technology-driven or product/supply-driven approach has not been successful in meeting the water and sanitation requirements especially in developing countries. This is certainly the case in Sub-Saharan Africa. As discussed above, marketing is responsible for driving an organisation, and is applicable to the urban water sector in Sub-Saharan Africa. In his study of the National Water and Sewerage Corporation (NWSC) in Uganda, Kayaga (1997) found that the management of the corporation was not customer orientated and that this contributed to the low levels of revenue. He concluded that the water utility should be customer-oriented and market-driven.

Bhattarai (1999) studied the extent of marketing of water services in four secondary towns representing different geo-demographic, economic and socio-cultural environment in Nepal. He found that management of water services in Nepal was supply driven and not managed commercially and that the services faced the vicious cycle of under-funded declining levels of service. Pricing was not set to recover costs and marketing orientation was non-existent. He recommended that the way to change from the vicious to virtuous situation is for utility managers in Nepal to adopt marketing orientation.

Gupta (1999) studied the management practices of Agra Jal Sansthan water utility in India. He found that the utility provided poor services that resulted in 85% of its customer base being dissatisfied with the services and that the utility’s financial position was weak. He concluded that the financial position of the utility could be improved if the utility was managed as a commercial entity and implemented marketing techniques.

Research findings show the importance of pricing and service differentiation in management of urban water services in developing countries. What is missing to facilitate application of these concepts is a mechanism through which water utilities can use these concepts and improve water services to existing and potential customers. If such a mechanism was available, perhaps utilities could meet the twin
objectives of improving and extending water services while also being financially sustainable. The findings of recent research imply that water utilities should use approaches such as market segmentation, service and price differentiation (MSSPD), which is customer focused and market driven.

There are five competing concepts under which organisations can choose to conduct their marketing activities (Kotler, 1997):

- Production concept;
- Product concept;
- Selling/sales concept;
- Marketing concept-Target market, Customer needs, Integrated marketing and profitability; and
- Societal marketing concept.

Kotler (1997) considers the first three concepts to be of limited use in modern organisations. The marketing concept holds that the key to achieving organisational goals consists of determining the needs and wants of target markets and delivering the desired satisfaction more effectively and efficiently than competitors. It starts with a well defined market, focuses on customer needs, integrates all the activities that will affect customers, and produces profits (or financial sustainability of the utility) by satisfying customers (Kotler, 1997).

Kotler (1997) argues that in a world faced with demographic and environmental challenges, the societal marketing concept is appropriate. The societal marketing concept holds that the organisation’s task is to determine the needs, wants, and interests of target markets and to deliver the desired satisfaction more effectively and efficiently than competitors in a way that preserves or enhances the consumer’s and the society’s well-being (environment). The concept calls upon marketers to balance three considerations: company profits, consumer want satisfaction, and public interest. This concept is applicable to water utilities. For water utilities in Sub-Saharan Africa, financial sustainability such as breaking even or achieving a modest surplus rather than making huge profits would be the main consideration.
A problem that is common in many water utilities in Sub-Saharan Africa is that of inadequate capacity of the water supply infrastructure. The marketing approach to this problem is to manage demand in order to bring demand and supply into balance. Lovelock (1992) has suggested the following five strategies for managing demand:

- Product variations- offering a different type of service when demand is seasonally based;
- Modifying the timing and location of delivery rather than modifying demand for a service;
- Pricing strategies; and
- Communication efforts, where customers are informed of peak periods through signing, advertising and sales messages.

Other strategies for managing demand in the water sector include provision of more water storage and application of different management options, which can also reduce costs.

Pricing is often the first variable to be proposed for bringing demand and supply into balance. Basic economic theory suggests that for price to be effective as a demand management tool, the utility manager must have some sense of the shape and slope of the demand curve for water services. This would show how the quantity of service demanded responds to increases or decreases in the unit price.

Another aspect to note is that there may be separate demand curves for different market segments reflecting variations between segments in the demand for the service as demonstrated by willingness to pay. It is a difficult task to determine the nature of all these different demand curves. Research, trial and error, and analysis of parallel situations in other locations or in comparable services are ways of obtaining an understanding of the situation. This difficulty is considerably overcome by conducting willingness to pay studies that have been widely shown to be indicative of demand in the water sector (Whittington et al, 1987). Pricing is therefore a vital strategy in managing water demand and also in enabling water utilities achieve financial sustainability. This is more so for water utilities with infrastructure constraints, as is the case in Sub-Saharan Africa. Pricing (including demand and demand assessment) is discussed in section 2.7.
Application of marketing concepts makes such an important contribution to an organisation’s objectives and/or profits that it has now been adopted in the business sector, the non-profit sector and the global sector (Kotler, 1997). Kotler (1997) further states that marketing works only when all employees appreciate their impact on customer satisfaction, and that internal marketing must precede external marketing. This view of applying marketing to management of organisations is valid for water utilities as it makes no sense to promise excellent services before the utility’s staff are ready to provide excellent services.

In selecting service options and responding to customer demand for the options, the impact of service options on the environment should also be considered and managed in order to be sustainable. Moreover the utility’s water supply infrastructure should be capable of delivering to the customers the services promised by the utility.

Successful application of marketing to management of water services in a utility should start with the top management, who should ensure that both internal and external marketing are carried out within the overall marketing strategy. Water utilities can use the following common principle of strategic marketing (Wilson & Gilligan, 1997):

- Where are we now?
- Where do we want to be?; and
- How might we get there?

This principle will guide the research on market segmentation, service and price differentiation (MSSPD) and the application of these concepts in the urban water sector in Sub-Saharan Africa. The approach has the potential to help water utility managers meet the challenges discussed in section 2.3. As a first step in meeting these challenges, water utilities need to review their objectives. Typical objectives for a utility in Sub-Saharan Africa are presented in the following section.
2.6.5 Achieving utility objectives (Where do water utilities need to be?)

Whichever management model is adopted, urban water services should be managed in an effective, efficient and sustainable manner. A sustainable water system is that which functions well, is utilised to the full with continuing health and socio-economic benefits, and operates efficiently on at least a break-even, if not a surplus basis (WHO, 1990). The key for sustainable delivery of water services is commercial orientation, since this is what ensures sustainability.

A progressive urban water utility or municipality typically has the objective to improve service provision to all groups of customers, while meeting its financial objectives. Key objectives for utilities in Sub-Saharan Africa should include:

- To capture more of the water market, such as by extending coverage;
- To achieve equity in service provision by serving the poor, most of who are currently not served and rely on alternative sources;
- To improve customer service; and
- To improve the utility’s financial position.

These are the crucial marketing objectives for progressive water utilities in Sub-Saharan Africa, and the MSSPD approach can lead to their achievement. The key to improving the utility’s financial position and achieving overall sustainability of water services is appropriate pricing. Pricing is considered in the next section.

2.7 Pricing of urban water services

This section starts with a brief look at the role of pricing in utility management and a brief history of water pricing in Sub-Saharan Africa. Pricing policy is considered including demand, demand assessment, the contingent valuation method (CVM), use of demand in pricing, and pricing to meet the costs of provision.

2.7.1 Role of pricing in utility management and finance

Pricing of water services plays a key role in sustainable management of water services and utility operation in particular. Tariff design goals include the following:
Generating adequate and stable revenues to operate and maintain water systems,
Promoting conservation and efficient allocation of water and
Equitably allocating system costs.

Because of the mix of economic, social, and political factors shaping water tariff design, the undertaking is as much an art as a science. Despite ample evidence that tariffs can be set high enough to finance efficient water services but low enough that poor citizens can afford the water they need for basic hygiene, too often utilities in Sub-Saharan Africa charge prices that cover only a small fraction of supply costs. With inadequate income, utilities defer maintenance and repairs and are unable to extend services to unserved areas. In addition, lack of adequate income leads to deterioration of services provided to existing customers as illustrated in figure 2.1 (section 2.3.3). Usually the poorest are left unserved and thus forced to turn to alternative, more expensive, suppliers. In order to improve water services in Sub-Saharan Africa, appropriate pricing is necessary.

On a global level, there is a substantial financing shortfall across the whole water sector of both capital investment and investment for the operation and maintenance of existing infrastructure (DFID, 2001). The challenge of financial sustainability has two aspects (DFID, 2001):

- How to find enough money for capital investment to reach all the currently unserved people; and
- How to raise enough money to cover operation, maintenance and eventual replacement of existing water supply infrastructure.

There is therefore a strong case for charging realistic tariffs and for collecting revenues properly in order to finance operation and maintenance (DFID, 2001).

Evidence in other parts of the world show that pricing of water is an important aspect of utility management. In 1984, the American Waterworks Association (AWWA, cited by Grigg 1986) made a survey on the most severe constraints in the water supply industry. Out of the 24 constraints, inadequate rates were considered the most severe one, and several other cost-recovery related constraints were identified. In 1989, water supply and sewerage systems were privatised in England and Wales, and one reason
for this was that publicly owned water supply departments faced restrictions on the amount of money they could borrow for rehabilitation of existing infrastructure and financing of new investments (Mason, 2001). This shows that cost-recovery related constraints by no means concern only Sub-Saharan Africa.

2.7.2 Water pricing history in Sub-Saharan Africa

From the time they gained independence, many countries in Sub-Saharan Africa have considered water supply as a social service, which should be free or very cheap. Katko (1991) observes that before the mid-1980s, this unrealistic policy was hardly criticised and it was accepted by most of the external support agencies (ESAs). It was only in the latter part of the water decade that discussion started on the crucial issues of cost recovery and water pricing. In his study on paying for water in East Africa, Katko (1991) observed that there has been a dramatic decline of real water tariffs in Kenya and Tanzania, as in most countries in Sub-Saharan Africa ever since their independence in the 1960s. Many countries started off with a free water policy, that later changed into "cost sharing". As governments became more cash trapped, quasi-government corporations were created to manage water services on commercial basis, at least in policy if not in practice.

In most countries of Sub-Saharan Africa, water tariffs are geographically uniform and have to be decided (or approved) at cabinet level. With this arrangement, tariffs can only occasionally be adjusted, and then without adequate consideration of inflation and cost increase. Katko (1991) concluded that unless proper water pricing policies are introduced to the water supply sector, long-term sustainability would not be possible. Many countries now realise the need for appropriate pricing of water services.

As is the case elsewhere in the world, countries in Sub-Saharan Africa have often considered water to be one of the essential basic needs. The risk with the basic need approach is that the needs would be satisfied for free or at a low price. Yet this is the approach that has been taken in pricing for water in Sub-Saharan Africa. If the same approach were applied to all basic needs, huge amounts of funds would be needed. Besides, the basic need approach does not sufficiently consider demand. According to
Max-Neef (1986) "fundamental human needs are finite, few and classifiable, and they are the same in all countries and all historical periods". Max-Neef identified nine such needs to be permanence (or subsistence), protection, affection, understanding, participation, leisure, creation, identity (or meaning) and freedom. From this it follows that shelter (housing), food (including water) and clothing should not be seen as basic needs but rather as satisfiers of the fundamental human need of permanence (that is, subsistence). The policy of free water or highly subsidised water in Sub-Saharan Africa has failed. This is evidenced by the low rates of water coverage in the region.

Out of the major constraints facing the water sector in Africa as reported by WHO in 1990, pricing and in particular inadequate cost recovery framework was the most severe (Dabbagh, 1991). Funds to the sector can be increased by additional allocations to central or local government budgets, by increasing external support or by direct payments by consumers. Any increases in government budgets based on taxation are unrealistic with the prevailing economic problems facing many countries in Sub-Saharan Africa. Since official development assistance (ODA) to countries in Sub-Saharan Africa over the last decade has decreased rather than increased (UNDP 2001), direct payments by consumers seem to be the only possible alternative. This calls for appropriate pricing of water services.

2.7.3 Pricing policies

The first and primary requirement for water pricing and tariff development is that the water system is operative and sustainable. OECD (1987) mentions the following objectives of water pricing or charging:

- Allocative efficiency;
- Equity;
- Financial requirements;
- Public health;
- Environmental efficiency;
- Acceptability and understanding;
- Administrative costs;
• Energy; and
• Employment.

In practice, different tariff structures can be used to meet these objectives. Allocative efficiency means that the water services should be provided in such a way that the community’s net benefits are maximised. Ideally, this would determine both quantity and quality, and the price should reflect the incremental costs to the community of satisfying marginal demands. Such a charging system is usually known as marginal cost pricing (OECD, 1987), and is discussed further in section 2.7.9.

The equity goal in pricing is usually politically defined. Equity (or fairness) is a highly subjective concept that involves the national income distribution, which may be dependent on government policy (OECD (1987). Roth (1987) observes that “when water is sold in containers by private vendors throughout the developing world, there is no problem in charging for it: customers pay on delivery as they do for milk or fuel oil. But when water is delivered from pipes, the levying of payments creates substantial moral, political, technical and administrative problems”. Water pricing in Sub-Saharan Africa is unnecessarily politicised on the grounds of equity. The head of a household in an affluent neighbourhood along a famous beach in Mombasa, Kenya, told the author that “I am connected to the water distribution network and pay a flat rate of only KSh150/= (£1/50) per month, but the pipe is dry most of the time. You see we get almost free water from the Water Corporation (utility) but without water in the pipes. I now spend KSh8 000/= (£80/=) every month buying water from tankers”.

The concept of equity demands the use of the willingness to pay criterion that incorporates ability-to-pay. When considering an equitable system of charging for water, questions of cross-subsidisation between groups of customers or market segments by another as well as parity and equalisation are raised.

IBRD (1985) summarised the pricing objectives under four main elements:
• Efficiency;
• Social equity;
• Financial autonomy; and
• Administration.
These objectives are contradictory and therefore compromises are necessary. Yet, IBRD (1985) stated that institutional capacity is often more important than the theory surrounding tariff setting. Katko (1991) applied this approach in his study on a cost recovery model and alternative institutions in developing countries. Katko (1991) concluded that in the context of Sub-Saharan Africa, the major principles concerning tariff structures are:

- After the ambitious period from the 1960s to the 1980s, the real problems of water supply in developing countries are now admitted. Means should be sought for solving them, especially those related to cost recovery.
- In practice, “free” water policies have led to inequitable situations: often the rich get the service, whereas only the poor pay the market price for water. Instead, progressive tariffs should be used for large consumers and cross-subsidised prices for the poor.
- There is evidence that people in the poorest areas are willing and able to pay for operative water services. The problem is caused by inappropriate water pricing policies.
- Vending, reselling and bottling industries are challenges to water utilities
- Cost recovery problems are often managerial and institutional by their nature. Innovative fee collection methods and alternative institutions are needed for revenue collection in low-income areas.

Katko's (1991) conclusions suggest the need to incorporate appropriate pricing policies with institutional and management improvements, all of which are key for sustainable improvement of urban water services in Sub-Saharan Africa. This implies that development of a holistic approach such as MSSPD is necessary.

2.7.4 Pricing as part of the MSSPD approach

Pricing is a key ingredient of the market segmentation, service and price differentiation (MSSPD) approach to management of water services. A key objective for progressive water utilities is to offer feasible service options at a price that people are willing to pay and that meets the costs of provision. The rationale is to give people what is possible or viable, what they want and what they are willing to pay for. In order to meet equity considerations, pricing of water services should be at a level that
customers are able and willing to pay. This is the implication of managing water as both an economic and a social good. It is therefore necessary to determine the amount of money that people are willing to pay for improved water services, and the costs of providing those services. The key factors that should be considered in pricing of water services are therefore demand and costs of provision.

2.7.5 Demand

Conventional engineering practice has tended to ignore price-demand relationships. The terms water demand and water requirement have been used interchangeably and taken to be the quantity of water required to meet the public health requirements in a particular community or area (Brandon, 1984). Indeed, there is some misunderstanding and lack of agreement amongst practitioners in the water sector on what the term “demand” actually means. Parry-Jones (1999) states that the concept of demand means different things to the different professions involved in the sector:

- To engineers, demand is the amount of water needed to supply a given population
- To social scientists, demand is a basic need or human right (social good) that must be addressed in the context of poverty, equity and the empowerment of low income groups
- To economists, demand is the willingness-to-pay for a particular level of service.

From the economists’ viewpoint, demand is an expression of willingness to pay (WTP) for water, where water is viewed solely as a commodity, good or a service. Willingness to pay (WTP) is defined as the maximum amount that a person would be willing to pay for a service rather than do without it (Katko, 1991). The view of water as purely a social good when demand becomes the “expression of expectation of delivery of a right” (WaterAid, 2001) can not be sustained in the context of challenges in Sub-Saharan Africa. Overall, most practitioners view demand as having both economic and social components and agree that by responding to demand, projects have an increased chance of sustainability (Deverill et al 2001).

Deverill et al (2001) argues that expressed demand does not necessarily need to be backed up by a willingness to pay, but could also be backed up by any other
meaningful contribution such as time, labour or materials as a financial contribution is not the only indicator of demand. This view is not in conflict with other views on willingness to pay, since “any other meaningful contribution” can be converted into appropriate comparable monetary measure for purposes of informing investment decisions.

The definition of demand offered by Deverill et al (2001) is “an informed expression of desire for a good or service, measured by the contribution people are willing and able to make to receive and sustain it”. Although this definition captures willingness-to-pay and does not exclude other meaningful contributions that could be appropriate in individual situations, it is doubtful whether “ability to pay” can be distinguished from “willingness to pay” given that people allocate their resources in different ways. It can be argued that in practice, determination of willingness to pay (WTP) automatically incorporates ability to pay. The key issue is to obtain an indication of peoples’ demand for a given level of water service, expressed in terms of the users’ willingness to pay for it through a monetary or economic contribution. This is what Deverill et al (2001) refer to as effective demand.

The definition reflects the fact that demand is associated with people exercising a choice. Consumers weigh up their perceptions of relative costs, benefits and risks and choose accordingly. This is consistent with the utility being customer focused and market orientated.

In the context of the MSSPD approach, it is necessary to determine demand and use the results (WTP) as the basis of pricing decisions. The question that arises is how to determine the amounts that people are willing to pay for each service option. Demand assessment is considered in the next section.

2.7.6 Demand assessment

Demand needs to be assessed in order to appraise and finance projects (DFID/WELL, 1998). In order to be customer focused, we should estimate the water demand, that is, the water quantity that will be demanded, given specific price levels and other parameters. In order to assess demand, the factors determining demand should be
understood. Demand is influenced by the following factors (Webster 1998, adapted from World Bank):

- Socio-economic characteristics: household income, gender, education, occupation and assets among other local demographic characteristics.
- Characteristics of supply: the relative merits of the proposed water supply (over the existing source, particularly relating to cost, quantity and reliability)
- Households' attitudes towards government policy and the water service provider.

In these factors the ability to pay, the willingness to pay (WTP) or contribute, and perceptions of payment and contributions are captured. It is evident that the key factors that influence demand (expressed as WTP) have to do with the service provided to customers, and this implies that market segmentation, service and price differentiation could have a crucial role.

Engineers rarely consider the influence that price has on water consumption, and when they do, assume that customers are able to pay between 3% and 5% of their income to sustain a basic water service (World Bank, 1993). The ability to pay has therefore traditionally been evaluated by the criterion that households should not be obliged to pay more than five per cent of their income for water (Katko, 1991). Practitioners often wrongly assume that ability to pay determined on this basis is an indication of household's willingness to pay (WTP) for water services, and therefore a measure of demand. While this criterion is a broad guideline, it is not necessarily applicable everywhere, since it does not take local conditions into account. Research shows that income is only one of the determinants of demand (World Bank, 1993). Households allocate their resources in different ways, and it is therefore necessary to carry out surveys to determine willingness to pay by asking people themselves.

In the last two decades, different methods have been developed for assessing demand. Methods for assessment of demand can be broadly categorised into two (adapted from Webster, 1998):

- Direct methods (stated preferences): where people are actually asked what they are willing to pay or to contribute for an improved supply
- Indirect methods (revealed preferences), where consumer behaviour is predicted through other means.

The main techniques are the contingent valuation methodologies (CVM), revealed preference (RP) and a combination of various participatory techniques. Table 2.1 shows the demand assessment techniques (adapted from Parry-Jones, 1999).
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>CVM</th>
<th>RP</th>
<th>Participatory Techniques such as focus group discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methodology</td>
<td>Detailed questionnaire to establish WTP or other possible contributions for different service options. May include a customer survey to obtain other relevant customer data</td>
<td>Detailed survey of existing behaviour (e.g. associated with water vendors)</td>
<td>Group discussions and exercises with trained facilitator</td>
</tr>
<tr>
<td>Principal Purposes</td>
<td>Explicit determination of WTP or other contributions for improved services. Data can be used to select options and to set prices for each option. Other relevant customer data can also be obtained</td>
<td>Data on current use of existing systems: provides information for planners to guide future investments</td>
<td>Establish local perceptions, preferences and local solutions or coping strategies. Can inform the utility, other interested agencies and the community itself on selection and pricing of service options.</td>
</tr>
<tr>
<td>Inputs needed</td>
<td>Multidisciplinary professional input to design the questionnaire. Trained enumerators for fieldwork</td>
<td>Trained enumerators</td>
<td>Trained facilitator with participative tools and the utility engineer to provide technical and financial information on service options</td>
</tr>
<tr>
<td>Outputs provided</td>
<td>WTP and contributions for particular options and socio-economic status of respondents. Can also reveal customer preferences for service options</td>
<td>Details of existing use and functioning of services.</td>
<td>Ranking of preferred costed options can be obtained, thus giving an indication of WTP for different service options.</td>
</tr>
<tr>
<td>(specifically related to demand)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use</td>
<td>Urban (and also peri-urban) water and sanitation projects. Can also be used for rural water projects although it is more expensive due to lower population density.</td>
<td>Most often for urban and peri-urban water projects</td>
<td>Usually smaller scale rural water and sanitation projects, but this method can be adapted and used in small urban communities, such as informal settlements.</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>High cost of specialised inputs.</td>
<td>Does not establish willingness to pay (or contribute) to potential options.</td>
<td>Result can be biased, needs a very well trained facilitator and thorough knowledge of local situation.</td>
</tr>
<tr>
<td>Compatibility</td>
<td>CVM determines maximum WTP for a particular option and is theoretically difficult to match the data with the WTP for a particular option deduced through a participatory exercise. However, both CVM and participatory approaches can use RP surveys to support data. Participatory approaches can also be improved (such as by using weighted scores) to yield both collective and individual data on WTP.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following points should be noted during the determination of demand (Deverill et al 2001):

- People should be informed of the benefits, costs and risks of any proposed improvements. Any new option will inevitably be compared to one (or many) already in use. People have to be able to re-assess the relative costs, benefits and risk factors involved in the new option(s), and on the basis of this, make a decision. To do this they must be adequately informed of the costs, benefits and associated risks of what is being offered, in a way that allows a comparison to be made with the existing system.

- People must be willing and able to express their demands, both individually and collectively. In many situations, marginalised groups within communities may need to be empowered and their individual and collective capacity built before this can occur.

- A meaningful contribution (whether it is money, time, labour or materials) is one that empowers consumers. Unlike beneficiaries, consumers have rights over what is delivered and how.

These points are consistent with a customer focused water utility. Utilities wishing to assess demand can use the same study to obtain other useful information that has a much wider application than determination of willingness to pay. The information gathered could also be used to (UNDP- World Bank, 1997):

- highlight people’s perceptions of their current service, how it is delivered, satisfaction levels and the service required
- highlight gender concerns and the high costs of coping strategies for the poor
- design acceptable cost recovery systems based on household cash flow
- establish acceptable tariffs that include elements of cross subsidisation
- anticipate future demand for higher levels of service through incremental development
- establish baseline data for future monitoring

Besides using the CVM and RP demand assessment techniques to assess demand, water utilities can give potential customers information about the characteristics, advantages, disadvantages and costs of different service options and enable existing
and potential customers to make informed choices (Deverill et al 2001). Deverill et al further states that demand can be informed in the following ways:

- Explanation of each option to each household
- The use of photographs, models
- Visit to other projects
- Water ladder (this is a tool from PHAST (Participatory, Health and Sanitation Transformation)) or other participatory tools and drawings.

The emphasis is on effective communication and dialogue with existing and potential customers, and this is consistent with the MSSPD approach.

2.7.7 Contingent Valuation Method (CVM)

The contingent valuation method (CVM) is a useful method that is widely used to assess demand in the water sector. The CVM has been developed over the years as a method of evaluating households' willingness to pay for improved water services and has been tested in several developing countries, including Sub-Saharan Africa (Whittington et al, 1987; Whittington et al, 1990; Whittington et al 1991). Whittington and Swarna (1994) describe the contingent valuation method (CVM) as a survey technique that attempts to elicit information about individuals' (households') preferences for a good or service. The CVM is a direct enquiry about households' or consumers' willingness to pay or their likely reactions to price changes.

The CVM uses pre-filled questionnaires and bidding games in finding out consumers' own hypothetical estimates of their willingness to pay. Respondents in a survey are asked a question (or series of questions) about how much they value a good or service. The technique is termed "contingent" because the good or service is not necessarily going to be provided by the enumerator or researcher; the provision of the good or service is hypothetical. The contingent valuation method can be used to obtain values of pure public goods, goods with both private and public characteristics (such as various kinds of infrastructure), and private goods. The CVM is often used to assess preferences for goods or services for which a conventional market does not exist (Whittington and Swarna, 1994).
The contingent valuation method offers a direct means of estimating the economic benefits of an improved water supply. Rather than attempting to infer from behavioural information how much an individual is willing to pay for improved service, one simply asks outright how much the individual or household would be willing to pay. The CVM has the following important advantages over indirect methods (Whittington and Swarna 1994):

- It can be used to value services that are impossible to assess with indirect approaches
- Respondents' answers to willingness pay (WTP) questions are easily understood by non-economists and decision-makers

Some researchers have questioned the reliability of the results of CVM, stating that the results can only be confirmed after suggested water supplies have been implemented. For instance, Yacoob (1990) was critical that willingness to pay methodologies are imprecise as predictors of actual behaviour. Whittington et al (1987) noted that hypothetical, strategic, compliance and starting-point biases can influence the CVM. Compliance bias occurs when a respondent wants to please the interviewer. This is often called the "social desirable effect", and can be avoided or reduced by taking time to explain the intentions of the study.

There are several ways of avoiding or reducing biases such as by proper sampling of households to be interviewed. By carrying out market segmentation before embarking on WTP surveys, it can be ensured that the sample is representative of all geographical locations and market segments in the city. Representative samples of households are then interviewed by experienced researchers and trained enumerators using a comprehensive pre-tested WTP questionnaire. Priced service options are explained and respondents are requested to state the amount of money they are willing to pay for the stated service option. Willingness to pay studies yield useful results when the bidding game starts at a level that reflects what is likely to be the cost covering tariffs.
The CVM direct approach has three drawbacks (AWWA, 1980):

- The individual may not know how the household would react if offered the opportunity to use a new water system at a specified price;
- The individual may know but not tell the truth; and
- Someone must actually go out and talk to members of the community.

In both the first and second drawbacks, whether or not respondents answer WTP questions accurately is an empirical problem that can be solved during analysis of respondents’ answers. The third drawback is actually an advantage of the CVM because it forces the water utilities or their consultants to observe the current water situation and see what services people really want and are willing to pay for.

The CVM is particularly useful in the urban areas, including peri-urban areas where a water market exists. Katko (1991) states that in situations where proposed and existing levels of water service are about the same, studies on existing markets may be a sufficient basis for planning. The CVM is likely to provide good estimates for willingness to pay in situations where respondents are already knowledgeable about the proposed levels of service cited in the bidding game. In this way, respondents do not have to imagine the service levels: they already know the service levels enjoyed by some households in the city. As this is the situation in many urban areas of Sub-Saharan Africa, the CVM is an appropriate method of determining WTP for improved water services.

In the context of the MSSPD methodology, demand is expressed in terms of willingness to pay (WTP), and is obtained through effective communication and dialogue with existing and potential customers. The approach involves offering different service options to respondents according to their market segments to obtain their willingness to pay for each option. The CVM is an appropriate method of estimating the amount of money that households are willing to pay (WTP) for various services options. Within the MSSPD approach, this information (WTP) is then used to inform the utility about service options that people want, and the prices they are willing to pay for them. The next section looks at the case for using WTP data to set water tariffs.
2.7.8 Use of demand (WTP) in pricing urban water services

Although the importance of demand assessment is widely accepted as relevant in the water sector, it is rarely undertaken. In the rare cases when demand assessment is carried out, its results are rarely ever used for pricing water services. This situation is perhaps due to lack of a coherent approach in managing urban water services. The implication of the MSSPD approach is that the utility engages with existing and potential customers to determine the most practical option to meet their water requirements, and at what price. This is consistent with the recommendation based on research on paying for water in East Africa, where Katko (1991) recommended that water should be managed as both a social and an economic good. Many countries in Sub-Saharan Africa now realise that water services should be managed as both a social and an economic good and have set policies to reflect this position. For instance in Malawi, the National Water Resources Management Policy and Strategies (quoted by Hanjahanja, 2001) stipulates that “water should be managed as an economic good, particularly in urban areas, where the aim should be to achieve cost recovery for investments in the sector”.

An important objective of pricing is therefore cost recovery in order for the utility to achieve financial sustainability. Responding to demand can provide significant opportunities for utilities to meet their objectives and approach full cost recovery. The economic theory that justifies cost based water pricing is summarised in section 2.7.9.

Analysis of the results of the willingness to pay studies can reveal the amounts that existing and potential customers are willing to pay for improved water services. A simple frequency distribution curve of households' willingness to pay bids for improved water services, obtained from a contingent valuation survey, can be used to support management decision-making and pricing. Focus group discussions can also be conducted in respective market segments (such as in informal settlements) to confirm the results of the willingness to pay studies. The results of willingness to pay (WTP) studies can then be used to develop the tariff policy.

The rationale is that demand should inform investment decisions and the design of the services, with prices being set to reflect the costs of provision while taking the WTP
for each segment into account. Through an interactive process, the prices for respective service level or option in each market segment are matched with the WTP for respective market segment, while ensuring that the utility is able to meet the costs of provision and therefore remain financially sustainable. In this context, the MSSPD methodology may be viewed as an approach that attempts to respond to a clearly expressed demand for a service (demonstrated by a willingness to pay for a selected level of service), and in a manner that leads to financial sustainability for the utility.

By considering water to be both an economic and a social good, social equity considerations might make it necessary to apply cross subsidies between market segments while pricing water services. It is however important to assess demand before considering introducing a subsidy even in low-income areas. Where found necessary due to social equity considerations, cross subsidies can be built in the tariff design in such a way that the more affluent segments of the city subsidise the less affluent. It should be noted however that it might be difficult to sustain subsidies in some cities because of the large number of low-income customers compared to the more affluent. It is therefore more prudent to provide each respective market segments with services whose prices are within households' willingness to pay (WTP). In Sub-Saharan Africa, the need for customers to fund recurrent costs and a substantial proportion of capital and replacement costs is necessitated by the reality. The use of demand (WTP) to inform the tariff policy within the MSSPD approach enables a water utility to meet equity objectives. This approach is useful for Sub-Saharan Africa. The next section looks at pricing to meet the costs of service provision.

2.7.9 Pricing to meet the costs of service provision

The underlying causes of poor cost recovery include:

- Poor services (caused by inefficiency in utility management among other reasons);
- Political will (interference, but now changing);
- Inefficient revenue collection system (due to lack of customer focus); and
- Absence of or inappropriate pricing or tariff policy.
Appropriate pricing is necessary in order to raise finance to meet operations and maintenance (O & M) expenses and for investment in new infrastructure. The problems of poor cost recovery, lack of funds for O & M and low levels of service (illustrated in figure 2.1 section 2.3.3) can partly be addressed through cost based pricing and effective revenue collection. It is important to consider the life cycle costs of water services (including O&M costs) in order to achieve financial sustainability and hence continued provision of services.

In order for water services to be provided in a financially sustainable manner, utilities should be committed to setting tariff structures that fully cover the costs of efficiently managed water operations. Setting prices to recover costs of provision is important because (Barker 1997):

- It provides the potential pool of resources for maintaining and extending the coverage of the service. Therefore it promotes the ideas of sustainability and replicability.
- It reinforces the message that water provision is a costly activity and that water conservation is an important resource aim.

Actual tariffs will vary with local conditions, but the operating, conservation, and equity goals should all be addressed. An important criterion in setting tariffs is to match service options with tariffs so that the water prices are set to meet the cost of water provision. A key objective of pricing is therefore to meet the costs of provision as a way of achieving financial sustainability.

There is widespread acceptance across the water sector that water prices should be set to be at least equal to the marginal cost of provision, if water is to be provided efficiently. This is based on the economic efficient allocation of water. The efficiency case for cost based water pricing is based on economic theory. The next section looks at the theory of economic efficient allocation of water.
Economic efficient allocation of water

A commodity or resource is economically scarce when it is not free, when money or some other scarce commodity has to be given up to obtain it. Therefore, scarcity gives rise to price. In any economy it is the scarce resources that are the limiting factors or constraints on development. Whether or not actual money prices are used, the concepts of supply and demand are fundamental to all of economics. The relationship between the price of a commodity and the quantity demanded is described by the demand curve. The demand curve is based on the idea that the lower the price of a good or service, the more consumers will be willing to buy. In general, when the price of a commodity falls, people will purchase more of it and vice versa. In economics, consumers' willingness to pay (WTP) means the maximum amount that a person would be willing to pay for a service rather than do without it (Barker, 1999).

There is widespread agreement between economists that a prerequisite of efficient water allocation is that the price charged for water should cover its marginal cost of production (Barker, 1997). The explanation for this requirement is that the demand curve for water (DD in figure 2.4) which shows the relationship between the quantity of water demanded and price charged can also be interpreted as the marginal benefit (MB) of successive increments of water consumption. Figure 2.4 illustrate graphically the demand curve for water (that equals the marginal benefit) and the concepts of marginal cost (MC). The demand curve shows the maximum sum of money that would be paid for each cubic meter (Barker, 1997).
The marginal cost (MC) of water is the addition to the total cost of the utility caused by producing one extra cubic meter. Barker (1997) states that the marginal cost curve shows in money terms the value of society’s resources used up in water production. Figure 2.4 illustrates that the optimal output of water is at $Q_0$ where the curves (MC and MB) intersect. This is an optimum because to the left of this point, marginal benefit (MB) from production and consumption is greater than the incremental costs used in the production of water. Hence on the units of water $OQ_0$ a net benefit is earned and this adds to society’s welfare.

At outputs greater than $OQ_0$ a net cost is incurred because MC is greater than MB. These considerations determine $OQ_0$ to be an optimal output and this amount can be sold at a maximum price of $OP_0$, which is the optimal price. Such thinking is the basis for the rule that price should be equal to marginal cost if outputs (water in this case) are to be produced efficiently. The rule has been widely adopted by international
lending agencies and its application in water pricing is often a condition of loans (Barker, 1997). Pricing water on the basis of costs of provision ensures that the customer gets the right message that water is an expensive commodity to provide. Price tied to amount consumed encourages conservation and discourages waste. It encourages economical use because waste has to be paid for. This is the basis of metering in order to bill customers on the basis of actual consumption.

Katko (1991) found that in Finland and some other OECD countries, water and sewerage charges tend to control water use and reduce wastage of water. He reported that introduction of sewage charges in Finland in 1974 resulted in a decrease in the average water consumption per capita up to 1984, in spite of the economic growth. He also found that the effect of price on water consumption was related to housing type and metering practices in Finland. The average water consumption decreased where individual meters and more recognisable water bills were introduced. The author's experience in managing water services in Mombasa confirms the relevance of Katko's (1991) findings to the situation in Sub-Saharan Africa.

Marginal cost pricing can be applied when demand is expanding, present facilities are fully used and new facilities are being installed (United Nations, 1980). In such a case the long-run marginal cost can be recommended as the price. This is the case in many countries of Sub-Saharan Africa.

Marginal cost pricing is the optimum method of setting tariffs, from the efficiency point of view. Marginal cost pricing however involves several application difficulties, and is difficult to apply in practice mainly for two reasons (Barker, 1999):

- The marginal cost price should be changed continuously according to production, and this is administratively very difficult; and
- Water supply investments are usually lumpy.

**Average incremental cost**

One special feature in the water sector is that it is typically capital intensive. It is difficult to calculate MC for urban water services because investments are not made in small increments but in large often, indivisible investments. To overcome the
constraints of marginal cost pricing, the concept of Average Incremental Cost (AIC) was introduced (United Nations 1981, IBRD 1985, WHO 1990). It is assumed that the Average Incremental Cost (AIC) equals Marginal Costs (IBRD 1985, WHO 1990). Barker (1997) agrees that the Average Incremental Cost (AIC) is an accepted approximation to Marginal Cost (MC). The AIC is a forward looking concept defined as the sum of the costs associated with the investment expressed in present value terms, divided by the incremental output of the investment again expressed in present value terms. The AIC is calculated by dividing the incremental costs of a project by the incremental water sales of the same project (Barker 1997, Franceys 1998).

Average Incremental Cost (AIC) = \( \frac{\text{Incremental cost}}{\text{Incremental water sales}} \)

The cost and sales over the economic life of the project are discounted by applying the present value method.

\[ \text{AIC} = \frac{\text{PV of costs}}{\text{PV of output}} \]

In effect this formulation treats output as a proxy or indicator of benefit.

Barker (1997) observes that setting price equal to MC in a constant cost industry will recover costs of provision. If costs are correctly defined to include normal profit and an allowance for maintenance expenditures, pricing water at MC will ensure that the total revenue of the utility will cover total costs of provision. This is because average revenue is the same statistic as price and the product of price and quantity is total revenue. In a constant cost industry, average cost and marginal cost (MC) are equal and multiplying average cost by quantity yields total cost. In summary,

\[ \text{AC} = \text{MC} \] in a constant cost industry, so \( P = MC = AC \) and

\[ AC \times Q = TC, \text{ Also } P (=AC) \times Q = TR. \]

Thus \( TR = TC \), and so the utility covers its costs with marginal cost pricing.

It can also be shown that in an increasing cost industry where long run average costs increase as output expands, setting price equal to MC generates surplus profit. In practice, therefore, cost covering average water prices (average tariff) should be set equal to AIC.

**Cost concepts**

If prices are to be set to recover costs of provision, it is important that all costs are identified and contained to appropriate levels. This is more so in developing countries. The economic cost of supplied water means the benefits foregone elsewhere in the
economy by using scarce resources for a given purpose. Economic cost has three components (IBRD, 1985):

- The cost of water itself;
- The investment cost; and
- The operation cost.

Together the three components are commonly referred to as the total costs. The first cubic metre is very expensive to produce, after which total costs increase only slowly. Costs will rise faster as production approaches capacity (IBRD, 1985).

Total costs = cost of water itself + capital cost + recurrent cost

The cost of water consists of drawing related charges, and this is particularly important with increasing scarcity of water resources. Where applicable and depending on the service options, water charges should take into account sewerage, effluent treatment and other environmental aspects of water use. Thus all the social and environmental costs of the water supply service should be included in the price.

Capital costs include interest and depreciation. Capital costs depend on the interest rate required and the assumptions related to depreciation, such as economic life time and depreciation method.

The average cost is determined by the total costs divided by production. Average cost starts at a very high level and falls rapidly with increasing volume. It is at a minimum at the optimum production level. With higher production the average cost rises again (IBRD, 1985).

Average cost = Total cost/water production

It is necessary to identify and consider all costs of provision while setting water prices (tariffs). The next section looks at tariff structures.

2.7.10 Tariff structures

The result of developing pricing policies is production of a tariff structure that is then used for billing customers. The utility’s financial objectives and the projected costs of service provision ought to be the main determinants of the criteria for tariff design.
practice, however, setting and implementation of water tariffs is often a highly contentious issue in most countries. Box 2.3 summarises the principal objectives of tariff design.

BOX 2.3: Objectives of tariff design

<table>
<thead>
<tr>
<th>Tariff design should have five principal objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adequate</strong>: The tariff should produce a level of financial resources, which will enable the utility to meet its financial commitments with sufficient contribution towards future investment.</td>
</tr>
<tr>
<td><strong>Conserving</strong>: The tariff structure should influence consumption in such a way that customers are able to purchase enough water to meet their needs without being wasteful.</td>
</tr>
<tr>
<td><strong>Fair</strong>: Though the average tariff should be adequate for the utility to achieve financial sustainability, the required level of revenue should be allocated between customer groups (market segments) in a fair and equitable manner having particular regard to the needs of the poorer members of the community.</td>
</tr>
<tr>
<td><strong>Simple</strong>: The tariff structure should be simple for the utility to administer and easy for customers to understand. Customers usually display greater willingness to pay and sustain payment of water bills when they understand the bills.</td>
</tr>
<tr>
<td><strong>Enforceable</strong>: The utility should be able to enforce the tariff through viable sanctions such as court action and disconnections for non-payment of water bills. Tariffs that can not be enforced are unlikely to be sustainable in the long run.</td>
</tr>
</tbody>
</table>


Tariff design can be based on several objectives such as those shown above, many of which are often contradictory. Tariff design will often require that compromises be made. In the past, the equity criterion was overemphasised while the efficiency criterion was not considered. This is however changing.

**Adequacy of Tariffs**

There is increasing consensus that for tariffs to be adequate, they should reflect the cost of providing the additional (incremental) services required to meet the increased demand as population grows, rather than refer to existing or historical costs. Thus the consumer is informed of the true costs of providing the additional services and through adjustments to their consumption, can indicate their willingness to consume at that rate. As the cheapest nearby water sources are the first to be used, the marginal cost price will normally be higher than the price based on historical costs.
For instance, in order for a water utility to break even and meet future investment requirements, the average tariff should be set equal to the Average Incremental Cost (AIC). The AIC sets the tariff equal to the average cost of producing water from the most recent or the next most feasible investment, which will usually be more expensive in real terms.

**Equity criterion and water metering**

The equity criterion can be met by using cross-subsidised minimum block consumption and increasing block rates for higher consumption. In addition, a volume-based tariff with some fixed charges can be used. Water metering can enhance equity.

Water metering plays a key role in tariff design and is an important aspect of pricing policy. Without metering, volumetric tariffs cannot be used, taking away the economic incentive for water conservation. It should be noted that metering, meter reading and maintenance of meters can be costly compared to the value of water consumed. Where consumption is metered, some governments try to protect the poor by directing utilities to charge an extremely low, subsidised rate for a "lifeline" consumption volume. Katko (1991) states that in practice the subsidised volume often far transcends the 20 litres per capita per day that is often assumed to meet bare minimum subsistence drinking, cooking, and hygiene needs. As lifeline allowances rise, so does the subsidy inherent in the tariff structure. Whether compensated through cross-subsidies or direct government payments, this approach removes the incentive to serve the poor or, because government fails to make the subsidy payment, leads to revenue shortfalls and deteriorating service. Moreover, if highly subsidised services are provided, only a few people will receive the service (Katko 1991).

**Fair tariffs: Service and price differentiation**

A crucial issue in tariff design is to match service options with the tariff structure, which is an effective method of achieving several criteria such as fairness while keeping the tariffs adequate. Other factors such as customers' willingness to pay (WTP) should be taken into account to ensure that tariffs are practical.
Tariffs can be lower to small domestic water users, but water should not be free for any customer group except for emergency cases such as fire fighting. This is especially important in Sub-Saharan Africa where high and middle-income consumers constitute a minor proportion of the revenue base, the majority being low-income customers. In order for water services to be provided in a financially sustainable manner, utilities should be committed to setting tariff structures that fully cover the costs of efficiently managed water operations.

Tariffs can be designed using the principles of flat rate, declining block rate and increasing block rate. For instance, both the equity and efficiency criteria can be met by using cross-subsidised minimum block consumption and increasing block rates for higher consumption. In addition to volume-based tariffs, fixed charges can also be used. Actual tariffs will vary with local conditions, but the operating, conservation, and equity goals should all be addressed.

Acceptability of tariffs
It is important that the water charges contained in the tariff structure are acceptable to customers. Besides levels of tariffs, a complicated tariff structure might not be acceptable to customers. Where the tariff structure is complicated for whatever reason, education of the public and social marketing should be considered. It is important that decision-makers accept and understand the need for the proposed system of water charges. Education or public relations might also alleviate this problem, which is often political in nature.

Methods of charging for water
There are several methods of charging for water. The charging systems employed should not cause too high administrative costs. This means that the tariff structure should be appropriately simple and should encourage efficiency. In addition, the administrative costs of revenue collection must not be too high.

Water charges are either volume or non-volume based, the former often based on metered consumption. Where meters have either not been installed or are not in working condition, flat rates are commonly used. Flat rates are particularly applicable to small (low consumption) customers.
Water use can also be estimated by rental value, water using fixtures or various consumption units. In the context of Sub-Saharan Africa, it is not feasible to base water charges on rental value since most dwellings are not valued.

The most common charges for water supply include consumption charges, meter charges, fixed charges, connection charges and service charges. Where applicable, charges for sewerage include effluent treatment charges, fixed charges, connection charges and service charges. Sewerage charges are normally based on the metered or estimated water consumption.

2.8 Chapter summary

This chapter focuses on the literature on management of urban water services. In particular, the chapter gives an overview of management of urban water services in Sub-Saharan Africa. The chapter has revealed several issues that build up the background to the research problem, and provide the theoretical basis and justification for the research.

The problem of financing and managing urban water services in Sub-Saharan Africa is critical. The literature review has exposed existing problems of poor cost recovery, lack of funds for O & M, low levels of service and low service coverage. The key technical problem in the sector was identified as that of low coverage and inadequate service provision to those already served. In addition to this, the urban population is rising rapidly. The problem in the African urban water sector is particularly big considering that the population is projected to rise by 70% to 501 million by 2015 (WHO/UNICEF, 2000). The levels of poverty in the region are high. In these circumstances, there is need for innovative approaches to cope with the rising water requirements.

The underlying institutional problems include deficiencies in public sector management, and these are being resolved through reforms of the water sector. The institutional instruments to address the institutional problem include various forms of
private sector participation (PSP), and these were reviewed. The literature on managing urban water services in Sub-Saharan Africa assumes that institutional reforms consisting primarily of private sector participation, decentralisation and community management will be sufficient to achieve sustainable solutions. The literature on the latest situation in Sub-Saharan Africa show that these institutional reforms and other efforts are far from meeting the existing challenges in the region. It is evident that to meet the increasing challenge of providing water services to the growing number of unserved people in urban areas, (and in a financially sustainable manner), require more innovative and holistic approaches.

Improvements in management of water services in Sub-Saharan Africa should focus on increasing the number of people who receive water services and on ensuring that the existing services are improved, with the utility achieving its financial objectives. To substantially improve urban water services in Sub-Saharan African is a substantial challenge that calls for change in management approaches. Irrespective of which institution (public or private) is the water utility, there is need to develop practical methodologies to address the problems of low coverage and inadequate service provision, in a holistic and financially sustainable manner. To improve services to existing customers and extend service coverage to un-served areas requires a framework or methodology that creates transparency and security for both the investors (such as water utilities and other water providing enterprises) and customers. This is difficult in low-income countries such as Sub-Saharan Africa, and both practical and flexible tools are required to enable utility managers to do so. This is the knowledge gap that this research hopes to contribute to.

In particular, there is need to develop a practical and flexible methodology that water utilities can use to structure service delivery and serve more customers in a financially viable manner. Such a methodology can help increase service coverage to unserved areas and reduce the increasing gap in service coverage. Economic and marketing theory offers a practical methodology that can be adapted for use in the urban water sector. Economic and marketing theory show that with appropriate pricing, a practical and flexible approach consisting of market segmentation, service and price differentiation has the potential to improve urban water services to existing and potential customers in a financially sustainable manner.
The key advantage of this approach is that through market segmentation, water utilities can target different appropriately priced service options to customers in different market segments and thus meet the needs of all customers in a financially sustainable manner. To implement this approach, water utilities would carry out market segmentation of their customer base then provide different service levels to different segments of the market according to demand (service differentiation) while pricing the different services appropriately. The purpose of this research is to investigate application of this approach in the context of the urban water sector in Sub-Saharan Africa.

2.8.1 The research

The literature review has identified the need for practical methodologies to address the problems of low coverage and inadequate service provision, in a holistic and financially sustainable manner. A practical and flexible approach consisting of market segmentation, service and price differentiation (MSSPD) has been proposed as having the potential to improve urban water services to existing and potential customers in a financially sustainable manner. The MSSPD approach is based on economic and marketing theory and adapted to suit the urban water sector in Sub-Saharan Africa. This research aims to investigate how an urban water utility could make use of market segmentation to facilitate service and price differentiation of water services, and thus meet the water requirements of existing and potential customers in a financially sustainable manner.

In particular, the research seeks to explore the possible application of the MSSPD methodology in management of urban water services in Sub-Saharan Africa, with the objective of meeting customer requirements in a financially sustainable manner.

The next chapter states the research problem and looks at the appropriate research methodology to be used for this research.
CHAPTER 3: Research Design and Methodology

3.1 Chapter outline
This chapter provides the methodological approach adopted during the research. The objectives of the research, the guiding hypothesis and research questions are stated. A methodology appropriate to the needs of the stated research questions is selected. The overall research design, process of field research and analytical framework for data are described and explained. The sources of data and the rationale for data collection and analysis are provided.

3.2 Research title and objectives

The title of the research is “Management of urban water services through market segmentation, service and price differentiation: Findings from Sub-Saharan Africa.” The research is designed to help water utilities in Sub-Saharan Africa achieve the twin objectives of improving urban water services while also achieving financial sustainability. The proposed method is to categorise customers into segments and provision of different appropriately priced levels of service that correspond to the water requirements of respective customer segments, taking into account their willingness to pay.

The central focus of the research is to investigate how urban water services in Sub-Saharan Africa could be improved by following a systematic and flexible approach consisting of market segmentation, service differentiation and appropriate pricing. The aim of this approach is to provide improved water services to all customer groups, including the poor, and enable the utilities achieve financial sustainability. A key aspect of the research is the structuring of service delivery to provide water at appropriate service levels through feasible service options that meet the different needs of existing and potential customers (including low-income groups) at a price that they are willing to pay.

2 “Achieving financial sustainability” in the thesis is taken to mean that the water utility has met its financial objectives such as meeting the full costs of providing services.
The study will therefore seek to group existing and potential customers into segments, develop a menu of service options with costs, and then find out the service options that customers (in each segment) want and are willing to pay for. The projected costs for providing the services will be compared with projected revenues to find out whether the utility can achieve financial sustainability.

The study will advance knowledge about management of urban water services in the context of Sub-Saharan Africa. It will provide an understanding of a methodology that urban water utilities could use to structure their service provision with their pricing policy in order to meet the water requirements of existing and potential customers while achieving financial sustainability. A focused study on the proposed approach would inform the wider sector debate on how to balance social and economic (commercial) objectives in the management of urban water services in developing countries.

3.3 Research hypothesis

The research hypothesis is that within similar representative conditions of this study, market segmentation, service and price differentiation is an appropriate strategy that urban water utilities in Sub-Saharan Africa could use to improve water services to existing and potential customers, and achieve financial sustainability.

3.4 Research questions

The research is seeking to answer the following key question:

“Could market segmentation, service and price differentiation enable urban water utilities in Sub-Saharan Africa improve water services to existing and potential customers in a financially viable manner?”

In order to comprehensively address this key research question, answers to the following subsidiary questions are sought:

1. What is the existing situation with regard to management of urban water services in Sub-Saharan Africa?
2. Are existing and potential customers in Sub-Saharan African cities satisfied with the existing water services?
3. How can water utilities carry out market segmentation, service and price differentiation of urban water services?
4. What is the perception of stakeholders (such as utility managers and customers) to market segmentation, service and price differentiation of urban water services?
5. Are existing and potential customers living in Sub-Saharan African cities willing to pay (WTP) for differentiated water services if marketed by the water utility at different prices?
6. Can urban water utilities in Sub-Saharan Africa meet the costs of providing differentiated water services with prices set taking into account the customers' willingness to pay levels?

3.5 Research design

Thorpe (2000) describes research as "a careful search, a systematic investigation towards increasing the sum of knowledge". In the context of academic environment, research is a process of enquiry or examination designed to discover information or relationships. Graham (2000) states that all research is influenced by its environment and is historic (as it is impossible to collect and analyse data simultaneously).

In the context of research, design means the overall configuration of the research. The kind of evidence to be gathered, the source and how it is interpreted in order to satisfy the research objectives are key consideration in research design. "Knowledge can help to recognise which designs will work and which will not and to adapt designs according to the constraints of different subjects or knowledge structures" (Easterby-Smith, et al 1999).

Easterby-Smith et al (1999) identified five design choices that Graham (2000) summarised as key considerations in any research design:

- Degree of involvement: is the researcher independent or involved?
- Size: will the research involve large samples or small numbers?
- Research approach: will the research attempt to test existing theories or will it aim to generate new theories?
- Research style: will the research be based upon experimental or fieldwork methods?
- Induction: will the research attempt to verify or falsify?

Easterby-Smith et al (1999) discusses the above issues in the context of management research and states that since "time and resources are usually very limited in research, it is important for researchers to be prepared to make choices and thereby provide a clear focus to their efforts". It is concluded that whatever research design or approach is selected, it must be appropriate to the nature of the study, both in terms of theoretical positions and the subject under investigation. They recommend the following possible criteria for choice of research design:
- Personal preference of the researchers (as regards philosophical viewpoint)
- Aims or context of the research to be carried out
- Whether the research will stand up to outside scrutiny: technical issues relating to sampling, validity, reliability and generalisability.

The extent to which the basic subject material in a discipline is quantified exerts a considerable influence on the preference of researchers for more positivist or phenomenological methods. Easterby-Smith et al (1999) summarise some of the differences from positivist and phenomenological viewpoints in table 3.1 below:
Table 3.1: Questions of reliability, validity and generalisability in research design

<table>
<thead>
<tr>
<th></th>
<th>Positivist viewpoint</th>
<th>Phenomenological viewpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Validity</strong></td>
<td>Does an instrument measure what it is supposed to measure?</td>
<td>Has the researcher gained full access to the knowledge and meanings of informants?</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>Will the measure yield the same results on different occasions (assuming no real change in what is to be measured)?</td>
<td>Will different researchers make similar observations on different occasions?</td>
</tr>
<tr>
<td><strong>Generalisability</strong></td>
<td>What is the probability that patterns observed in a sample will also be present in the wider population from which the sample is drawn?</td>
<td>How likely is it that ideas and theories generated in one setting will also apply in other settings?</td>
</tr>
</tbody>
</table>

Source: Easterby-Smith et al (1999)

Clearly, the researcher needs to consider the above issues as part of research design. Easterby-Smith et al (1999) consider research designs to be about organising research activity, including the collection of data, in ways that are most likely to achieve the research aims. Morgan and Smircich (1980) support this view when they state that “the appropriateness of a research approach derives from the nature of the social phenomena to be explored”.

Research design is considered by some as an action plan to reach from the initial set of questions to be answered, to the conclusions (answers) about these questions (Yin, 1984). Others consider research design to be a logical model of proof that allows the investigator to draw logical inferences concerning causal relations among the variables under investigation (Nachmias and Nachmias, 1992).

Another way of thinking about a research design is as a “blueprint” of research, dealing with at least four problems (Philliber et al, 1980), as quoted by Yin (1984):

- What questions to study;
- What data are relevant;
- What data to collect; and
- How to analyse the results.
This approach is supported by Remenyi. et al (1998) when they state that research methodology is essentially the procedural framework within which the research is conducted. The framework for conducting the research is developed by looking at the key research question.

The research question (stated in section 3.4 above) directs the researcher to investigate management aspects of urban water services with special regard to improvement in water services to existing and potential customers and achievement of financial sustainability by the water utility. The investigation should include a review of key issues involved in management of urban water services and the extent to which the needs of existing and potential customers in Sub-Saharan Africa are met.

The selection of the research methodology should be based on the suitability of the research method in relation to the research question. There are many research methods cited in various texts on research design. Hakim (1987 & 2000) has stated the main methods as experiments, surveys, histories and the analysis of archival information. Graham (2000) supports this in his analysis of theory of research, drawing upon the works of Easterby-Smith et al (1994) and Wass et al (1994). Graham has stated established methods for testing theories as the conducting of experiments, surveys, historical analysis and case studies.

The main advantages and disadvantages of various research methods or strategies have been covered in literature (Nachmias 1992), and as such these are not repeated here. Yin (1984) has provided guidance on when to use each research strategy, noting that different research methods have advantages and disadvantages depending on the following three conditions:

- The type or nature of the research question;
- The extent of control the investigator has over actual behavioural events; and
- The degree of focus on contemporary as opposed to historical events.

Yin (1984) discussed each of these conditions and provided a summary showing how each is relevant to the five main research strategies. The table is reproduced as table 3.2 below.
Table 3.2: Relevant situations for different research strategies

<table>
<thead>
<tr>
<th>Research Strategy</th>
<th>Form of research question</th>
<th>Require control over behavioural events?</th>
<th>Focus on contemporary events?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Experiment</td>
<td>how, why</td>
<td>Yes</td>
<td>yes</td>
</tr>
<tr>
<td>2) Survey</td>
<td>who, what, where, how many, how much</td>
<td>No</td>
<td>yes</td>
</tr>
<tr>
<td>3) Archival analysis</td>
<td>who, what, where, how many, how much</td>
<td>No</td>
<td>yes/no</td>
</tr>
<tr>
<td>4) History</td>
<td>how, why</td>
<td>No</td>
<td>no</td>
</tr>
<tr>
<td>5) Case study</td>
<td>how, why</td>
<td>No</td>
<td>yes</td>
</tr>
</tbody>
</table>

Source: Yin, 1994

Yin (1984) notes that different strategies are not mutually exclusive and variations within one strategy may occur. There are situations in which two strategies are relevant. A common situation in management research is the use of more than one strategy in any given study. An example is the use of a survey within a case study or a case study within a survey. Another such variation in experimental strategies is the quasi-experimental approach. This approach refers to situations where researchers using the “experiment” research strategy cannot manipulate the variable but the logic of the experiment design can be followed (Campbell and Stanley, 1966, and Cook and Campbell, 1979) as quoted by Yin (1984).

Both historic analysis and case studies deal with context and phenomenon simultaneously. The main difference between historical analysis and the case study method is that history is non-contemporary while a case study is contemporary. The word “contemporary” in itself is not sufficiently well defined, but for the purposes of research can be taken to mean, “having access to living sources”. Therefore, non-contemporary is an appropriate description of a phenomenon that has only dead sources. In this research the situation under study is of contemporary nature. The research is about phenomena occurring in the present or having occurred in the recent
past but with a link to the present. Consideration of column four (4) in the above table guides that the “history” strategy is not applicable in this research.

Experiments require control over contemporary events whilst surveys do not. The experiment method deliberately divorces a phenomenon from the circumstances that are relevant to that phenomenon, that is its context, in order to be able to focus on a particular variable. In this research, the phenomena under study, like many social phenomena, involve many variables, some of which may not even be identified. It is not possible to control the phenomena under study, unlike the laboratory situation. Consideration of column three (3) in the above table guides that the “experiment” strategy is also not feasible for this research.

Surveys attempt to deal with both phenomenon and context. However, the number of variables in any survey is limited by the size of the survey sample and thus the ability to investigate context is also limited. The main emphasis of the key research question is on aspects of methodology, which is “how” and not on aspects of quantity or “how much”. Furthermore, the phenomenon of service differentiation is not frequently occurring and little is known about it in the context of management of urban water services. As such, the above table indicates that a case study might be more appropriate as compared to the survey method.

With the above considerations, the case study comes out as the most appropriate research strategy for the key research question under investigation. The type of research question under investigation in this research is one that can benefit from the use of a survey within a case study (Yin 1994). It was therefore decided that survey techniques are also to be used within the framework of case study research, to collect and analyse preliminary data and thus enable a focused and detailed study. This is in accordance with the requirements for academic research that emphasise rigour.

3.5.1 The overall research design: Case study method of research

Due to the uniqueness of the phenomena and depth of study required, the overall research design selected for this research is a case study. Kumar (1999) has described the case study method as an approach to studying a social phenomenon through
analysis of an individual case. All data relevant to the case is gathered and organised in terms of the case. It provides an opportunity for the intensive analysis of many specific details often overlooked by other research methods.

Remenyi et al (1998) agrees with this view and states that the case study “provides a rich multi-dimensional picture of the situation being studied. The case study can illustrate relationships, corporate-political issues and other patterns of influence in the particular context being researched.”

Yin (1984) defined case study research as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used”. From a research strategy point of view, the case study is particularly valuable in answering who, why and how questions in management research (Remenyi et al 1998).

According to Yin (1984), “the case study enquiry copes with the technically distinctive situation in which there are often more variables of interest than data points and one result relies on multiple sources of evidence. The need for data to converge in a triangulation fashion guides data collection and analysis, as another result benefits from the prior development of theoretical propositions.” These views on case study method of research are relevant to the research question under investigation.

It is evident from this description of case study research that emphasis on the study of the contemporary situations and uncontrollable variables has brought the case study and quasi-experimentation approaches close together. The choice of the research method for this study can therefore be described as case study with the logic of quasi-experimentation, with survey techniques applied within the case study.

The research design for the case study comprises of five important components (Yin 1994):
1. Study question;
2. Its propositions;
3. Its unit of analysis;
4. The logic linking the data to the propositions; and
5. The criteria of interpreting the findings.

The first component (research question) is important for selection of research strategy. The key research question is essentially about "how" water utilities can improve urban water services to existing and potential customers in a financially viable manner. This study question directs the researcher to select a case study as the most relevant research strategy to be used.

The study proposition is necessary to help identify the relevant information. The more a study contains specific propositions, the more it will stay within feasible limits (Yin 1994). The study proposition directs attention to something that should be examined within the scope of the study. In order to direct the research to move in the right direction, the key research question was broken down into subsidiary questions or propositions. Apart from directing research in the right direction, the propositions also directs the researcher where to look for relevant evidence. This consideration informed the selection of Durban and Mombasa water utilities as case studies.

Selection of case study location is important because the case study approach rests on the assumption that the case being studied is typical of cases of a certain type, so that through intensive analysis, generalisations may be made that will be applicable to other cases of the same type. Both Durban and Mombasa are urban areas in the region being studied, and their selection meets the two considerations.

Yin (1984) states that the definition of the unit of analysis (and therefore of the case) is related to the way the key research question has been defined. Using this guide, it follows that the unit of analysis (and therefore the case) in this research is the water utilities in Durban and Mombasa.

The last two components, linking data to the propositions and criteria for interpreting the findings, represent the data analysis steps in case study research. Yin (1984) states that the current state of the art does not provide detailed guidance on these two components. He states that research design should however indicate what is to be
done after the data has been collected as indicated by the logic linking the data to the propositions and the criteria for interpreting the findings.

3.5.2 Maximising validity and reliability

The key consideration in any research method is objectivity, which can be divided into two components: reliability and validity (Kirk and Miller, 1989) as quoted by Sohail (1997). Reliability is the extent to which a measurement procedure yields the same answer however and whenever it is carried out. The validity is the extent to which a measurement procedure gives the "correct" answer.

As Kirk and Miller (1989) point out, the language of validity and reliability was originally developed for use in quantitative social science, and many procedures have been devised for assessing different facets of each. Easterby-Smith et al (1999) state that "there has been reluctance to apply these ideas to phenomenological, and social constructionist research because they might imply acceptance of one absolute (positivist) reality". However, it is important to note that a credible research design is one that attempts to maximise both validity and reliability (Bickman and Rog, 1998).

The following four types of validity are commonly referred to in research (Cook and Campbell, 1979):

1. **Internal validity**: the extent to which causal conclusions can be made,
2. **External validity**: the extent to which generalisations can be inferred from the data and local context to wider populations and settings,
3. **Construct validity**: the extent to which the constructs in the conceptual framework can be successfully measured in the research and
4. **Statistical conclusion validity**: the extent to which the research has used design and statistical methods appropriately to detect the effects that are present.

Although all types of validity are important when undertaking management research, the relative emphases may vary depending on the type of question being studied. For instance, researchers undertaking impact studies will be more concerned with establishing causal relationships (that is, internal and statistical conclusion validity) than on the transferability of the effect to other locations. More descriptive research
questions, which require the development of a comprehensive picture of a phenomenon (as in this research), will place greater emphasis on external and construct validity than on internal and statistical conclusion validity.

Yin (1984) has described the concepts of construct validity, internal validity, external validity and reliability as they apply to a case study. He has further identified several tactics for dealing with validity and reliability in the context of case study method of research, and these are presented in table 3.3 below.

Table 3.3: Case study tactics for research design tests

<table>
<thead>
<tr>
<th>Tests</th>
<th>Case study tactic</th>
<th>Phase of research in which tactic occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct validity</td>
<td>• Use multiple sources of evidence</td>
<td>• Data collection</td>
</tr>
<tr>
<td></td>
<td>• Establish chain of evidence</td>
<td>• Data collection</td>
</tr>
<tr>
<td></td>
<td>• Have key informants review draft case study report</td>
<td>• Composition</td>
</tr>
<tr>
<td>Internal validity</td>
<td>• Do pattern matching</td>
<td>• Data analysis</td>
</tr>
<tr>
<td></td>
<td>• Do explanation building</td>
<td>• Data analysis</td>
</tr>
<tr>
<td></td>
<td>• Do time-series analysis</td>
<td>• Data analysis</td>
</tr>
<tr>
<td>External validity</td>
<td>• Use replication logic in multiple-case studies</td>
<td>• Research design</td>
</tr>
<tr>
<td>Reliability</td>
<td>• Use case study protocol</td>
<td>• Data collection</td>
</tr>
<tr>
<td></td>
<td>• Develop case study database</td>
<td>• Data collection</td>
</tr>
</tbody>
</table>

Source: adapted from Yin (1984)

Remenyi et al (1998) recommend adoption of the following three principles in order to improve construct validity and reliability of case study research:

- Use of multiple sources of data;
- Creation of a case study database; and
- Maintaining a chain of data.
The research was designed and conducted to ensure its reliability and validity. The researcher employed several techniques to maximise validity and reliability, including:

- Use of multiple sources of data (documents, observations, in-depth interviews with key informants, surveys and focus group discussions for the data collection);
- Triangulation of methods and measures;
- Use of rich data gathering; and
- Use of both qualitative and quantitative techniques within the same study.

A database of primary and secondary data on the two case studies was created and maintained by the researcher, and formed the start of the writing-up of the thesis. These elements are discussed in section 3.7 below.

3.5.3 Logical replication and statistical replication

It is important to mention that a distinction is made between logical replication and statistical replication. This distinction is the key to answering questions related to the external validity or the generalisation of the case study. Yin (1984) has stated that survey research relies on statistical generalisation, whereas case study research (as with experiments), rely on analytical generalisation. In analytical generalisation, the researcher is striving to generalise a particular set of results in some broader theory. The case study, like an experiment, does not represent a "sample" and the researcher's goal is to expand and generalise the theories and analytical generalisation and not to enumerate frequencies and statistical generalisation.

An important insight is to consider multiple cases as one would consider multiple experiments, that is to follow a "replication" logic. This is different from a mistaken analogy in the past, which considered multiple cases to be similar to the multiple respondents in a survey or to the multiple subjects within an experiment, that is, to follow a "sampling" logic. The replication logic is analogous to that used in multiple experiments. This distinction is important particularly because the overall research design selected in the current research is a case study, but with other research methods included (such as survey) to provide a framework for detailed study.
3.6 Sources of data

As the study focuses on an investigation into utility management of urban water services and appropriateness of market segmentation, service and price differentiation, relevant primary and secondary sources of data pertaining to urban water services in Sub-Saharan Africa were sought. For primary sources of data, the researcher relied on interviews with key informants, independent descriptive observations, household questionnaire interviews and focus group discussions. Secondary sources of data included analysis of the water utility’s database, management reports, reports by engineering and management consultants, economic and social indicators and various types of documentation (both published and grey literature).

The research design informed the selection of primary and secondary data sources. Data was obtained by carrying out both exploratory and detailed fieldwork in several countries of Sub-Saharan Africa. Apart from field data, a substantial review of published and grey literature was also undertaken. The data was used to answer some of the subsidiary research questions.

3.6.1 Exploratory research fieldwork in Sub-Saharan Africa

The research benefited from data obtained from several countries in Sub-Saharan Africa. The researcher undertook exploratory research field visits to Kenya, Uganda, Tanzania, Lesotho, Swaziland and the Republic of South Africa. During visits to these countries, the researcher interviewed senior and top managers of urban water utilities and obtained an understanding of existing management of water services. Observations were made and field notes taken during the exploratory research fieldwork. Links were made with several water utilities in Sub-Saharan Africa. The utilities were requested to co-operate and support the research project. The utilities agreed and the researcher maintained regular contact with them throughout the research period.
A second visit was made during the third year of the research to discuss preliminary research findings and receive comments from water utility managers in Sub-Saharan Africa, before compiling the final report. Preliminary findings from the detailed case studies (Mombasa and Durban) were presented and discussed at the 2nd Regional Conference on "The Reform of the Water Supply and Sanitation Sector in Africa" held in Kampala, Uganda from 26 to 28 February 2001. The conference was organised by the Water Utility Partnership (WUP). The researcher used the forum to obtain feedback and additional data from water sector professionals in Africa. Through contacts at WUP, data on urban water services from other African countries was obtained.

In addition to carrying out exploratory fieldwork in several countries in Sub-Saharan Africa, detailed research fieldwork was carried out in the Republic of South Africa and Kenya. These two countries were selected for detailed fieldwork, on the basis that:

- The city of Durban in the Republic of South Africa had piloted implementation of service differentiation and pricing of urban water services, and useful lessons could be learnt from studying the case.
- Good institutional links existed between WEDC and Durban Metro Water and Waste (DMWW), the water utility responsible for management of urban water services in Durban.
- The researcher had good links with the National Water Conservation and Pipeline Corporation (NWCPC), the water utility responsible for management of urban water services in Kenya. The researcher had worked for the utility as the senior manager responsible for management of water services in Mombasa and the coastal region. The researcher's good contacts in the utility and his knowledge of the city (including its water supply infrastructure) would be beneficial to the research, especially during the fieldwork phase of data collection.
- The two countries afforded inter-regional/national and cross-cultural comparisons.
3.6.2 Detailed research fieldwork in the Republic of South Africa

The phenomena under investigation in this research, managing urban water services through market segmentation, service and price differentiation, has been piloted by Durban Metro Water and Waste (DMWW), the water utility with mandate to manage water services in Durban City in the Republic of South Africa. DMWW was therefore selected as a case study for this research, as directed by one of the subsidiary research questions or proposition.

The researcher made contact with the top management of DMWW, who agreed to collaborate in the research, and to provide access to all available data. The researcher obtained access to the utility’s database including the management reports on Cato Crest pilot project in Durban, Republic of South Africa. DMWW’s management and staff were available for interviews and provided useful information on the project under investigation. The management of DMWW also provided logistical support that facilitated collection of field data on Cato Crest pilot project through questionnaire surveys and focus group discussions. A comprehensive report on the fieldwork research carried out in Durban is presented in chapter five. A paper based on the Durban research was published in the Journal of the Chartered Institution of Water and Environmental Management (CIWEM), Volume 15, November, 2001, pp277-281.

3.6.3 Detailed research fieldwork in Kenya

The National Water Conservation and Pipeline Corporation (NWCPC), is the water utility with mandate to manage water services in Mombasa City and the surrounding areas in the coastal region of Kenya. NWCPC is typical of many urban water utilities in Sub-Saharan Africa, especially with regard to the research question under study. NWCPC was therefore selected as one of the two main case studies for this research. The researcher has intimate knowledge of the city, including its water supply infrastructure, having been responsible for the city’s water supply system earlier in his career, when he held the position of the utility’s Senior Regional Manager in Mombasa.
Each research location had comparative advantages that enhanced the overall richness of the data, and also offered particular relevance in answering respective subsidiary research questions. The techniques used in data collection are summarised in section 3.7 below.

**3.7 Data collection and justification**

The essence of the research process is to answer the research questions by producing suitable evidence supported by appropriate arguments (Remenyi et al 1998). This calls for a suitable tactic for collection of data. One of the sources of data is the household.

**3.7.1 Questionnaire development and household surveys**

Questionnaires were developed to facilitate data collection from households in Durban and Mombasa. Questionnaire surveys were used to elicit information about existing and required water services both from existing and potential utility customers (individual householders). The purpose of the survey was:

- To gather baseline data about existing water services in respective customer segments; and
- To explore respondent perceptions relating to various aspects of improved water service options priced at different levels, including the respondent's willingness to pay (WTP).

The quality of data derived from a questionnaire survey depends on the following four critical elements (Bickman and Rog, 1998):

- the extent to which the questions used were good measures of survey objectives;
- the techniques used for collection;
- the quality of interviewing; and
- the size and representativeness of the sample.
Work by Fowler & Mangione (1990), as quoted by Saywell (2000) reinforce the importance of good question design amongst these criteria, as this was found to be one of the main sources of error in survey estimates.

These references guided the design and preparation stage for the household customer survey and willingness to pay study for this research. In particular, two checklists summarise the main elements of survey question design outlined in these references. The first checklist relates to what constitutes a good question in surveys. The characteristics of questions and answers fundamental to good measurement process are (Bickman and Rog, 1998):

- Questions need to be consistently understood;
- Questions need to be consistently administered or communicated to respondents;
- What constitutes an adequate answer should be consistently communicated;
- Unless measuring knowledge is the goal of the question, all respondents should have access to the information needed to answer the questions accurately; and
- Respondents must be willing to provide the answers called for in the question.

The second is a general checklist for designing survey instruments (Bickman & Rog, 1988). These checklists were used to improve phrasing and emphasis of survey questions. In addition, as mentioned above, the household survey questions were subject to evaluation to ensure that respondents could understand the questions asked, to check for any ambiguity in question phrasing, and to identify local cultural differences which may affect user responses. This was achieved through:

- Discussions with colleagues at WEDC about question design and emphasis;
- In-country pilot survey (pre-testing). The pilot survey consisted of 70 household questionnaires and was carried out during August 2000 in a part of Mombasa with similar customer segments to those chosen for the full survey. Data collection procedures were consistent with those used in the main planned survey, although for the pilot survey household selection was determined by convenience rather than a rigid sampling procedure. Enumerators were requested to note any problems or difficulties experienced when conducting the pilot survey and to summarise these at the end of each of the questionnaires, to be discussed with the researcher. The pilot survey was analysed and amendments to the questionnaire
survey forms were made. The refined questionnaire was then used for the comprehensive household survey.

The household questionnaire was administered by trained enumerators as part of a deliberate effort to improve accuracy and response rate (on the assumption that self-administered postal questionnaires have a lower chance of being completed and returned). This assumption was found to be valid for household questionnaire surveys in Africa (Saywell, 2000). Additionally, the willingness to pay study included a bidding game designed to elicit the amount that respondents are willing to pay for improved water services, and sought to answer a key research question. Research experience elsewhere in Africa show that accuracy of household responses to scenarios in the bidding game is best achieved when trained enumerators administer the questionnaires (Whittington et al, 1991).

Copies of both the pilot and the final household customer survey and willingness to pay questionnaires used during the research are presented in appendices 3.3 and 3.4. Information relating to how the surveys were administered is presented in the following sub-sections.

In both Durban and Mombasa, a thorough procedure was developed to guide survey administration. This involved an orientation course for enumerators lasting two to three days in duration, presented jointly by the researcher and the consultant market researcher. The orientation course provided general guidance on the purpose of the research, general survey administration, and specific guidance in relation to particular questions arising in the survey. As part of the orientation course, field pre-test followed by discussion sessions on the questionnaire and responses were carried out. When the research team was sufficiently confident, the full survey was undertaken. Gender balance was maintained for enumerator teams, which was important when discussing sensitive issues with female household members.

3.7.2 Rich data and Semi-structured interviews

'Rich data' (Bickman and Rog, 1998) are detailed and complete sources of information that provide a full and comprehensive picture of a phenomenon, thereby
reducing the opportunities for respondent duplicity, or observer bias. The researcher focused on conducting all key informant interviews in person, taking notes in the same language that the interview was conducted in so that "Rich data" sources for the research can be preserved.

Semi-structured interviews were conducted with key water sector personnel in each country, as a way of examining aspects of management of urban water services in the Sub-Saharan African country visited. In this way, more detailed information was elicited on the six subsidiary research questions identified earlier in this chapter. Informants with whom interviews were conducted ranged from middle to senior and top management of organisations responsible for policy and management of urban water services. These interviews yielded data relevant to the thesis. Each interview typically lasted an hour or more in duration, and was guided by a list of pre-arranged questions. As relevant issues arose during conversation, further questions, not included in the list were posed.

Prior to the commencement of the interview, interviewees were informed about the purpose of interview and wider research. The researcher used the pre-arranged list of questions to trigger discussion during the interviews but the list was not rigidly applied. There was flexibility to ask follow up questions to particular answers as the interview progressed. Details of individuals involved in the research, together with designation and organisation are listed below.

Household interviews were however conducted with the help of enumerators after thorough training and briefing in an attempt to reduce bias. In this way, the potential for enumerators to inadvertently introduce bias into the research was substantially reduced. The researcher also made direct observations.

3.7.3 Direct observation

Observation simply involves watching and listening to what is going on. By making a field visit to the case study site, an investigator is creating the opportunity for direct observation. Since the phenomena under investigation is of contemporary nature, some relevant behaviours or environmental conditions are available for observation,
which serve as yet another source of evidence in the case study. The observations ranged from formal to casual data collection activities. Apart from direct observations, the researcher also used semi-structured interviews to collect research data.

3.7.4 Data collection in Kenya for the Mombasa case study

The researcher made elaborate arrangements for data collection at both the national and regional level. The researcher obtained official research authorisation from the office of the permanent secretary, office of the president, responsible for provincial administration and internal security in Nairobi. A copy of the research authorisation is presented as appendix 2. This authority enabled the researcher to obtain co-operation of all possible sources of information (including public offices), and this facilitated access to data from various sources.

The regional administration in Mombasa, including Mombasa municipal council facilitated the research and provided data. The top management of NWCPC in Nairobi and the regional management in Mombasa agreed to collaborate in the research. Access to all available data such as the live customer database, recent management reports and reports from engineering and management consultants were provided.

The overall research design was a case study with survey techniques incorporated within the case study, to provide a framework for detailed study and improve validity and reliability of the study. Six sources of evidence can be the focus of data collection for case studies: documentation, archival records, interviews, direct observation, participant observation and physical artefacts (Yin, 1984).

Preliminary data was obtained through interviews and pilot customer surveys. The data was analysed after which appropriate modifications were made to the questionnaire before collecting more data through the refined, comprehensive and tested questionnaire.
The fieldwork employed multiple data collection techniques, and details of each method are summarised in the following sections. Since the quality of research findings are inextricably linked to the quality of the data collected, much emphasis in the research was placed on sample selection, participant acquisition, data collection, data management and analysis. The measures presented in section 3.5.2 above were employed to improve the reliability and validity of the data collection process.

3.7.5 Sampling techniques considered for the research

Sampling is the process of selecting a few (a sample) from a bigger group (the sampling population) to become the basis for estimating or predicting a fact, situation or outcome regarding the bigger group (Kumar, 1999). A sample is a sub-group of the population that a researcher is interested in. Remenyi et al (1998) defines a sample as the set of individuals from a larger group (target population) who are selected to provide the information.

The sampling techniques considered for the research are discussed briefly in the following section.

1) Random sampling

These are methods in which all members of the population have an equal chance of being selected. A sample frame is therefore necessary. Random sampling is further categorised as simple random sampling and stratified random sampling.

Simple random sampling

From the sample frame each member of the population is given a number. A sample is then chosen at random. Selection can be through methods such as use of computer generated numbers using drums or from random samples.

Advantages

- The method is fair and generally acceptable especially to respondents
- All members have equal chance of being selected
Disadvantages

- A sample frame is required (this was not available for the Mombasa research)
- Respondents with similar water services and hence views could be selected (a purely simple random sample might not be representative of the diverse water situation in Mombasa)

These disadvantages are significant. The limitations are applicable not only in Mombasa but also in many urban areas of Sub-Saharan Africa. Simple random sampling was therefore found unsuitable for the research question under investigation.

**Stratified random sampling**

In this method, the population is stratified according to some attribute such as geographical location or type of dwelling. The researcher then chooses samples with the same proportions as in the population. For instance if 30% of the Mombasa population live in Mombasa Island geographical area, then 30% of the sample should come from Mombasa Island geographical area. This method of sampling was found applicable to the research question under investigation. In the Mombasa field research, stratified sampling was inevitable. The challenge was to combine the two strata levels (market segment and geographical location), that is, for instance, to determine how many people living in the flats in Mombasa Island to interview.

Both the simple random and stratified sampling techniques are based on the researcher's ability to identify each element in a population. While it is easy to do this if the total population is small, it is difficult and expensive to identify each sampling unit where the population is large as in Mombasa City. In such cases, the use of a combination of sampling techniques is more appropriate. This was the approach adopted in Mombasa.

2) **Quasi-random sampling**

These are methods that are half-random and half non-random. In this method, the researcher would have say in whom to pick as a sample. Quasi-random sampling methods are further categorised into systematic sampling and multistage sampling.
Systematic sampling

This is where the population has a similar characteristic, for instance where the housing units are similar. The researcher can assign numbers to the units and then choose say odd numbered houses to interview. This method could not be used in this study as there was no similar characteristic.

Multi-stage sampling

This method tries to solve the problem of a study area that is too large. The study can be divided into smaller units, say administrative boundaries. Some of these units are selected while others are left out. The units are selected at random. At the smallest (manageable) units chosen, the sample frame is used to select some of the population to be studied.

The main advantage of this method is the reduction in time and manpower requirements and hence cost. The main disadvantage of using multi-stage sampling is that some areas are left out entirely from the study. In this study, water services and views of respondents in the areas left out may be substantially different from those in the areas studied. For this reason, this method was found inappropriate for the research question under investigation. Multi-stage sampling method was therefore not used.

3) Non-random sampling

These are methods in which the researcher uses a variety of considerations in selecting the sample. The methods include cluster sampling and quota sampling.

Cluster sampling.

This method tries to solve problems associated with a large study area. Such a large area may be subdivided into smaller units and then some of the units are selected at random using random sampling techniques. At the lowest units, the researcher physically selects some of the population members. There is no sample frame to choose from.

Cluster sampling is based on the ability of the researcher to divide the sampling population into groups, called clusters and then to select elements within each cluster,
using the SRS technique. Clusters can be formed on the basis of geographical proximity or a common characteristic that has a correlation with the main variable of the study (as in stratified sampling).

The main advantage of this sampling method is reduction in time and manpower requirements and hence reduction in cost. The main disadvantage is that as the method is not random, bias can be introduced.

Quota sampling

This method also tries to solve problems associated with a large study area. In this method, the entire study area is divided into sampling points and each research assistant is given a sampling point to work from. Each research assistant is given a quota of people to interview from each sampling point. The research assistant selects the particular person to interview at random from the sampling point. The research assistant could for instance interview every 3rd household on the left as he/she walks outwards and away from the starting point which would be the centre of the sample.

Advantages

This method is considered very practical as it facilitates market segmentation. It is therefore popular with market surveys and is used widely in business and management research (Remenyi et al 1998). The method is less costly and takes less time. This method was found appropriate for the research question under investigation and was therefore used in Mombasa.

Disadvantages

Research assistants can introduce bias if they are inexperienced, untrained and unprofessional. The method may not be acceptable for some types of studies.

3.7.6 Selection of sampling techniques for the Mombasa survey

The accuracy of an estimate depends on the extent of variability or heterogeneity of the study population with respect to the characteristics that have a strong correlation with the phenomena under study (Kumar, 1999). In this research, the phenomena under study is “willingness to pay” for differentiated water services. A characteristic
that is likely to have a strong correlation with willingness to pay for respective water services is the type of dwellings people live in as represented in the study by market segments. In order to reduce heterogeneity in the population, for a given sample size and thus improve accuracy in the results, stratified random sampling should be used in this study (Kumar, 1999).

Kumar (1999) has stated that in stratified random sampling, the researcher attempts to stratify the population in such a way that the population within a stratum is homogeneous with respect to the characteristic on the basis of which it is being stratified. It is important that the characteristics chosen as the basis of stratification are clearly identifiable in the study population. It is also important for the characteristic that becomes the basis of stratification to be related to the main variable the researcher is exploring.

In this research, the study population is existing and potential customers in Mombasa. The basis of stratification is the type of dwelling, which is related to income and attitudes, and these are related to the main variables under exploration ("willingness to pay" for differentiated water services). The situation we are researching on is "water services" in different segments of Mombasa. The fact being researched on is the respective segment's "willingness to pay" for different water service options.

An important aspect of the research is to estimate the willingness to pay (WTP) for each market segment for selected water service options offered to that segment. Research in Sub-Saharan Africa show that WTP for water services is influenced by two main factors (Whittington et al, 1987):

- the existing service levels; and
- households' incomes (ability to pay).

In Mombasa, geographical location is indicative of existing water services while residential housing types are indicative of incomes. It was therefore decided to survey a representative sample of respondents distributed into two strata levels that take the above two factors into account: geographical location and residential housing types.
The nature of the research required the researcher to use a combination of quota, stratified and random sampling techniques. Quota sampling was selected because it was the most practical as it ensured that respondents would be selected for interview from each of the four geographical areas of Mombasa and each of the four types of dwellings. An individual research assistant (enumerator) would be given a quota of people to interview in a given sampling point. Geographically, Mombasa is divided into four areas. Stratified sampling was used to stratify the population according to the following geographical areas:

1. Mombasa Island;
2. Mombasa North mainland;
3. Mombasa West mainland; and
4. Mombasa South mainland.

These four geographical areas also correspond to the four water distribution sub-systems in Mombasa. Water pressures and hence levels of service generally vary by the water distribution sub-system.

In Mombasa, as in many urban areas of sub-Saharan Africa, the type of dwelling that people live in are generally a reflection of their socio-economic status. The people who live in slums and other informal settlements are generally the very poor, although there are also poor people living in other market segments such as the 1, 2 or 3 roomed dwellings. People living in well-planned residential estates with infrastructure services tend to be the more affluent in the population. The two most favourable means of segmenting a water supply market in a city are considered to be by house types or housing density, as these are the most easily visible means of differentiation. The type of dwelling is particularly a convenient method that a water utility could use to segment the water market.

The Mombasa population was divided into four categories according to the type of dwellings that households live in, thus defining four customer segments. These are:

- Bungalows and maisonettes;
- Flats;
- 1, 2 or 3 roomed dwellings and Swahili type of dwellings; and
• Dwellings located in informal settlements (slums) made of informal building materials such as recycled timber, iron sheets, card boards, paper or similar.

The population was therefore stratified according to the four types of dwellings. This method of segmenting the customers was found to be practical for implementation in the field since all dwellings could easily fit into one of these specific customer (or market) segments. It is also known that in the urban areas of Sub-Saharan Africa, this categorisation readily fits into income groups that make up specific market segments. Another advantage of this categorisation is that viable technical options for urban water supply distribution could be marketed and provided to suit this type of segmentation.

House to house surveys formed a central part of the data collection process. Enumerators were engaged to conduct the house to house surveys. Individuals with previous experience in collecting data and administering surveys were employed in this process. Where possible, the researcher joined enumerator teams as an observer.

In each sampling point, the research assistant (interviewer) used a random sampling technique to select respondents whom to interview. For instance, a research assistant would go to the centre of an area, turn 180°, walk to the left, interview the 4th dwelling and so on. If the respondent in the identified dwelling was unavailable or unwilling to answer the questions, the enumerator moved to the next dwelling. Also, if householders were absent, this information was recorded and the interview was conducted with the next available dwelling in the vicinity.

The interviewer would go round the sampling area till he/she interviews the number of respondents equal to the quota allocated to that respective sampling point. In this way, 312 respondents were interviewed representing the four geographical areas of Mombasa (Mombasa Island, Mombasa North mainland, Mombasa West mainland and Mombasa South mainland) and also representing the four segments of customers (Bungalows and maisonettes, Flats, Swahili houses and 1,2,3 roomed dwellings and informal settlements). The quota for each geographical area and each customer segment was determined using results of the 1999 census data for Mombasa. As the census data was available for each of the four geographical areas and down to the
locations, it was possible to set quotas that were proportional to the population recorded for each area and approximate customer segment.

Summary of sampling technique for the research

The overall sampling method was the probability sampling technique (stratified), which was selected as the preferred means of conducting the household survey. Stratified sampling refers to the process whereby a population is divided into strata (or groups) and a simple random sample of each stratum is collected (Bickman and Rog, 1998). The stratified population can be sampled on either an equal or unequal probability basis. In this case, the strata (divisions) were sampled non-randomly, with random sampling of individual households.

The study aimed to develop as sizeable a data set in each division and customer segment within the logistical constraints in place. Sampling was conducted in each of the four divisions in Mombasa city, thereby ensuring that the responses gained were representative of a cross-section of householder’s opinion and views.

The research did not aim to prove that results from the survey were statistically significant, but rather to establish credible relationships between selected variables.

3.7.7 Data collection in Durban

The Durban pilot project was studied principally as a case study in combination with other social research methods. Primary and secondary data on qualitative and quantitative indicators were obtained through intensive interviews with the management of DMWW, customers and community leaders. The following research methods were used within the case study approach:

- Interviews were held with key DMWW staff and management on various aspects of the project from inception through planning, implementation and operation. The utility’s database was also studied.
- Customer surveys were conducted using questionnaires designed to obtain perceptions of household members on key water service characteristics such as
quantity, quality, cost, convenience and reliability including customer involvement in provision of services. Trained local research assistants successfully interviewed 100 households.

- Two focus group discussions were held to obtain information directly from customers and thus triangulate information obtained from interviews, questionnaire surveys and the utility's database. Two local consultant researchers (facilitator and assistant facilitator), with experience in participatory research methodologies, organised and facilitated the focus group meetings with members of the community. The facilitator chaired the meeting and posed key questions to guide participants as they discussed relevant issues around various aspects of the project. The assistant facilitator took minutes of individual contributions and group views then produced a comprehensive report on the meeting.
- Interviews were held with community leaders including the area councillor, to obtain their perceptions of various aspects of the project.

3.7.8 Triangulation of data

Triangulation reduces the risks of distortion inherent in the use of only one data collection method. Interviews, questionnaires and documents are all vulnerable to self-report bias or ideological distortion: effective triangulation implies the use of additional methods to verify research findings. The research was designed and conducted to ensure its reliability and validity. It is considered good practice in research to use multiple sources of data in order to triangulate collected information. This allowed for varied perspectives on the same issue to be obtained. A mixture of both qualitative and quantitative techniques was employed during the research, including questionnaire surveys, key informant interviews and field observations in order to achieve the target.

In this research, triangulation took the form of cross-checking reported figures gathered using one method, with information found from alternative sources. For example, information from key informant interviews was cross-checked with staff from both the utility and Mombasa Municipal council. Whenever possible, the researcher sought "rich data".
3.7.9 Peer review and feedback

Soliciting feedback from key sector professionals is a valuable method of testing researcher bias, assumptions, and flaws in logic or methods. During the preparatory stage for this research, peer review of questionnaire design and research methodology was sought from colleagues at WEDC, and IHE Delft, and research collaborators in Uganda, Republic of South Africa and Kenya. This in turn led to changes in emphasis for the questionnaire survey. The comprehensive questionnaire survey in both Durban and Mombasa was preceded by a pilot survey as a pre-test for the questionnaire. The comments by local collaborators and the research assistants in the field were incorporated in the final questionnaire that was used for the comprehensive survey and willingness to pay study.

More specific checks for validity and reliability are described in detail in the following sections outlining the main methodological tools employed.

An extensive customer survey was undertaken in Mombasa using a comprehensive customer survey and willingness to pay questionnaire. Using the sampling techniques discussed below, a sample of 312 respondents (households) was selected and interviewed to represent Mombasa population. The customer survey and willingness to pay questionnaire that was used in Mombasa is presented in appendix 1.

Interviews were held with key utility staff in order to obtain information. Information was also obtained from the utility's database of existing customers and also from recent technical and management reports. The utility's database was found useful for existing utility customers.

The utility's database was not useful for areas that are not served by the utility. In these areas, other methods were used to triangulate customer survey data. The method of data collection used in such areas was focus group discussions. It was known prior to the research that the market segment consisting of dwellings in informal settlements (slums) was hardly served by the water utility. It was considered appropriate that information from this market segment be obtained through the use of focus group discussions.
Focus group discussions were therefore arranged and held in selected informal settlements. Social development personnel from the social services department of Mombasa municipal council assisted in arranging for the meetings.

3.8 Analysis of data

3.8.1 Rationale of data analysis

Theory is created as a result of data analysis. Analysis of data is a process of moving between description and explanation. Description is making complicated things understandable by reducing them to their component parts. Explanation is making complicated things understandable by showing how their component parts fit together according to some rules (Graham, 2000). In qualitative research, the distinction between data collection and data analysis may not be clear-cut (Symon and Cassell, 1998). As research fieldwork progresses, the researcher will often be creating, testing and modifying analytic categories as an iterative process, such that data analysis may be considered “an organic whole that begins in the data gathering stage and does not end until the writing is complete” (Potter, 1996). Miles and Huberman (1994) consider analysis for qualitative data to be the “sorting through of case studies to identify similar phrases, relationships between variables, patterns, themes and common sequences”. Quantitative data analysis is a well-defined branch of mathematics, and was used where appropriate in so far as it helps to relate quantitative data to the aspects under investigation in this research.

The data collected during this study was both qualitative and quantitative in nature. Qualitative data was generated through a series of semi-structured interviews with key informants. Where a local researcher was used as facilitator to facilitate focus group discussions (as in Durban), strict guidance to interpret and report verbatim was specified so that no ‘third party’ bias could be introduced. A reporter who understood the local language took minutes during the focus group discussions and a comprehensive report was completed within two days of the discussion.
Quantitative data was generated from the household questionnaires. Notes and observations were made by enumerators during the course of their surveys and presented to the researcher every evening. Any difficulties encountered with conducting the interview was recorded on the day of the interview and discussed with the researcher in the evening of the same day.

The qualitative and quantitative data from household questionnaires were coded and entered into the computer, then analysed using the Statistical Package for Social Scientist (SPSS) software (version 10.0).

Detailed data analysis is presented in the form of case studies in chapters 4 and 5.

3.8.2 Analysis of Durban research data

The data collected from various sources were recorded and analysed. Questionnaire responses from 100 households were analysed using the statistical package for social scientists (SPSS version 10) software. Questionnaire responses from the customer survey provided information on perceptions of household members on key water service characteristics such as service options, quantity, quality, cost, convenience and reliability including customer perceptions of the water utility. Frequencies, tables and figures were produced to enable focus on key aspects relevant to the research, and wherever practical results of this analysis were compared with those from qualitative data. Multiple sources of data enabled triangulation and minimisation of the bias inherent in qualitative data as a result of researchers' subjectivity. A common limitation in this type of research is the researcher's inability to understand the local language. In the Durban fieldwork, recruitment of local consultant researchers, facilitator, assistant facilitator and research assistants (as enumerators) helped to mitigate this limitation. Detailed results of the analysis of Durban data are provided in chapter 4.

3.8.3 Analysis of Mombasa research data

Unlike in Durban, language was not a limitation for the Mombasa research fieldwork since the researcher understood the local language and culture, as did the facilitators, assistant facilitator and research assistants (enumerators).
As for the Durban research, questionnaire responses from 312 households in Mombasa was coded and entered into the computer, then analysed using the statistical package for social scientists (SPSS version 10) software. Analysis of customer responses on key water service characteristics was carried out including customer preferences of service options and the amounts that households are willing to pay. The analysis was done for different customer segments and different service options. Details of the analysis of Mombasa data are provided in chapter 6.

3.8.4 Response analysis

In the Durban case study, 100 household questionnaires were completed as part of the first component of the research. In the Mombasa case study, 312 household questionnaires were completed as part of the second component of the research. The main reliability and validity issues with regard to data collection are included in the list below. Efforts to mitigate error arising in these forms are also detailed.

Sample selection bias occurs when the basis for drawing a list for sampling is incomplete or faulty. In the Mombasa survey, the geographical locations and customer segments by type of dwelling were distinct and visible. In addition, the customer segments and their physical location were discussed and agreed with the social development experts responsible for social services in Mombasa Municipal Council (MMC). This confirmed the sampling criteria and ensured that those interviewed were a representative sample of the city population. Within a specific customer segment, households were selected on random basis. This served to minimise sample selection bias.

Non-response error occurs due to the biased nature of the responding sample. The issue of how representative the study population is in respective customer segments was addressed through discussions to determine site selection for respective customer segments. As the survey was carried out door to door and involved over 300 respondents, non-response error was reduced.

Item non-response error (failure of respondents to answer individual questions). Analysis of missing values from the questionnaire indicates acceptably low levels of
item non-response for the majority of variables. Questions that addressed more sensitive issues though included in the pilot survey, were avoided and replaced with less sensitive ones during the comprehensive survey.

Response error (respondents misunderstand the wording of questions as presented). Attention was paid to providing enumerators with a detailed orientation towards the research and the questionnaire questions prior to fieldwork. Furthermore, the researcher also personally conducted several household interviews in each customer segment and the reliability of responses cross-checked with completed questionnaires by enumerators.

3.8.5 Research database

This research generated a large quantity of data relating to management of urban water services. Although a synthesis of this information is provided in this thesis, the bulk of the raw data is not presented in the thesis but is otherwise accessible.

3.9 Summary

This chapter has reviewed the hypothesis, objectives and key research questions that have guided the research work. A number of important points can be highlighted. In an attempt to understand the issues at stake in this research from a variety of perspectives, a mix of methods has been adopted within the overall methodological design of a case study research. Thus, quantitative and qualitative methods were combined and a cross-section of stakeholders interviewed with regard to key issues. Considerable effort was paid to systems and procedures through which validity of the data could be maintained (such as triangulation). In addition, two cities in Sub-Saharan Africa were considered in order to improve the reliability of the findings. The analysis of the data followed a framework designed to examine and extract relevant material in relation to the guiding hypothesis and research questions. In particular, presentation of the analysis of data was done in a systematic manner, in accordance with the management approach under investigation in this research.
CHAPTER 4: Market Segmentation, Service and Price Differentiation of Water Services in Durban

4.1 Chapter outline

A key challenge facing managers of water utilities in developing countries is to provide services to the rising urban population, including the poor, in a financially sustainable manner. An important aspect of this research is to investigate feasibility of service and price differentiation in the context of urban water services in Sub-Saharan Africa.

In this chapter, a case study of a pilot project in Sub-Saharan Africa is presented. The case study shows how the water utility in Durban City implemented service and price differentiation of urban water services with the aim of serving the poor segments of the urban population in a financially sustainable manner. In particular, the case study also shows the importance of appropriate pricing policies for sustainability of differentiated services. The Durban case study helps to answer subsidiary questions 3 and 4 of this research, which were stated in chapter 3.

The purpose of this chapter is therefore to answer the third and fourth subsidiary research questions, which can be restated in the context of the Durban pilot project as:

3. How did the water utility in Durban City (DMWW) implement service and price differentiation of water services in the pilot area?
4. What are the perceptions of stakeholders (such as utility managers, customers and politicians) on service and price differentiation of urban water services?

The case study examines management of water services in Durban City where service differentiation and pricing was piloted. The chapter reports on the pilot project, findings and lessons learnt. Among the key findings was that enormous improvement in provision of water services to the urban poor was achieved. Cost recovery was achieved through innovative structuring of public-private partnerships, an appropriate pricing policy and flexible payment systems. The case study demonstrates that by
structuring service delivery with appropriate pricing, utilities could serve more customers (including people living in informal settlements), at affordable cost and achieve financial sustainability. The finding suggests that service differentiation and appropriate pricing has potential to improve urban water services in low-income countries.

A journal paper based on the Durban field research has been published by the Journal of the Chartered Institution of Water and Environmental Management.

4.2 Background to the field research

Review of literature showed that service and price differentiation has been applied on pilot basis in Durban, Republic of South Africa, by the city’s water utility, Durban Metro Water and Waste (DMWW). Macleod (1997) states that service differentiation is a viable method of providing services to informal settlements in urban areas. He outlined DMWW’s experience in provision of water to informal settlements in Durban through service differentiation and pricing. He further reported implementation of an innovative pilot water project in which potential customers were offered differentiated water services at different prices. It was therefore found appropriate that detailed field research be undertaken in Durban to study the pilot project where this concept was used. The author visited Durban in July 1999 to research on the project, which is reported in this chapter.

The purpose of the field research in Durban was to review and learn the successes, problems and methodologies used by DMWW in the implementation of service differentiation and pricing of water services. Data on the Durban water system was obtained through in-depth interviews with middle and top management of the utility. A focus group discussion was held with customers and community leaders to get their views on the project. Additional information was obtained through customer questionnaires.
4.3 Institutional set up and management of water services in Durban City

A water utility that has piloted service and price differentiation is Durban Metro Water and Waste (DMWW). Located on the eastern coast of the Republic of South Africa, Durban has a population of over 3 million and is one of the largest cities in Africa.

DMWW is the water utility mandated to manage water and sewerage services in Durban City. It is a public utility operating as an autonomous department of Durban Metro city council, under the municipal management model. The Executive Director heads DMWW, and is responsible to the Town Clerk for management of water and sewerage services. The Town Clerk is the city’s Chief Executive Officer and reports to the Mayor, who is the head of the city council. The city council is made up of councillors elected by city residents. Durban is a typical African city consisting of both planned and unplanned settlements; the latter often referred to as informal settlements. With minor variations, the institutional and management set up in Durban is typical of many cities in Sub-Saharan Africa.

4.4 Study Objective and Methodology

The objective of the Durban study was to explore the feasibility of managing urban water services through service and price differentiation. In order to fully explore and understand the pilot project, and hence answer the subsidiary research questions stated earlier, the following peripheral questions were framed:

1. How did the project begin, how was it implemented and how does it operate?
2. How did service differentiation and pricing policy affect water services in the project area (informal settlement)?
3. Have the objectives of DMWW been fulfilled?
4. What are the reasons for success and/or failure?
5. Can the project be replicated in other low-income urban areas?
6. What lessons can be learnt from the pilot project?
4.4.1 Research Method

It was necessary for the Durban study to explore and answer the above questions using appropriate research methods. Provision of infrastructure is closely linked to development. Nichols (1991) states that development work depends on an effective partnership between project planners and the local community, and that effectiveness of development projects are best reviewed using social research methods. Nichols (1991) recommends the use of social research methods consisting of:

- Participant observation,
- Case studies,
- Group discussions,
- In-depth interviews with key informants and
- Surveys.

The Durban pilot project was studied principally as a case study in combination with the above listed social research methods. Primary and secondary data on qualitative and quantitative indicators were obtained through intensive interviews with the management of DMWW, customers and community leaders. The following research methods were used within the case study approach:

- Interviews were held with key DMWW staff and management on various aspects of the project from inception through planning, implementation and operation. The utility's database was also studied.
- Customer surveys were conducted to obtain perceptions of household members on key water service characteristics such as quantity, quality, cost, convenience and reliability including customer involvement in provision of services. Trained local research assistants interviewed 100 households (using questionnaires).
- Focus group discussions were held to obtain information directly from customers and thus triangulate information obtained from interviews, questionnaire surveys and the utility's database. Two local consultant researchers (facilitator and assistant facilitator), with experience in participatory research methodologies, organised and facilitated the focus group meeting with members of the community. The facilitator chaired the meeting and posed key questions to guide participants as they discussed relevant issues around various aspects of the project. The assistant
facilitator took minutes of individual contributions and group views then produced a comprehensive report on the meeting. Interviews were held with community leaders including the area councillor, to obtain their perceptions of various aspects of the project.

4.4.2 Data analyses and limitations

The data collected from various sources were recorded and analysed. Questionnaire responses from 100 households were analysed using the statistical package for social scientists (SPSS version 10) software. Frequencies, averages and tables were produced and analysed together with the qualitative data. Multiple sources of data enabled triangulation and minimisation of the bias inherent in qualitative data as a result of researchers' subjectivity. A common limitation in this type of research is the researcher's inability to understand the local language. Recruitment of local consultant researchers, facilitator, assistant facilitator and research assistants (as enumerators) helped to mitigate this limitation. Time was also a limitation with only two weeks available for fieldwork in Durban. Despite these limitations, the data obtained from Durban provide a clear insight into the pilot project from which key lessons; findings and conclusions are made.

4.5 Origin and Implementation of Cato Crest Pilot Project

It is estimated that 26% of the total population in Durban live in informal settlements (DMWW, 1999). Cato Crest is an informal settlement that grew up in the midst of a well-planned high-class residential area in Durban. Like most informal settlements in cities of developing countries, the area is ill planned, lacks basic infrastructure services, and is characterised by a high population density with a high rate of unemployment. Durban metro's attempts to forcibly move the people (squatters) away were unsuccessful largely due to political changes then taking place in the country. It became necessary to provide basic water services to residents in informal settlements.
Faced with the need to develop suitable technology to serve informal settlements at minimum cost, DMWW considered several service delivery options ranging from standpipes operated by water committees to kiosks and ground tanks. The result was the development of the ground tank. Macleod (1997) described the design principle of the ground tank system as being to limit consumption, hence reducing water demand and consequently the cost of the distribution network. The system limited household water consumption to 200 litres per day (6 m³/month). The size of the ground tank was set at 200 litres to be filled once a day. This amount was considered adequate for a typical household in an informal settlement. The consumption was small enough to enable all households to be connected using small diameter polypropylene pipelines that could be cheaply constructed in an informal settlement. After the technology was developed, Cato Crest informal settlement was selected for the pilot project. Implementation of the project started in February 1993 when the settlement had 372 households.

MacLeod (1997) stated the objectives of the Durban pilot project as to:
1. Provide an acceptable quality of drinking water at an affordable price to the households in the informal settlement.
2. Deliver water directly to each dwelling unit to avoid carrying water for long distance.
3. Provide water supply infrastructure at a low cost.
4. Control the volume of water supplied each day, rather than controlling the price per month, using a pre-payment system.
5. Provide infrastructure in a manner, which would create employment within the community.
6. Reduce administrative costs to the lowest level possible.
7. Provide infrastructure in a manner, which made it difficult to connect illegally to the water system and at the same time reduce water loss

The above objectives are key to successful management of water services in low-income countries.
4.6 Implementation of Service Differentiation in Durban

Market segmentation is a prerequisite for service differentiation. In Durban, the market was segmented principally on the basis of house types. It has been noted above that a key motivation for the pilot project was to improve water services to the urban poor. In Durban, as indeed in many urban areas of Sub-Saharan Africa, it is fairly easy to locate areas where the very poor live by observing house types, which are good indications of levels of income. Different water service options can then be developed to suit various market segments.

In Durban, development of the ground tank system provided DMWW with the following range of water service options that were offered to potential customers in areas without utility water services:

- High pressure system (full pressure);
- Semi-pressure system (roof tank);
- Low pressure system (ground tank);
- Communal water standpipe or kiosk; and
- Commercial water tank or Kiosk (5000 litre tank).

Service options offered to potential customers depend on factors such as capital, affordability, land tenure and public health considerations (availability of sewerage). DMWW aimed to provide the selected service level in a specific area to meet the community’s preferences. Marketing of service options was done in all areas without utility water services. New customers in areas with water services were offered service levels already provided in that area. This is what Kotler (1997) refers to as segment marketing, where an organisation assumes that customers belonging to a particular segment have fairly similar wants and needs. Kotler (1997) adds that segmentation is a midpoint between mass marketing and individual marketing. Some segment members will want additional features and benefits not included in the offer, while others would gladly give up something that they don’t want very much. He concludes that segment marketing offers several benefits over mass marketing. Segment marketing is considered more appropriate for the water sector. Thus
DMWW did not produce, distribute and promote one water service for the entire Durban City (mass marketing), but applied market segmentation.

DMWW negotiated with the Cato Crest Civic Organisation (CCCO) regarding water supply in Cato Crest. CCCO was a community-based organisation whose role was to deal with socio-political problems and general needs of the local people. DMWW used community meetings to market the service options. They worked through community leaders to mobilise and obtain people's commitment to the selected option. After initial community meetings, DMWW staff went door to door and encouraged people to sign up their willingness to pay. The advantages and disadvantages of each service option including its limitations and cost were explained to potential customers. Whereas committees were used to facilitate meetings and access potential customers, water supply contracts were made between the utility and individual customers.

During the fieldwork study, respondents were asked to state the service option selected by each household before implementation of the project. Figure 4.1 shows that 71% of respondents had selected ground tanks, 4% kiosks, 7% private stand pipes, 4% roof tanks, 2% full pressure while 14% did not choose.
The service options implemented in Cato Crest were limited to ground tanks and kiosks, thus meeting the preferred choices of over 75% of households. Assuming that those who selected stand pipes (7%) and those who did not choose any option (14%) could obtain water from water kiosks operated by bailiffs, the requirements of about 96% of Cato Crest residents were met through service differentiation. Implementation of service differentiation in Durban has since resulted to about 260 000 connections with full pressure, 4000 connections with roof tanks and 4000 connections with ground tanks.

4.7 Pricing of water service options in Durban

DMWW’s pricing policy was to recover total costs of water provision through cross subsidy over the entire customer base. Households who chose not to accept even the lowest cost service received essential water supplies from water kiosks at minimum tariff. (Universal access to water was accepted on the basis of minimum tariff for the poor, even before the government decree). A rising block tariff structure with different tariffs for different service options was implemented as shown in table 4.1.
Table 4.1: Water tariff structure in Durban (1997)

<table>
<thead>
<tr>
<th>Charges</th>
<th>Ground tank system</th>
<th>Roof tank system</th>
<th>Full pressure system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection Charge</td>
<td>£15.75</td>
<td>£31.54</td>
<td>£98.50</td>
</tr>
<tr>
<td>Deposit</td>
<td>Nil</td>
<td>£5.00</td>
<td>£10.80</td>
</tr>
<tr>
<td>Consumption up to 6m³/Month</td>
<td>(Consumption limited to 6 m³/Month)</td>
<td>£0.1/m³</td>
<td>£0.16/ m³</td>
</tr>
<tr>
<td>Cons. 6m³ to 30 m³/Month</td>
<td>N/A</td>
<td>£0.16/ m³</td>
<td>£0.16/ m³</td>
</tr>
<tr>
<td>Cons. Over 30 m³/Month</td>
<td>N/A</td>
<td>£0.2/ m³</td>
<td>£0.2/ m³</td>
</tr>
<tr>
<td>Monthly Fixed Charges</td>
<td>£0.77/Month</td>
<td>Nil</td>
<td>£0.45/Month</td>
</tr>
</tbody>
</table>

Source: Adapted from Durban Metro Water tariff Schedule, 1997

(1 Rand=£0.09 or 1GBP=11.478 South African Rand)

DMWW priced the service options in such a way that the highest service level (full pressure system) attracted the highest charges while the ground tank system had the least charge. Pricing of the ground tank water system (including kiosks) was aimed at covering operation and maintenance costs only. In this way, the highest service levels (options) subsidised the lower ones. This method of pricing ensured social equity among various segments of customers, while also ensuring financial sustainability for the utility.

The cost of installing the ground tank for each household at Cato Crest was estimated at R800 (£70). In order to reduce the cost of installation, the community provided labour. On installation, each potential customer contributed R175 (£15.25) to the cost of the tank. Pipes and accessories were provided free by DMWW. Customers were offered two modes of payment for the R175 (£15.25):
- One lump sum payment; or
- 10 monthly instalments.

To reduce administration costs, the monthly charge was a flat rate payable in advance by each household. The monthly water charge was based on a maximum daily consumption of 200 litres per household.

DMWW's service and price differentiation method provided a household in an informal settlement with two main service options priced as follows:
- Obtain water at 15 cents for a 25 litre container (£0.11 for 200 litres) from a water kiosk (operated by a water bailiff) or
- Obtain water from an individual 200 litre-ground tank at a cost of R175 (£15.25) payable by instalments, and flat rate monthly payments of R8.55 (£0.75).

The pricing policy was supported by a disconnection policy that provides for disconnection of defaulters. The advance payment system removed the need for this action. Although DMWW did not conduct willingness to pay studies before implementing the tariff, this study found that 80% of respondents considered the water tariff to be affordable as shown in figure 4.2.

Figure 4.2: Is water tariff affordable?

4.8 Management of the water distribution system

Operations and maintenance is a common weakness of many water utilities in Sub-Saharan Africa. In Durban, management of the ground water system was through public-private partnerships. The distribution system was operated and maintained by a small-scale private operator (known as a water bailiff) through a franchise. The
community participated in the selection of the water bailiff from among prominent dwellers of the informal settlement such as those owning a shop in the area (and thus seen as permanent). The selected water bailiff was trained by DMWW in operation, maintenance and management of the ground tank water system. After training, the bailiff took over the management of about 150 ground tank connections and one water kiosk. The kiosks complimented the ground tank so that people who did not have ground tank connections at their dwelling obtained water from kiosks. The bailiffs managed the water kiosks and also maintained the water distribution system within the informal settlement.

4.8 1 Payment system for the public-private partnership (water bailiff)

The utility priced the service options and payment to the water bailiff in such a way that installation of additional water tanks was not a threat to the bailiffs' income. DMWW billed the water kiosk (bailiff) at a bulk tariff of 7-cents/25 litre container (£0.05 for 200 litres). The bailiff sold water to customers at 15 cents per 25 litres (£0.11 for 200 litres).

Each ground tank owner was required to pay (in advance) a flat rate of R8.55 (£0.75) per month at the DMWW cash office. DMWW then paid R4 (£0.35) to the water bailiff for each ground tank under the bailiff's management. Ground tank owners were required to show the bailiff copies of payment receipts as proof that the monthly payment had been received by DMWW. Only then could the bailiff provide water to the ground tank owner for the next one month.

4.9 Recent developments in pricing policy and change in tariff structure

In April 1998, there was a major change in the operation of the project following changes in DMWW's pricing policy and tariff structure. The change was reportedly due to new legislation in the South African constitution that provided for universal access to water for life. DMWW decided to provide free water to every domestic
consumer in Durban for the first 6m³/month. The new water tariff structure effective July 1999 is shown in table 4.2.

Table 4.2: New water tariff structure in Durban, effective July 1999

<table>
<thead>
<tr>
<th>Charge</th>
<th>Ground tank system</th>
<th>Roof tank system</th>
<th>Full pressure system</th>
<th>Industrial, Commercial and other uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection Charge</td>
<td>£20.70</td>
<td>£40.14</td>
<td>Varies according to nominal size of connection (Min £139.40)</td>
<td>Varies according to nominal size of connection (Min £139.40)</td>
</tr>
<tr>
<td>Consumption up to 6m³/Month</td>
<td>Nil (200litre tank filled daily)</td>
<td>Nil</td>
<td>Nil</td>
<td>£0.30/m³</td>
</tr>
<tr>
<td>Cons. 6m³ to 30 m³/Month</td>
<td>Nil</td>
<td>£0.20/m³</td>
<td>£0.30/m³</td>
<td>£0.30/m³</td>
</tr>
<tr>
<td>Cons. over 30 m³/Month</td>
<td>Nil</td>
<td>£0.60/m³</td>
<td>£0.60/m³</td>
<td>£0.30/m³</td>
</tr>
<tr>
<td>Monthly Charges</td>
<td>Fixed</td>
<td>Nil</td>
<td>£2.10/Month</td>
<td>Varies according to size of connection (£2.10 to £210.33)</td>
</tr>
</tbody>
</table>

Source: Durban Metro Water Tariff Schedule, 1999/2000
(1 Rand=£0.09 or 1GBP=11.478 South African Rand)

4.9.1 Effect of change in pricing policy on the ground tank system

The change in tariff structure disrupted the smooth operation of the ground tank water system. Since the system operated on the basis of a maximum consumption of 200 litres per day per household, (equivalent to 6 m³ per month), the change in tariff meant that all consumers on the entire ground tank system were removed from the billing system. The following happened soon afterwards:

- Maintenance of the ground tank system and water kiosks deteriorated, there being no more contact between the bailiff and customers.
- Demand for ground tanks reduced substantially.
- The ground tank system and kiosks no longer operated as originally intended; there was no more regulation of flow by the bailiff, and a household could now consume over 200 litres per day.

The new pricing policy put overall sustainability of the ground tank system at risk.
4.10 Findings of the Pilot Project

The community considers the project as successful, and the utility met its objectives. There was high willingness to pay for the ground tank service option among residents of the informal settlement. Customers demonstrated this by making the required payments and providing labour for installation of ground tank connections. DMWW reported having had problems meeting the high demand for connections.

98% and 100% of households obtain enough water from ground tanks and kiosks respectively even during the dry season. Figure 4.3 shows that 94% of households with ground tank connections considered the 200litres per day as adequate.

Figure 4.3: Is 200litres per day enough?

An open question asking 100 respondents to state the most likeable feature of their water supply service elicited the following responses (table 4.3):
Table 4.3 Most likeable feature of water supply services to households

<table>
<thead>
<tr>
<th>Proportion of Respondents</th>
<th>Most likeable feature of water supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>39%</td>
<td>Water is “nearby”</td>
</tr>
<tr>
<td>31%</td>
<td>Water is “always available”</td>
</tr>
<tr>
<td>18%</td>
<td>Water is “clean”</td>
</tr>
<tr>
<td>10%</td>
<td>Water is “cheap”</td>
</tr>
<tr>
<td>2%</td>
<td>Nothing special/No response</td>
</tr>
</tbody>
</table>

In addition, 80% of households interviewed considered the water tariff (original) affordable. This response shows that the decision to change the tariff structure and remove an entire segment from the billing system was not based on customer knowledge. The responses show that residents have a convenient, reliable, adequate, good quality supply of water within easy reach and at reasonable cost.

Although financial records for the pilot project were not available for this study, DMWW indicated that the project was not financially fully self-sustaining, and required cross-subsidy between service levels. DMWW achieved overall financial sustainability by subsidising the investment in the project area with earnings from the rest of the customer base.

The project achieved most of its original objectives, but the objectives have since changed. The success of the project is however limited to the 5-year period from inception in 1993 to 1998 when the pricing policy changed. The project is no longer progressing well.

Provision of free water to anyone connected through a ground tank adversely affected the partnership between the utility, the customers and the water bailiffs. The bailiffs no longer had motivation to manage the water system. With water freely available from those already connected with ground tanks, there was no more incentive for others to seek connections or buy from water kiosks. The objective to limit water consumption is no longer achievable with the new tariff structure.
4.11 Reasons for the successes and/or failures

Service differentiation has improved water supply situation to the informal settlements of Durban. The main reasons for success were:

- Appropriate (and innovative) technology;
- Service differentiation that enables people to select the water system that meets their needs and is affordable to them;
- Marketing system for the service options and effective dialogue with potential customers;
- Financial strength of the utility, supported by large and rich customer base;
- Implementation methodology that involved potential customers in improving their living conditions;
- Pricing policy and tariff structure that considered affordability;
- Partnerships based on win-win situation for all stakeholders;
- Flexible payment system that made cost recovery feasible; and
- Selection and training of water bailiffs (private operators) that enabled them to operate and maintain the ground tank water system.

The main weaknesses were:

- Free water policy. This was the main cause of failure of the otherwise successful project.

Disadvantages of the system include the following:

- The water is limited to 200 litres per day (but 94% of households consider this amount as adequate); and
- The system has some limitations; for instance this system is not compatible with waterborne sanitation, as there are no sewers or septic tanks. (On-site sanitation would often be a more appropriate solution for such an area).

In spite of this, people obtained water at affordable cost, and the advantages outweigh the disadvantages.
4.11.1 Could the project be replicated?

A key question is whether or not the concept of differentiated levels of services is replicable.

DMWW considers that their objectives were achieved. The pilot project is already being replicated in Durban. DMWW’s designs for water supply to informal settlements (such as Malagazi) are based on the ground tank water system. Housing developers in collaboration with DMWW now carries out marketing of the ground tank.

The focus group meeting revealed that willingness to pay for improved water services among residents of Cato Crest informal settlement is high. The residents did not stop paying for water because of lack of willingness, or affordability to pay. They paid water charges according to DMWW’s tariff structure and never understood why the utility told them to stop paying. The pricing policy and tariff structure adopted at the start of the project was crucial to sustainability of improved water services in the informal settlement and should have been maintained by the utility. This finding supports the view that willingness to pay for improved water services among low-income customers is high when appropriate service levels are provided.

Elsewhere in cities of Sub-Saharan Africa, several aspects of the project such as the design philosophy, technology and management system could be adapted and replicated. The financing and pricing policy used in Durban could also be replicated, but with modification of the tariff structure. Whereas Durban has a high proportion of affluent residential, commercial and industrial customers and only a small proportion of customers in informal settlements, the reverse is the case in most cities of Sub-Saharan Africa. In many African cities, the customer base consists of a high proportion of low-income customers with only a small proportion of affluent residential, commercial and industrial customers. The level of cross subsidy would therefore be lower than in Durban, due to the lower proportion of affluent customers.
4.12 Lessons learnt from the Durban Pilot Project

Several key lessons emerge from the Durban pilot project:

- People have different preferences for provision of water services. Service differentiation with suitable, appropriately priced service options aimed at providing services that people need and can afford, is a suitable method of extending water services to poor sections of the urban community;
- Poor urban residents are willing to pay for improved water services;
- A flexible project design based on limiting household consumption, hence minimising capital costs to the water utility, enables the utility to recover capital costs through cross-subsidy while charging the poor for the full operation and maintenance costs;
- It is possible for water utilities to improve services in informal areas through partnerships with small-scale private operators. This method has potential for effective and efficient management of water services at minimum cost to the utility;
- An important ingredient for success of service differentiation is political acceptance and dialogue with potential customers through appropriate communication channels; and
- A suitable pricing policy, appropriate tariff structure and provision for flexible payment systems (such as prepayment) is essential for sustainable cost recovery and overall financial sustainability of differentiated services.

4.13 Chapter Summary

In this chapter, a case study has been presented on the Durban pilot project in which service differentiation was piloted in an informal settlement. The Durban pilot project shows that a water utility can successfully implement service differentiation through innovative use of technology and management to provide required and affordable service options. Appropriate pricing of service options (levels) with provision for flexible payment systems is necessary for sustainability of differentiated water services. The operation and maintenance phase of service delivery can be successfully
managed through public-private partnerships, structured on win-win basis between the water utility, customers and small-scale private operators.

Cost recovery in an informal settlement is feasible, thus contributing to financial sustainability of the water utility. Service differentiation should be implemented together with an appropriate pricing policy and tariff structure in order for service improvements to be sustainable. The pilot project demonstrates the potential for water utilities to improve management of water services in low-income urban settlements through service differentiation and pricing.

In Durban, service and price differentiation was successfully implemented. The system performed well for a few years until pricing policies were changed, removing a substantial proportion of customers from the billing system. The revised pricing policies adopted by the utility did not send appropriate signals to customers and thus the services were not financially self-sustaining. Interviews with the utility's managers confirmed that differentiated water services were provided to customers in a financially sustainable manner prior to April 1998. Interviews with customers in informal settlements, most of who are the poor and at the lower end of income levels, showed that they considered the original water tariffs to be acceptable. It is therefore evident that the original tariff structure was not only acceptable to customers but was financially sustainable for the utility. Deterioration of services after the change in tariff structure shows that pricing is a key ingredient of service differentiation.

The Mombasa case study on market segmentation, price and service differentiation is presented in the next chapter.
CHAPTER 5: Case study of Market Segmentation, Service and Price Differentiation (MSSPD) of water services in Mombasa, Kenya: Where are we now?

5.1 Chapter introduction and outline

An important aspect of this research is to investigate feasibility of service and price differentiation in the context of urban water services in Sub-Saharan Africa. The Durban case study presented in chapter 4 showed the potential for service and price differentiation to improve urban water services, especially in informal settlements. In chapters 5 and 6, a case study of market segmentation, service and price differentiation of water services in Mombasa is presented. The Mombasa case study attempts to answer subsidiary questions 1, 2, 3, 5, and 6 of this research. The purpose of chapters 5 and 6 is therefore to answer the first, second, third, fifth and sixth subsidiary research questions, which can be restated as:

1. What is the existing situation with regard to management of urban water services in Mombasa?
2. Are existing and potential customers satisfied with the existing water services?
3. How can a water utility such as NWCPC (Kenya) implement service and price differentiation of water services in Mombasa?
4. Are existing and potential customers living in Mombasa willing to pay (WTP) for differentiated water services if marketed by the water utility at different prices?
5. Can urban water utilities such as NWCPC in Mombasa meet the costs of providing differentiated water services with prices set taking into account the customers’ willingness to pay levels?

On completion of the Durban fieldwork research, more comprehensive fieldwork research was undertaken in Mombasa, Kenya. The fieldwork research sought to collect data in Mombasa and use it to answer the subsidiary research questions restated above. The Mombasa Data is presented in form of a case study, and in a format that demonstrates application of market segmentation, service and price differentiation in the management of urban water services. The format of presentation
of the case study can be referred to as a strategic marketing plan, to emphasise the unique methodology that was adopted.

A conference paper on this case study entitled "Optimising cost recovery through service differentiation and pricing: Initial findings from Mombasa, Kenya" was presented at the 2nd regional conference on the reform of the water and sanitation sector in Africa, held in Kampala, Uganda from 26th to 28th February 2001.

Mombasa is Kenya's second largest city and is located at the eastern coast of the Indian Ocean. Mombasa is a typical city in Sub-Saharan Africa. The researcher has good knowledge of the city's water supply infrastructure and good contacts with senior managers of the utility. Mombasa was selected as the location of the case study for both practical and logistical reasons.

In this case study of market segmentation, service and price differentiation of water services in Mombasa, the analysis of the existing situation (Where are we now?) in Mombasa is provided. Market segmentation is used to examine existing water services in Mombasa. Proposals to improve services to existing customers and to capture more of the water market (Where do we want to be?) are presented. An outline of necessary infrastructure and management improvements that the water utility should undertake in order to improve water services and achieve financial sustainability is provided. Projections of costs for infrastructure improvements and the revenue that the utility can obtain from improved water services are provided. In particular, suggestions on how to achieve the desired outcomes (How might we get there?) are presented. Expected benefits are summarised and possible risks identified for allocation as appropriate.

The Mombasa case study presented in chapters 5 and 6 attempts to use market segmentation, service and price differentiation as an approach to provide improved water services to existing and potential customers in a financially sustainable manner, taking into account the customers' stated willingness to pay.

Chapters 5 and 6 reports on the market segmentation, customer survey and willingness to pay studies undertaken in Mombasa. Research data is used to propose feasible service options, which are costed and prices set using results of the customer
survey and willingness to pay study. Among the key findings was that services can be improved and financial sustainability achieved with prices set taking into account the willingness to pay levels for different segments of customers. The case study demonstrates that by structuring service delivery with appropriate pricing, utilities could serve more customers (including people living in informal settlements), at affordable cost and achieve financial sustainability. The finding suggests that the market segmentation, service and price differentiation approach has the potential to improve urban water services in low-income countries.

5.2 The context of the case study

The theoretical background and justification for market segmentation to facilitate service and price differentiation of water services was provided in chapter 2. A key objective of this research is to investigate whether it is possible for a water utility to achieve financial sustainability and at the same time serve existing and potential customers, including the poor. Therefore, ideally before undertaking a comprehensive willingness to pay survey, it is necessary to do a pilot survey and make a quick check on possible tariffs to ensure that the differentiated options are offered to customers (or potential customers), along with valid differentiated tariffs. Therefore it is necessary to determine average tariffs based on operating expenditure, depreciation (ideally current cost) and weighted average cost of capital, all the time making realistic assumptions about non revenue water and bill collection efficiency (taking into account reasonable assumptions about anticipated increases in efficiency).

From the average tariff it is then possible to determine the cost of supplying customers in a differentiated manner. From the social mapping come rough estimates of the numbers of different customers potentially wanting to take advantage of differentiated services. It is then possible to check back to see if it is possible to make such a system financially sustainable. From this it is possible to determine the prices of the differentiated products for which one is determining willingness to pay in the subsequent survey. If studies on existing water supply infrastructure indicates a lack of capacity, (over and above dealing with issues of unaccounted for or non-revenue water), then it is possible to work out the long run marginal cost of supplying that
water. This number should inform the upper bound on prices and may well be used as an economic signal to high demand users. It need not be reflected in all the prices unless it forms the greater part of the supply.

In the Mombasa case study presented in this and the next chapter, these ideas are applied and followed through to differentiated prices for differentiated services offered to the various segments of the population in Mombasa.

5.3 Specific objectives of Mombasa case study

As stated in chapter 3, this research is designed to help water utilities in Sub-Saharan Africa achieve the twin objectives of improving urban water services while also achieving financial sustainability. The Mombasa case study categorises customers into segments and proposes utility provision of different appropriately priced levels of service that correspond to the water requirements of respective customer segments, taking into account their willingness to pay.

The case study was conducted taking into account the central focus of the research, which is to investigate how urban water services in Sub-Saharan Africa could be improved by following a systematic and flexible approach consisting of market segmentation, service differentiation and appropriate pricing. The aim of this approach is to provide improved water services to all customer groups, including the poor, and enable the utilities achieve financial sustainability. A key aspect of the case study is the structuring of service delivery to provide water at appropriate service levels through feasible service options that meet the different needs of existing and potential customers (including low-income groups) at a price that they are willing to pay.

The Mombasa case study sought to group existing and potential customers into segments, developed a menu of service options with costs, and then found out the service options that customers (in each segment) wanted and were willing to pay for. The projected costs for providing the services were compared with projected revenues to find out whether the utility could achieve financial sustainability.
The objective of the study was to enable NWCPC to improve its service provision to customers (including the low-income customers who are currently not served), while meeting its financial objectives. The case study was prepared in the form of a strategic marketing plan (SMP) that also demonstrated a methodology that water utilities could use to structure their service delivery to customers while meeting their objectives. In the context of sub-Saharan Africa, and as discussed in chapter 2, the key objective for a progressive urban water utility or municipality is to improve service provision to all groups of customers, while meeting its financial objectives. Other objectives for utilities include:

- To capture more of the water market;
- To achieve equity in service provision by serving the poor, most of who are currently not served and rely on alternative sources;
- To improve customer service; and
- To improve the utility's financial position.

These were the key objectives of the market segmentation, service and price differentiation plan for water services in Mombasa. The plan shows how NWCPC can improve services to customers and potential customers in Mombasa and the coastal area in a financially sustainable manner.

**5.4 Marketing water services in Mombasa**

Theoretical justification of applying marketing techniques in the urban water sector was discussed in chapter 2. Marketing was defined as "the management process responsible for identifying, anticipating and satisfying customer requirements profitably" (Jones, 1989). This definition implies that ongoing communication with existing and potential customers is required to check the effectiveness of efforts to identify, anticipate and satisfy customer requirements. While different water utilities have different financial objectives, all utilities need to generate sufficient funds for future investment.

Another perspective on marketing is to view it as a set of tools or elements that are necessary for achievement of customers' requirements. One such tool is the marketing mix or the 7p’s of marketing (product, price, promotion, place, people, process and
presence) which are aspects to be reviewed in order to respond adequately to demand (Brassington and Pettitt, 2000). The point was made in chapter 2 that it is useful to consider water as a service rather than a product. A utility with a marketing orientated philosophy would have its entire operations, its personnel and its technical systems being geared to providing improved customer satisfaction and to contribute towards meeting its financial objectives. Market segmentation, service differentiation and appropriate pricing are key to achieving these objectives, and were applied in the Mombasa case study.

5.4.1 Relevance of marketing water services in Mombasa

A casual observation of the water situation in Mombasa (and in many cities in Sub-Saharan Africa) reveals that a thriving water market exists. Whereas the official water utility (NWCPQ has the legal mandate to supply water to all customers in the city, other suppliers operate in the city as well. Evidence of the existence of a water market and the competition faced by the utility is seen in form of:

- Illegal connections to the water utility's distribution network;
- Private water vendors (hand carts, wheelbarrows, water tankers etc);
- Individual and/or private water sources such as wells and boreholes; and
- Other non-utility water sources such as springs.

These observations were made during the exploratory field research in August 1999, and confirmed by the results of the pilot customer questionnaire and WTP study. Good opportunities exist for the utility to capture more of the water market served by these alternative methods, through application of marketing techniques. As stated above, marketing is about satisfying customers while meeting the financial objectives of the organisation that is providing the services. In the context of water utilities such as NWCPQ, marketing is about satisfying customers in its area of operation while meeting the objectives of the water utility. The objectives of NWCPQ are reflected in its mission statement, which states (NWCPQ, 1995):

"The Corporation is committed to providing a regular supply of high-quality water to its customers at an affordable price and at a reasonable profit to the corporation."
In order to achieve its objectives, it is necessary for a water utility to prepare a business strategy. Business strategy may be viewed as a set of actions by means of which a market position relative to other competing enterprises is sought and maintained. "Strategy" is not synonymous with "long-term plan" but rather consists of an enterprise's attempts to reach some preferred future state by adapting its competitive position as circumstances change (Wilson and Gilligan 1997).

One of the most significant findings of the customer survey carried out in Mombasa is that many customers have multiple water sources. This means that although NWCPC has legal mandate to supply water to all the people living in Mombasa, in practice it faces substantial competition from other sources. The perceived monopoly status of NWCPC as a water undertaker in Mombasa is not real, perhaps a reflection of the level of service provided to customers by NWCPC. It is therefore necessary for NWCPC to market its services with a view to capture more of the existing water market and benefit fully from its legal monopoly status. This could lead to increase of water sales with potential for increase in revenue and thus enable NWCPC to attain financial sustainability.

Application of marketing techniques could enable NWCPC to survive and thrive in the water market. A Strategic Marketing Plan (SMP) enables an organisation chart a course that could improve its effectiveness. An effective water utility is one that achieves its mission. NWCPC's mission is "to provide a regular supply of high-quality water to its customers" and make "a reasonable profit". NWCPC needs a strategic marketing plan to enable it to achieve this mission.

5.4.2 How to market water services

Section 2.6 of chapter 2 discussed marketing of urban water services, and explained how water utilities could market water services. Application of the market segmentation, service and price differentiation (MSSPD) approach requires NWCPC to know its existing and potential customers. NWCPC can then build beneficial exchange relationships with existing and potential customers. The customer value chain consisting of know, target, sell and service (Sage R, 2000) was stated in section 2.6 to be a useful approach that the utility can use to this objective. Market
Segmentation was stated in section 2.6.1 to be the key to understanding existing and potential customers and is considered in the next section.

5.5 Market segmentation in Mombasa

Segmentation was defined as the process of identifying groups of customers with enough characteristics in common to make possible the design and presentation of a product or service each group needs (Heskett, 1986). By identifying a segment’s special needs, the service provider can then design services to meet them better and in a financially sustainable manner. In the context of urban water services, useful segmentation of existing and potential water users or customers can be achieved by considering the following factors (Wilson and Gilligan, 1997):

- Are the segments unique or identifiable so that they can be distinguished from each other?
- Are the segments stable such that their future behaviour can be predicted with a fair degree of confidence?
- Are the segments appropriate to the water utility’s objectives and resources?
- Can appropriate data be made available to render the segments measurable?
- Are the segments substantial enough to render efforts of service and price differentiation effective?

These factors were considered as the basis of market segmentation of water customers in Mombasa. Also considered were geo-demographic techniques of market segmentation. Wilson and Gilligan (1997) recommend the use of these techniques because “people with broadly similar economic, social and lifestyle characteristics tend to congregate in particular neighbourhoods and exhibit similar patterns of purchasing behaviour and outlook”. It should be noted however that in practice, market segments can only be broad, and meant to provide a guide for improving services (or infrastructure development) with no suggestion that the people living in those segments are the same and have completely similar requirements.

The criteria found appropriate for segmenting the water market in Sub-Saharan Africa is the type of dwelling. In Mombasa, as in many areas of Sub-Saharan Africa, the
types of dwelling that people live in are generally a reflection of their socio-economic status. The people who live in slums and other informal settlements are generally the very poor, although there are also poor people living in other market segments such as the 1, 2 or 3 roomed dwellings and Swahili houses. People living in well-planned residential estates with infrastructure services tend to be the more affluent in the population. The type of dwelling is therefore a convenient method that water utilities such as NWCPC could use to segment the water market.

Considering the above factors, it was found appropriate and practical to carry out market segmentation in Mombasa on the basis of the type of dwellings that households live in. In the Mombasa research, dwellings were categorised in four easily identifiable segments, corresponding to categories often used in urban planning (MFP, 2000):

- Bungalows and maisonettes;
- Flats;
- 1, 2 or 3 roomed dwellings (and Swahili type of dwelling); and
- Dwellings located in informal settlements (slums) made of informal building materials such as re-used timber, iron sheets, packaging boards and paper.

This method of market segmentation was found to be relatively easy to implement in the field as all dwellings could easily fit into one of these specific market segments. It is also known that this categorisation readily fits into income groups that make up specific market segments. Another advantage of this categorisation is that viable technical options for urban water supply distribution could be marketed and provided to suit this type of segmentation. Two other market segments were identified as follows:

1. Mixed development, consisting of a variety of different types of dwellings
2. Commercial, industrial and institutional establishments

Any dwelling located in an area with mixed development could be regarded as belonging to one of the four market segments identified above. It was assumed that for purposes of this research, commercial, industrial and institutional establishments
would require (and be willing to pay) the highest possible level of service that domestic users of water would demand.

In Mombasa, needs and conditions differ from one customer group or market segment to the next. Market segmentation therefore provides a basis for NWCPC to structure service delivery and pricing policy to suit the special needs of each customer group. People also experience substantially different water services specific to their market segment. Suitable options for improved services were developed bearing in mind the different needs and demands of these groups, using the results of the pilot customer survey and WTP study. Though the *product* delivered to all segments in the water market would be similar (good quality potable water that meets the necessary standards), the method of delivery, and hence the *service* would be different to suit the segment’s special requirements and willingness to pay.

A common marketing principle that can be followed by water utilities is (Wilson and Gilligan, 1997):

- Where are we now?
- Where do we want to be?
- How might we get there?

This method was followed in the Mombasa case study of market segmentation, service and price differentiation. This chapter will concentrate on aspects of the Mombasa case study upto “where are we now”, while chapter 6 will address aspects of “where do we want to be” and “how might we get there”.

**5.6 Where is the utility (NWCPC) now?**

In order to effectively implement service and price differentiation, it is necessary to obtain information about the existing and potential customers. This information can be obtained by carrying out a comprehensive customer survey and willingness to pay study in all customer groups. Data on existing and potential customers is confirmed and a summary of existing water services obtained. Customers’ preferences and willingness to pay for water service options priced at cost covering levels are also
obtained. In some customer groups such as those living in the informal settlements, focus group discussions can be conducted to collect additional data including their perceptions and preferences for priced water service options. An institutional analysis of the utility and its water supply infrastructure is carried out including analysis of the utility’s operating environment. This information was obtained in Mombasa and is presented in the following sections.

The sections that follow (5.6.1 to 5.6.10) looks at the current situation in NWCPC with regard to the institutional set up and management, finance and water services to customers in Mombasa and the coastal area.

5.6.1 Institutional arrangements and management

The National Water Conservation and Pipeline Corporation (NWCPC) is a public water company mandated by the Kenya Government to supply water services to all customers in Mombasa and the coastal area among others. A board of directors appointed by the government provides policy direction to the corporation. Board members are drawn from the private sector with representatives from the Government. The board has a non-executive chairman and a Managing Director. The Managing Director is the chief executive who heads the management team and reports to the board of directors. The Minister for Water Development is responsible for water affairs in the country, and this includes regulation of the sector and approval of tariffs.

The senior management team at the corporation’s head office in Nairobi consists of the Managing Director and five Chief Managers responsible for each of the corporation’s five departments (finance, human resources, corporate services, development, and operations). The corporation is divided into five regions; each headed by a Regional Manager. Coast is the largest region with a total of ten areas each headed by an Area Manager. The ten Area Managers report to the Chief Regional Manager at the regional headquarters in Mombasa. Four of the ten areas in coast region are in Mombasa City. These are Mombasa West Mainland, South Mainland, North Mainland and Mombasa Island.
5.6.2 Cost recovery and current financial performance

Water production

Mombasa is among the areas that comprise Coast region of NWCP and is the regional headquarters. The area receives water from a combination of sources that supply the entire Coast Region. The current total production from all sources is about 34,310,000 m³/year (NWCP, 1990-2000). Table 5.1 shows the production capacities of various sources of water for Mombasa and the coastal area.

Table 5.1: Water production for Mombasa and the coastal area.

<table>
<thead>
<tr>
<th>Bulk water source</th>
<th>Capacity (m³/day)</th>
<th>Current Production (m³/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baricho (Sabaki) Water Works</td>
<td>72,000</td>
<td>47,000</td>
</tr>
<tr>
<td>Mzima Pipeline</td>
<td>35,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Marere Pipeline</td>
<td>12,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Tiwi Boreholes</td>
<td>6,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Taveta Lumi</td>
<td>1,200</td>
<td>1,000</td>
</tr>
<tr>
<td>Total</td>
<td>126,200</td>
<td>94,000</td>
</tr>
</tbody>
</table>

Source: NWCP's database (1990-2000) and verified by the author

Current annual water production = 94,000 x 365 = 34,310,000 m³/year

Water consumption

Water supply in Mombasa and the coastal region is fully metered. Despite 100% metering, only about 56% of billed consumption is based on actual meter reading. This is because meters are either not functional or not read. Consumption data for different categories of customers has therefore been estimated based on component of consumption that is billed according to actual meter readings. There are presently three categories of customers with estimated consumption as follows:

Residential (individual connections or yard connections) = 14,092,543 m³ (63%)
Kiosks or public = 1,565,838 (7%)
Industrial = 6,710,735 (30%)
Total water consumption = 22,369,116 m³

(Some institutional customers such as hotels are included in the category of residential customers.)

The current average per capita consumption is estimated at about 29 litres per capita per day, assuming that 70% of the water sold is used for domestic consumption by a population of about 1,500,000 in Mombasa and coastal area.

**Billing and revenue collection**

The existing water tariff in Mombasa is applicable to all urban water projects managed by NW CPC. The tariff is low and does not meet the full costs of water provision. NW CPC’s efforts to increase water tariffs resulted in introduction of a new tariff that became effective on 1st November 1999. The new tariff does not also cover full costs of water provision. Table 5.2 shows a summary of the new tariff.

**Table 5.2: Current water tariff for Mombasa and the Coastal area (1999)**

<table>
<thead>
<tr>
<th>CONSUMPTION (m³/month)</th>
<th>RATE (KSh/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No meter installed (Flat rate charge)</td>
<td>200.00 (per month)</td>
</tr>
<tr>
<td>0-10</td>
<td>20.00</td>
</tr>
<tr>
<td>11-20</td>
<td>25.00</td>
</tr>
<tr>
<td>21-50</td>
<td>30.00</td>
</tr>
<tr>
<td>51-100</td>
<td>45.00</td>
</tr>
<tr>
<td>101-300</td>
<td>75.00</td>
</tr>
<tr>
<td>&gt;300</td>
<td>100.00</td>
</tr>
<tr>
<td>Water sold through a meter at a kiosk per unit of 20 litres or part thereof, charge per cubic metre (Bulk Water Purchase from NW CPC)</td>
<td>15.00</td>
</tr>
<tr>
<td>Water sold by retail at a kiosk per unit of 20 litres or part thereof, charge per unit (Water Sales to customers)</td>
<td>2.00 per 20 litres</td>
</tr>
<tr>
<td>Bulk Sales to a water undertaker for resale, charge per cubic metre</td>
<td>15.00</td>
</tr>
</tbody>
</table>

Source: Adapted from Kenya Subsidiary Legislation, 1999. (New tariffs that took effect in November 1999)
Analysis of NWCPC’s records (NWCPC, 1990-2000) show that the average volume of water billed by the utility is about 22,369,116m³ per year. Since the coastal region produces about 34,310,000m³ of water per year, the unaccounted for water (UFW) is therefore about 35%. Prior to implementation of the new (November 1999) tariffs, the average value of water sold was KSh679 862 316 per year. Based on billing, the current average tariff is KSh30.40 (about US$0.40) per m³. This tariff is low and is below production costs; this is a common feature of water tariffs in many countries in Sub-Saharan Africa.

The average revenue actually collected is KSh462 841 404 per annum (based on actual collection for three consecutive months prior to changes in tariff). The bill collection efficiency is therefore 68%. The average revenue collected per unit volume of water sold is KSh20.70 (US$0.30)/m³. This is effectively the current average tariff as it takes into account operating management efficiency.

Detailed calculations for performance indicators such as revenue collection are presented in appendix 5.

Outstanding arrears (cumulative since 1989) KSh795 404 683
(includes disputed bills)

The average revenue collected per unit volume of water sold is KSh20.70 (US$0.30)/m³. This is effectively the current average tariff as it takes into account operating management efficiency.

Current volume of water sold per annum = 22,369,116m³/year
Current annual billing (potential revenue) = KSh679 862 316/year
Current average annual revenue (actual revenue collected) = KSh462 841 404
(Before implementation of the November 1999 tariff)
Current average tariff (based on actual revenue collected) = KSh21/m³
Current bill collection efficiency = 68%
Current unaccounted for water (UFW) = 35%
Average operating ratio = 42%
Water connections (for Mombasa and coast region)

Number of connections 59,330
Number of working meters 47,449 (80%)
Number of non-working meters 11,881 (20%)
Total number of staff in Coast Region 596
Number of employees per 1000 connections 10
Average number of people per connection 30
Average per capita consumption 29 litres per capita per day.

Current water consumption per category

There are presently three categories of customers with estimated consumption as follows:

Residential (individual connections or yard connections) =14,092,543 m³ (63%)
Kiosks or public =1,565,838 m³ (7%)
Industrial =6,710,735 m³ (30%)
Average total amount sold per year =22,369,116 m³ per year

Table 5.3 summarises the financial performance of NWCPC in recent years.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Revenue Billing</td>
<td>405,742,032</td>
<td>677,695,470</td>
<td>732,179,338</td>
<td>Increasing</td>
</tr>
<tr>
<td>Water Revenue Collection</td>
<td>356,823,793</td>
<td>430,328,755</td>
<td>566,805,552</td>
<td>Increasing</td>
</tr>
<tr>
<td>Bill collection efficiency</td>
<td>88%</td>
<td>64%</td>
<td>77%</td>
<td>76%</td>
</tr>
<tr>
<td>(Recurrent Expenditure)</td>
<td>153,928,925</td>
<td>201,197,356</td>
<td>197,775,828</td>
<td>43,124,916</td>
</tr>
<tr>
<td>Operating Ratio (Expenditure/Collections)</td>
<td>43%</td>
<td>47%</td>
<td>35%</td>
<td>42%</td>
</tr>
</tbody>
</table>

Source: Adapted from NWCPC database and audited financial accounts (1990-2000), calculations by the author.

**Data for 1999/2000 financial year includes both old and new tariffs. The billing program has had system problems leading to errors in billing. Billing data for 1999/2000 is therefore suspected to have errors.

*Data for recurrent expenditure does not include loan repayments and depreciation.
As recurrent expenditure shown in table 5.3 above does not include loan repayments and depreciation, it is unlikely that NWCPC Mombasa can balance its books and achieve financial sustainability at the current level of operation. Observations in Mombasa and interviews with operations and maintenance managers revealed that necessary expenditure on the water system is often postponed. This information implies that the recurrent expenditure is understated. Review of audited financial reports for the period 1995-1999 shown that NWCPC has not met its financial objectives (NWCPC, 1990-2000).

Although the average bill collection efficiency is decent at 76% and unaccounted for water at 35%, the level of outstanding revenue is high. High levels of outstanding revenue indicate that the revenue collection system is inefficient. It is also likely that there is over-billing: the amount billed is probably higher than the amount that should be billed. This situation is common in capacity constrained cities where water is available for a few hours on rationing basis. When water meters are not read or malfunction, customers often receive water bills based on estimated readings. It is understandable if customers continue to pay bills that may be for a higher amount of water than that consumed, in order to avoid disconnection. This situation is particularly likely to occur where water tariffs are low and a disconnection policy is implemented. Customers would rather pay the inflated bills and avoid disconnection of water and associated problems of lack of water whenever it is available in the pipeline.

5.6.3 Existing service levels and customer services

An important aspect of the research was to assess existing water services. Several research methods (interviews, observations, surveys and focus group discussions) were used to collect data on existing water service levels and customer services. Triangulation of data was done to confirm existing situation. In order to collect primary data on existing water services, a customer survey was found appropriate. Also incorporated in the customer survey questionnaire was a willingness to pay study. Questionnaire development and a pilot customer survey preceded the comprehensive customer survey and willingness to pay study.
Questionnaire development and piloting

The customer questionnaire for this research was prepared at WEDC then piloted in Mombasa during August 1999. Research assistants were identified, interviewed, recruited and trained in order to assist the researcher as enumerators. The research assistants were drawn largely from the staff of the Business Studies Department of Mombasa Polytechnic. A part of the city consisting of all market segments was selected for the piloting of the questionnaire. The selection was done using information obtained from the city’s director of social services, a map of the city obtained from the city’s planning department and the researcher’s knowledge of the city. The part of the Mombasa city (Mombasa Island) selected for piloting of the questionnaire consisted of low density high income dwellings, medium density middle income dwellings, high density low income dwellings and high density low income informal dwellings.

70 respondents (from 70 households) in Mombasa Island completed 70 customer questionnaires with the assistance of enumerators. The 70 respondents were identified at random in a part of Mombasa that is known to include all market segments. The time taken to complete each questionnaire ranged from 30 minutes to 45 minutes. The researcher entered the data in the computer and analysed the completed questionnaires. The results of the pilot customer survey were analysed to form a picture of the current water situation in Mombasa. This information was used to prepare a revised comprehensive customer survey and willingness to pay questionnaire, incorporating the findings of the pilot survey. The refined questionnaire was then used to carry out a full-scale customer survey in a larger sample.

Comprehensive customer survey and willingness to pay study

The comprehensive customer survey and willingness to pay study was undertaken in Mombasa during August 2000. The purpose of the survey was to assess existing service levels and customer services, and also to obtain data on the amount of money that existing and potential customers are willing to pay for improved water services in Mombasa.

The research assistants identified earlier during the piloting of the questionnaire were trained again and sampling done for the comprehensive survey. A combination of
sampling methods (random, stratified random and quota sampling) were used to ensure that respondents interviewed represented all four geographical locations of Mombasa and all four market segments. The details of the sampling methods used in Mombasa are provided in chapter 3. A copy of the customer survey and willingness to pay questionnaire used in Mombasa is presented as appendix 1. A copy of the research authorisation by the Kenya government is presented as appendix 2.

A representative sample of 312 respondents was interviewed using a comprehensive questionnaire administered by trained enumerators. Six enumerators carried out the survey over a two-week period during August 2000. Each questionnaire took between 30 and 45 minutes to complete, and an enumerator completed about six to eight questionnaires in a day. The author held daily meetings with the enumerators to discuss the sampling and interviews. The data was analysed using the statistical package for social scientists (SPSS version 10) software. Focus group discussions were also held in three informal settlements.

The next section shows existing levels of service provided by the water utility (NWCPC), as perceived by customers.
Levels of service provided by NW CPC

Respondents were asked to state their main source of water. Only 44% (33.5% with individual and 10.6% with shared water connections) of the respondents stated that NW CPC was their main direct provider of water services. 33% and 5% of respondents respectively cited kiosks and hand cart vendors as their main source of water. Some of the kiosks and vendors obtain water from the NW CPC distribution network while others obtain water from wells and boreholes. Figure 5.2 shows the main sources of water for households in Mombasa.

Figure 5.2

The survey data show that out of 312 respondents (in 312 households) interviewed in Mombasa, only 2 (0.6%) did not give an answer, implying a high response rate for this survey. The customer survey revealed that only 44% of households in Mombasa receive water services directly from NW CPC and even these do not receive continuous supply of water.

Table 5.4 shows the percentage share of the water market for each main water source.
Table 5.4

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valid</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indiv. Connections</td>
<td>104</td>
<td>33.3</td>
<td>33.5</td>
<td>33.5</td>
</tr>
<tr>
<td>Shared Connections</td>
<td>33</td>
<td>10.6</td>
<td>10.6</td>
<td>44.2</td>
</tr>
<tr>
<td>Water Kiosks</td>
<td>102</td>
<td>32.7</td>
<td>32.9</td>
<td>77.1</td>
</tr>
<tr>
<td>Hand-Cart Vendors</td>
<td>14</td>
<td>4.5</td>
<td>4.5</td>
<td>81.6</td>
</tr>
<tr>
<td>Water Tankers</td>
<td>4</td>
<td>1.3</td>
<td>1.3</td>
<td>82.9</td>
</tr>
<tr>
<td>Public B/holes&amp;wells</td>
<td>12</td>
<td>3.8</td>
<td>3.9</td>
<td>86.8</td>
</tr>
<tr>
<td>Private B/holes&amp;wells</td>
<td>20</td>
<td>6.4</td>
<td>6.5</td>
<td>93.2</td>
</tr>
<tr>
<td>Own B/holes&amp;Wells</td>
<td>21</td>
<td>6.7</td>
<td>6.8</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>310</td>
<td>99.4</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>Not Applicable</td>
<td>2</td>
<td>.6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>312</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Out of the 44% of households in Mombasa who receive water directly from the water utility (NWCPC), only 39% receive water continuously as illustrated in Figure 5.3 below. Most customers receive water on rationing basis.

**Figure 5.3**

![Water supply frequency for households in Mombasa](image-url)
The survey revealed that water supply services in Mombasa and the coastal area require improvement. Water is supplied to customers mainly on rationing basis. Figure 5.4 shows typical the duration that households in Mombasa receive water from NWCPC.

**Figure 5.4: Duration of water supply to households in Mombasa**

Figure 5.4 shows that water supply duration for customers who receive water from NWCPC in Mombasa is as follows:
- more than 4 hours (46%),
- 2 to 4 hours (36%) and
- Less than 2 hours (18%).

Existing customers revealed that service delivery is often characterised by water shortages, intermittent supply at low pressure or no water at all.

The market segmentation carried out in the Mombasa study has revealed enormous knowledge for existing and potential customers. Most of the existing customers are not satisfied with the services currently provided by NWCPC. Many potential customers are not served by NWCPC and have resorted to alternative sources. This situation has resulted to a thriving water market in Mombasa.
Results of analysis of service levels and customer services for each market segment in Mombasa are presented in tables 5.5 and 5.6. Table 5.5 also shows the main source of water for each market segment.

Table 5.5

**Crosstabulation of Main source of water & Market Segment by type of dwelling**

<table>
<thead>
<tr>
<th>% within Market Segment by type of dwelling</th>
<th>Bungalows/ Maisonettes</th>
<th>Flats</th>
<th>1,2 or 3 Roomed hse or Swahili Hse</th>
<th>Dwelling in Informal settlement or Slum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main source of water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indiv. Connections</td>
<td>59.2%</td>
<td>70.7%</td>
<td>17.5%</td>
<td>1.3%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Shared Connections</td>
<td>12.1%</td>
<td>22.7%</td>
<td>44.3%</td>
<td>5.1%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Water Kiosks</td>
<td>6.9%</td>
<td>69.6%</td>
<td>1.3%</td>
<td>32.9%</td>
<td></td>
</tr>
<tr>
<td>Hand-Cart Vendors</td>
<td>7.9%</td>
<td>44.3%</td>
<td>2.1%</td>
<td>4.5%</td>
<td></td>
</tr>
<tr>
<td>Water Tankers</td>
<td>5.3%</td>
<td></td>
<td>2.1%</td>
<td>4.5%</td>
<td></td>
</tr>
<tr>
<td>Public B/holes&amp;wells</td>
<td>3.4%</td>
<td>7.2%</td>
<td>3.8%</td>
<td>3.9%</td>
<td></td>
</tr>
<tr>
<td>Private B/holes&amp;wells</td>
<td>2.6%</td>
<td>4.1%</td>
<td>17.7%</td>
<td>6.5%</td>
<td></td>
</tr>
<tr>
<td>Own B/holes&amp;Wells</td>
<td>25.0%</td>
<td>2.1%</td>
<td>100.0%</td>
<td>6.8%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 5.5 shows that the NWCPC is the main direct source of water for 44% of households through individual and shared connections.

Further analysis of water sources show that customers in different market segments rely on different sources for their main supply of water. The levels of service as indicated by the water supply frequency for each market segment are shown in table 5.6.
Table 5.6

Crosstabulation of Water supply frequency vs Market Segment by type of dwelling

% within Market Segment by type of dwelling

<table>
<thead>
<tr>
<th></th>
<th>Bungalows/Maisonettes</th>
<th>Flats</th>
<th>1,2 or 3 Roomed hse or Swahili Hse</th>
<th>Dwelling in Informal settlement or Slum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water supply frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t receive water</td>
<td>34.6%</td>
<td>17.2%</td>
<td>57.7%</td>
<td>96.2%</td>
<td>54.2%</td>
</tr>
<tr>
<td>directly from NWCPC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
<td>17.9%</td>
<td>25.9%</td>
<td>19.6%</td>
<td></td>
<td>15.4%</td>
</tr>
<tr>
<td>Twice a day</td>
<td>9.0%</td>
<td>13.8%</td>
<td>4.1%</td>
<td>1.3%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Once in 2 or 3 days</td>
<td>6.4%</td>
<td>8.6%</td>
<td>4.1%</td>
<td></td>
<td>4.5%</td>
</tr>
<tr>
<td>Continuous</td>
<td>29.5%</td>
<td>31.0%</td>
<td>13.4%</td>
<td>2.5%</td>
<td>17.9%</td>
</tr>
<tr>
<td>Other</td>
<td>1.3%</td>
<td>3.4%</td>
<td>1.0%</td>
<td></td>
<td>1.3%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 5.6 above shows that over 54% of households do not receive water directly from NWCPC. Water supply in Mombasa is intermittent with only 18% of households receiving water continuously. The segment that is least served by the utility consists of people living in informal settlements (or slums). 96% of people in this segment do not receive any direct water service from NWCPC. Table 5.6 also shows that the water shortage in Mombasa affects all market segments in different proportions.

Existing service options

As part of the customer survey, respondents in Mombasa were asked to state whether they had piped water connections, and if so the type of connection they had. 45% stated that they had individual water connections, 12% had shared connections and 43% did not have any piped water connection. Figure 5.5 illustrates the situation with regard to piped connections.
The above finding would suggest that NW CPC supply water directly to 57% (45% +12%) of the respondents. This is however not the case since the survey has revealed that there are water shortages in Mombasa. Many customers who are connected to the distribution network do not receive enough water while some do not receive water at all. These findings confirm that existing customers are not satisfied with the water services they receive from NW CPC.

Analysis of survey data show that customers who are connected to the distribution network and do not receive enough water from NW CPC also use water from other sources. The survey revealed that 58% of customers who use NW CPC water also use water from other sources, mainly because NW CPC water services are inadequate. Figure 5.6 illustrates the situation.
Figure 5.6 shows that although NWPC has legal monopoly to provide water services in Mombasa, both existing and potential customers use other water sources as well. This situation also confirms that NWPC water services are inadequate and supports the case for new investment in water supply infrastructure. This has implications on the tariff structure that NWPC should adopt.

It is also significant that 25% of customers living in bungalows and maisonettes have their own boreholes and wells as the main source of water (table 5.5). This is the most affluent market segment and could be important as a customer in order to facilitate cross subsidy with less affluent market segments.

5.6.4 Water pricing: Customers' perception on paying for water

An important aspect of the research was to find out customers' perceptions on pricing of water services and existing payments in order to inform price differentiation. Results of the customer survey show that most customers (97%) pay their water bills and only 3% do not pay.
It is likely that NWCPC customers who stated that their water bills were not reasonable are the ones who had complaints on billing. At 46%, the level of billing complaints is considerably high. This is probably due to erroneous billing where customers are charged for water not consumed.

Although 69% of respondents stated that their water bills were reasonable, the current average monthly bills paid by customers are quite low compared to the indicative tariffs computed using the average incremental cost (AIC) method. Table 5.7 summarises the range of average monthly water bills (for existing NWCPC customers) in each market segment.

Table 5.7

Crosstabulation of monthly water bills with Market Segment by type of dwelling

<table>
<thead>
<tr>
<th>% within Market Segment by type of dwelling</th>
<th>Market Segment by type of dwelling</th>
<th>1,2 or 3 Roomed hse or Swahili Hse</th>
<th>Dwelling in Informal settlement or Slum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of Monthly water bills</td>
<td>Bungalows/ Maisonettes</td>
<td>Flats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over KSh2400/= /Month</td>
<td>20.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>KSh1801-2000/= /Month</td>
<td>4.4%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>KSh1401-1600/= /Month</td>
<td>13.3%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>KSh1001-1200/= /Month</td>
<td>2.6%</td>
<td>2.9%</td>
<td>5.7%</td>
<td>5.8%</td>
</tr>
<tr>
<td>KSh801-1000/= /Month</td>
<td>20.0%</td>
<td>2.6%</td>
<td>5.7%</td>
<td>10.0%</td>
</tr>
<tr>
<td>KSh601-800/= /Month</td>
<td>11.1%</td>
<td>10.5%</td>
<td>2.9%</td>
<td>8.3%</td>
</tr>
<tr>
<td>KSh401-600/= /Month</td>
<td>15.6%</td>
<td>36.8%</td>
<td>17.1%</td>
<td>23.3%</td>
</tr>
<tr>
<td>KSh201-400/= /Month</td>
<td>11.1%</td>
<td>47.4%</td>
<td>40.0%</td>
<td>31.7%</td>
</tr>
<tr>
<td>KSh200/=&amp;below/Month</td>
<td>4.4%</td>
<td>25.7%</td>
<td></td>
<td>9.2%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The cross tabulation of monthly water bills per market segment (table 5.7) shows the actual distribution of water bills in each market segment and reveals that a higher proportion of people living in bungalows and maisonettes pay significantly higher water bills to the utility than those living in other segments. Table 5.7 shows that 58% of customers living in bungalows and maisonettes are already paying an average of KSh800/= or more per month. This segment is therefore a potential source of substantial revenue for the utility. The table also shows that about 60% of customers pay the utility KSh400/= or more per month for water services.
Table 5.8 shows that a high proportion of customers who pay NWPC lives in bungalows, maisonettes and flats. This also reflects on market segments that NWPC directly supply with water. It is noteworthy that only 1% of customers living in informal settlements pays NWPC for water, implying that potential customers in this market segment pay to alternative water suppliers. This finding is particularly relevant for service differentiation. It is important for the utility to investigate how it can engage with beneficial exchange relationships with potential customers in this market segment.

**Table 5.8**

<table>
<thead>
<tr>
<th>Market Segment by type of dwelling</th>
<th>Pays NWPC for water</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Total</td>
</tr>
<tr>
<td>Bungalows/Maisonettes</td>
<td>53</td>
<td>23</td>
<td>76</td>
</tr>
<tr>
<td>% within Market Segment by type of dwelling</td>
<td>69.7%</td>
<td>30.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Flats</td>
<td>43</td>
<td>15</td>
<td>58</td>
</tr>
<tr>
<td>% within Market Segment by type of dwelling</td>
<td>74.1%</td>
<td>25.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>1,2 or 3 Roomed hse or Swahili Hse</td>
<td>35</td>
<td>62</td>
<td>97</td>
</tr>
<tr>
<td>% within Market Segment by type of dwelling</td>
<td>36.1%</td>
<td>63.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Dwelling in Informal settlement or Slum</td>
<td>1</td>
<td>78</td>
<td>79</td>
</tr>
<tr>
<td>% within Market Segment by type of dwelling</td>
<td>1.3%</td>
<td>98.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>132</td>
<td>178</td>
<td>310</td>
</tr>
<tr>
<td>% within Market Segment by type of dwelling</td>
<td>42.6%</td>
<td>57.4%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Figure 5.7 shows that overall, most customers pay relatively small amount as water bills.

These figures and tables show that there is scope for increasing the existing level of tariff, especially if it is accompanied by improved water services and billing.

In order to understand customers’ perceptions on paying for water, respondents connected to the water distribution network and who receive water services from the utility were asked to state their views on billing. 86% of the respondents stated that they were metered and that the meters were read regularly and customers billed on the basis of meter readings. 97% of respondents stated that they received water bills regularly. This finding means that NW CPC is efficient in despatch of bills to customers. 46% of respondents had billing complaints. 85% stated that they understood their water bills.
Although existing level of water services in Mombasa is low, existing tariffs are acceptable to customers. Figure 5.8 shows that 69% of respondents consider their monthly water bills as reasonable.

**Figure 5.8**

![Bar chart showing percent of respondents considering monthly water bill reasonable](image)

It should be noted that water bills in Mombasa include a component for sewerage charges, which are based on a percentage of water consumption. There is no separate billing for sewerage.

“Inadequate quantity of water” is the reason given by 82% of respondents who stated that they were not satisfied with the utility’s water supply. NWCPC’s water is of acceptable quality. Existing water tariffs are also acceptable since only 10% said that water was costly. Information on how customers perceive tariffs in important since it informs water pricing by the utility. These findings further confirm that NWCPC water is inadequate and supports the case for new investment in water supply infrastructure. Data obtained from analysis of existing water supply infrastructure in Mombasa is consistent with this finding.
5.6.5 Customers' perceptions of NWCP's services and coping strategies

Summary of customers' perceptions

This section looks at customers' perceptions in general, after which specific market segments are examined. In the customer questionnaire, aspects of customer service were considered to be the process of obtaining new water connections and how NWCP's representatives handled complaints on irregular delivery of bills and service interruptions. Customers who stated that they do not currently receive services from NWCP were not requested to give a view on NWCP's customer service. When asked to state the overall customer service provided by NWCP, only 22% of existing customers stated that the utility provided "good" customer service (figure 5.9), while 78% regard existing NWCP customer services as average or poor.

Figure 5.9

Analysis of the consumer survey data reveals that many customers are not satisfied with services provided by NWCP. Figure 5.9 (above) shows that there is room for NWCP to improve customer services.
Customers who stated that they were not satisfied with water services provided by NWPC were requested to give reasons for their dissatisfaction. Figure 5.10 shows that inadequate quantity of water is the main cause of dissatisfaction among existing customers.

The fact that only 10% of those dissatisfied with NWPC water supply stated cost as the reason for their dissatisfaction suggests that paying for water is not a significant problem among existing customers. This finding implies that there is scope for reviewing the pricing levels, especially if the utility could also improve water services to customers. It is likely that customers who are not satisfied with NWPC on the basis of cost of water are currently over-billed, as there are many billing complaints.

Customers living in bungalows or maisonettes

NWPC is the main source of water to 59% of customers in this market segment who all have individual house connections. The main source of water for the rest of the customers is their own boreholes or wells (28%), handcart vendors (8%) and water tankers (5%).
55% of customers in this market segment use NWCPC water in combination with water from other sources. This means that NWCPC has substantial competition from other sources.

Customers living in flats

NWCPC is the main source of water to 83% of customers in this market segment either through individual connections (71%) or shared connections (12%). The main source of water for the rest of the customers is water kiosks (7%) and handcart vendors (7%). Public boreholes and wells are the main source of water to 3% of customers in this market segment.

36% of customers in this market segment use NWCPC water in combination with water from other sources. This means that NWCPC has significant competition from other sources.

Customers living in 1, 2, or 3 roomed dwellings and Swahili houses

NWCPC is the main source of water to 40% of customers in this market segment either through individual connections (17%) or shared connections (23%). The main source of water for the rest of the customers is water kiosks (44%). Private operators manage almost all kiosks (98%). Public and private boreholes and wells is the main source of water to 13% of customers in this market segment while handcart vendors are the main source for 2% of the customers.

46% of customers in this market segment use NWCPC water in combination with water from other sources. This means that NWCPC has significant competition from other sources.

Customers & potential customers living in informal settlements (slums)

Analyses of the customer survey show that water kiosks are the main source of water to 70% of customers in this market segment. The main sources of water for the rest of the customers are boreholes and wells (22%). Private operators manage almost all
kiosks (98%). Piped connections are the main source of water to only 6% of customers in this market segment and handcart vendors are the main source of water for 2% of the customers. Households in this market segment use an average of between four and five 20-litre containers of water per day. Households use high quality water for drinking and cooking while low quality water is used for washing and other uses.

5.6.6 Summary of existing service levels for water services in Mombasa

The market segmentation and customer survey carried out in Mombasa provided useful data that can be used as the basis for improving services through service differentiation. Useful insight on the perceptions of existing customers on tariffs was gained, and this information can be used in setting appropriate pricing policies. A summary of existing service levels for each segment of existing and potential customers is presented in table 5.9.
Table 5.9: Summary of existing service levels in Mombasa per market segment

<table>
<thead>
<tr>
<th>Selected parameter</th>
<th>People living in Bungalows &amp; maisonettes</th>
<th>People living in Flats</th>
<th>People living in 1, 2 or 3 roomed dwellings &amp; Swahili Houses</th>
<th>People living in informal settlements (Slums)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity supply in dwelling</td>
<td>100%</td>
<td>97%</td>
<td>60%</td>
<td>6%</td>
</tr>
<tr>
<td>Do not receive water directly from NWCPC</td>
<td>35%</td>
<td>17%</td>
<td>58%</td>
<td>96%</td>
</tr>
<tr>
<td>Receive continuous supply of water from NWCPC</td>
<td>30%</td>
<td>31%</td>
<td>13%</td>
<td>2%</td>
</tr>
<tr>
<td>Receive water once or twice a day from NWCPC</td>
<td>27%</td>
<td>40%</td>
<td>24%</td>
<td>1%</td>
</tr>
<tr>
<td>Individual House connections</td>
<td>94%</td>
<td>78%</td>
<td>23%</td>
<td>2%</td>
</tr>
<tr>
<td>Shared connections</td>
<td>Nil</td>
<td>12%</td>
<td>28%</td>
<td>4%</td>
</tr>
<tr>
<td>No piped water connection</td>
<td>6%</td>
<td>10%</td>
<td>49%</td>
<td>94%</td>
</tr>
<tr>
<td>Pays NWCPC for water directly</td>
<td>70%</td>
<td>74%</td>
<td>36%</td>
<td>1%</td>
</tr>
<tr>
<td>Obtain free water from b/hole or well</td>
<td>5%</td>
<td>3%</td>
<td>39%</td>
<td>41%</td>
</tr>
<tr>
<td>Obtains water from handcart vendors</td>
<td>18%</td>
<td>45%</td>
<td>57%</td>
<td>46%</td>
</tr>
<tr>
<td>Obtain water from kiosks</td>
<td>Nil</td>
<td>22%</td>
<td>56%</td>
<td>79%</td>
</tr>
<tr>
<td>Proportion with own b/holes/wells</td>
<td>39%</td>
<td>Nil</td>
<td>2%</td>
<td>Nil</td>
</tr>
<tr>
<td>Monthly water bill</td>
<td>KSh1400</td>
<td>KSh500</td>
<td>KSh450 (KSh425 to 741)</td>
<td></td>
</tr>
<tr>
<td>People in household</td>
<td>6.81</td>
<td>5.52</td>
<td>6.31</td>
<td>5.44</td>
</tr>
<tr>
<td>Main water source</td>
<td>Indv. Hse connections (59%) and own b/holes or wells (25%)</td>
<td>Indv. Hse connections (71%) and shared connections (12%)</td>
<td>Water kiosks (44%) and shared connections (23%)</td>
<td>Water kiosks (70%) and b/holes or wells (18%)</td>
</tr>
</tbody>
</table>

Source: Customer survey and WTP study conducted by author in Mombasa during August 2000, data analysis by author using SPSS version 10 software.

Results of focus group discussions

In addition to the customer survey, focus group discussions were held in order to triangulate information obtained from the survey. Findings from the customer survey were confirmed through focus group discussions held in three informal settlements. The focus groups identified and discussed existing water sources. Separate meetings were held for men and women in each settlement to enable all participants to discuss
freely. The groups ranked existing sources in order of most preferred (1st ranking) to least preferred. A trained facilitator with the assistance of a Water Engineer familiar with the utility’s water supply infrastructure facilitated each focus group meeting. An assistant facilitator took notes of the discussions. Table 5.10 shows the range and ranking of current water sources in the three informal settlements.

Table 5.10 Existing water sources and coping strategies (group ranking) in three informal settlements in Mombasa

<table>
<thead>
<tr>
<th>Service option</th>
<th>Kisumu Ndogo (men)</th>
<th>Kisumu Ndogo (women)</th>
<th>Muoroto Paradise (men)</th>
<th>Muoroto paradise (women)</th>
<th>VOK (men)</th>
<th>VOK (women)</th>
<th>Overall ranking of existing sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary water kiosk</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kiosk with no structure</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Water collected from shallow well (salty water)</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>Roof catchment</td>
<td>N/A</td>
<td>N/A</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Borehole or well with pump (salty water)</td>
<td>3</td>
<td>5</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Hand cart vendor (from kiosk or from wells and boreholes)</td>
<td>4</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Water tanker (free water supplied during severe shortages)</td>
<td>N/A</td>
<td>4</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Traditional source (pools of rain water, often muddy)</td>
<td>N/A</td>
<td>6</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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Table 5.10 shows that there is a wide range of water sources in informal settlements with kiosks being the most preferred water source. All groups considered kiosks to be providing the best quality water. Most of the alternative water sources (apart from some handcart vendors) provide water of low quality that is only suitable for washing. Most households buy drinking water from kiosks or obtain from handcart vendors but use other sources for non-drinking water.

5.6.7 Competitor analysis

Competitor analysis is necessary for effective service and price differentiation. It is important to consider the current situation with regard to infrastructure in order to formulate or develop feasible service options, and thus propose feasible service differentiation for respective market segments. A summary of the existing situation in each market segment is presented in table 5.11.

Table 5.11

<table>
<thead>
<tr>
<th>Market Segment by type of dwelling</th>
<th>Piped connections</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ind. hse connection</td>
<td>Shared connection</td>
</tr>
<tr>
<td>Bungalows/Maisonettes</td>
<td>93.4%</td>
<td>12.1%</td>
</tr>
<tr>
<td>Flats</td>
<td>77.6%</td>
<td>27.8%</td>
</tr>
<tr>
<td>1,2 or 3 Roomed hse or Swahili Hse</td>
<td>22.7%</td>
<td>49.5%</td>
</tr>
<tr>
<td>Dwelling in Informal settlement or Slum</td>
<td>2.5%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Total</td>
<td>45.2%</td>
<td>11.9%</td>
</tr>
</tbody>
</table>

Table 5.11 reveals that existing competitors have come about to fill the vacuum left by NWCPC. For instance, 94% of respondents in informal settlements do not have a water connection from NWCPC. Since potential customers in this market segment must be obtaining water from other sources, there is an opportunity for NWCPC to capture more of this market, provided that suitable service options are developed. The survey revealed that as a result of NWCPC’s inadequate services in all market
segments, customers also use other sources of water. The main source of water for customers in various market segments is shown in table 5.12.

Table 5.12

<table>
<thead>
<tr>
<th>Main source of water</th>
<th>% within Market Segment by type of dwelling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bungalows/Maisonettes</td>
</tr>
<tr>
<td>Indiv. Connections</td>
<td>59.2%</td>
</tr>
<tr>
<td>Shared Connections</td>
<td></td>
</tr>
<tr>
<td>Water Kiosks</td>
<td>6.9%</td>
</tr>
<tr>
<td>Hand-Cart Vendors</td>
<td>7.9%</td>
</tr>
<tr>
<td>Water Tankers</td>
<td>5.3%</td>
</tr>
<tr>
<td>Public B/holes&amp;wells</td>
<td></td>
</tr>
<tr>
<td>Private B/holes&amp;wells</td>
<td>2.6%</td>
</tr>
<tr>
<td>Own B/holes&amp;Wells</td>
<td>25.0%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

It should also be noted that there are illegal connections that constitute part of the competition. Because of their nature, illegal connections were not recorded in the customer survey, and the utility would need to implement a programme of discovering and registering them.

Competitors in the bungalows and maisonettes market segment.

Table 5.12 (above) shows that NWCPC is the main source of water to 59% of customers in this market segment. The main competitors in this market segment are customers through private boreholes and wells. Both handcart and water tanker vendors offer some competition to the utility. The market share that competitors command is as follows:

- Private boreholes and wells (28%)
- hand cart water vendors (8%)
- water tankers vendors (5%)
Competitors in the flats market segment

NWCPC is the main source of water to 83% of customers in this market segment. NWCPC has limited competition in this market segment from handcart vendors (7%), water kiosks (7%) and public boreholes and wells (3%). The market share that competitors command is as follows:

- Public boreholes and wells (3%)
- hand cart water vendors (7%)
- kiosks (7%)

Some of the water sold through kiosks comes from NWCPC while the rest comes from private wells or boreholes.

Competitors in the Swahili houses market segment

NWCPC is the main source of water to 40% of customers in this market segment. 44% of customers use kiosks as their main source of water. Some of the water sold through kiosks comes from NWCPC. The market share that competitors command is as follows:

- kiosks (44%)
- Boreholes and wells (14%)
- hand cart water vendors (2%)

Competitors in the informal settlements (slums) market segment

Most customers (94%) in this market segment do not have any water connections; NWCPC directly serves only about 6% of customers in this segment. The main source of water for 70% of customers is kiosks. Some of the water sold through kiosks comes from NWCPC. 75% of customers are satisfied with drawing water from kiosks. Of those who are not satisfied with services from kiosks, 34% cite inadequate quantity or pressure as the cause. 53% cite cost and 13% cite low quality as the cause for their dissatisfaction. The market share that competitors command is as follows:

- kiosks (70%)
- Boreholes and wells (22%)
- hand cart water vendors (2%)
Private operators manage most kiosks (98%) and community groups manage only 2%. The focus group discussions held in three informal settlements revealed that potential customers in this market segment perceive the water obtained from NWCPC’s pipelines to be of high quality. Table 5.13 shows the range of existing water sources and customers’ preferences indicated by the group ranking.

Table 5.13 Existing water sources (competition) and group ranking (preference for sources) in three informal settlements

<table>
<thead>
<tr>
<th>Service option</th>
<th>Kisumu Ndogo (men)</th>
<th>Kisumu Ndogo (women)</th>
<th>Muoroto Paradise (men)</th>
<th>Muoroto paradise (women)</th>
<th>VOK (men)</th>
<th>VOK (women)</th>
<th>Overall ranking of existing sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary water kiosk</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kiosk with no structure</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Water collected from shallow well (salty water)</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>Roof catchment</td>
<td>N/A</td>
<td>N/A</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Borehole or well with pump (salty water)</td>
<td>3</td>
<td>5</td>
<td>N/A</td>
<td>N/A</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Hand cart vendor (from kiosk or from wells and boreholes)</td>
<td>4</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Water tanker (free water supplied during severe shortages)</td>
<td>N/A</td>
<td>4</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Traditional source (pools of rain water, often muddy)</td>
<td>N/A</td>
<td>6</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

"1" is most preferred, "6" is least preferred and "N/A" is not applicable to the informal settlement.

Table 5.13 (above) shows that there is a wide range of water sources in informal settlements with kiosks being the most preferred water source. All groups considered
kiosks to be providing the best quality water. The focus group discussions revealed that the few people with connections receive water at low pressure and containers often take a long time to fill up. Most of the alternative water sources (apart from some handcart vendors) provide water of low quality that is only suitable for washing. Most households buy drinking water from kiosks or obtain from handcart vendors but use other sources for non-drinking water.

The demand for clean water through NWCP’s pipelines is high as indicated by a high willingness to pay for improved water services. NWCP is therefore well placed to compete with other water sources in this segment.

**Summary of competitor analysis in all market segments**

In order to meet existing competition, NWCP should improve water services to customers who are already connected but are not receiving adequate services. It is evident from the customer survey that existing and potential customers are relying on alternative water sources mainly because of NWCP’s failure to provide appropriate services. NWCP is clearly well placed to compete with other water sources in all market segments. The utility should also extend water services to customers who are presently not served.

**5.6.8 PEST analysis of the utility (NWCP)**

Political, Environmental, Social and Technological (PEST) analysis of NWCP was carried out as part of the institutional analysis in order to understand the environment in which NWCP operate. This is essential for effective service and price differentiation.

**Political Analysis**

- NWCP is under political pressure to improve services to existing customers and extend services to those not currently served.
Some politicians may prefer that provision of water services remain in the public sector. Some do not favour necessary reforms in the water sector (such as commercialisation or privatisation). This could be a threat to NWCPC.

- Political interference in the management of NWCPC (such as in appointment of senior staff, disconnection of water to defaulters and supply of goods and services)
- Political reluctance to increase water tariffs, thus keeping tariffs below cost recovery levels.
- Pressure and interference from international finance agencies such as the World Bank and others in management of NWCPC

Environmental Analysis

- It is not environmentally feasible to provide a conventional water distribution network in informal settlements that are not connected to a wastewater collection system. It is only feasible to extend pipelines to a limited number of yard connections and kiosks for on selling. Lack of drainage in informal settlements poses environmental problems.
- Development of additional water supply infrastructure (water production and transmission facilities) has to meet the environmental impact assessment criteria.

Social Analysis

- Water is considered a social necessity and so NWCPC staff face low social status caused by the current insufficient water supply to customers.
- Enforcing payment for water through disconnection for some customers (such as hospitals and schools) is socially unacceptable.
- 39% of Mombasa population is classified as absolute poor and living below the poverty line (MFP, Second report on Poverty in Kenya, 2000). (Urban poverty in Kenya is defined as those earning less than KSh2648 per capita a month). This constitutes a high proportion of NWCPC's customers and potential customers. The customer survey found that though these people are poor, they have aspirations for high levels of service that they can hardly afford. Focus group
discussions in three informal settlements estimated monthly household expenditure at KSh6683/= per month. This is about US$0.5 per capita per day) assuming a family of six.

- The key macroeconomic indicators show that the Kenyan economy generally performed poorly in the 1990s due to local and global factors. The country is in its fourth successive year of economic stagnation (recession) and that is against a background of a decade of less than 2 per cent annual economic growth. The El Niño rains of 1997/98 and subsequent prolonged drought has made the situation worse. The continued slowdown in economic performance is reflected in virtually all the key sectors of the economy (MFP, Kenya Economic Survey, 2000). Virtually all NWCPC’s customers and potential customers are adversely affected by the poor state of the economy.

**Technological Analysis**

Future water sources include distant ones such as Mzima and Nchoro springs, which have potential to meet water requirements in Mombasa and the coastal area at minimal energy costs (NWCPC, 1995-1997). It is hoped that the Sabaki ground water source, though high on energy costs, will continue producing good yield, thus keeping treatment costs low. In terms of water supply infrastructure, there is no technological risk because water supply technology is known and has been tested.

NWCPC faces a persistent problem with billing computer hardware and software. Several systems have been installed without much success (NWCPC, 2000). Accurate billing in a fully metered distribution system with intermittent water supply is a big challenge to many water utilities in developing countries.

**5.6.9 SWOT analysis of the utility (NWCPC)**

Apart from PEST, a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of NWCPC was carried out as part of an institutional analysis. NWCPC has key strengths that could enable the utility to exploit the enormous opportunities available in Mombasa and the coastal region. If the few weaknesses are attended to,
the utility could reduce the existing threats and ensure survival. NWCP has the potential to thrive and meet its objectives.

**NWCP’s Strengths**

NWCP has several key strengths:

- NWCP has an existing (though inadequate) water supply infrastructure
- NWCP has experienced staff (though not customer focused)
- All customers in Mombasa know NWCP (even without advertising its services).
- NWCP has good income from industrial and commercial customers, such as tourism.
- NWCP has potential gravity water supply systems even though they are distant sources

**NWCP’s Weaknesses:**

- Water supply infrastructure is inadequate, especially water production transmission and distribution facilities (NWCP, 1995-1997)
- Low morale among staff (staff motivation is low), possibly due to low remuneration caused by poor financial performance.
- Staff not customer focused (lack of commercial attitude among staff and management). This has resulted to over-billing of some customers among other mal-practices.
- Customer database is inadequate or inaccurate
- Weakness in debt collection

**NWCP’s Opportunities:**

- Legal mandate to operate water services in Mombasa as a monopoly (Laws of Kenya Cap.446, 1988)
- Ready market for water as customers’ requirements are not currently being met by suppliers
- Customers used to paying high charges for water services due to shortages
High density urban settlements offer economies of scale for water distribution. To capture a greater proportion of the water supply market, particularly in low-income areas and informal settlements. Increasing income from industrial and commercial customers, especially tourism. Political support for reforms in the water sector, especially commercialisation of water services. This is a good opportunity for NWCPC to transform itself into a thriving efficient and effective utility.

NWCPC’s Threats:

NWCPC’s threats consist of:

- Competitors in the water market (vendors, private and public boreholes and wells)
- Low tariffs due to delay and/or inability to review tariffs
- Mombasa City does not have any water sources close by; All sources are far away with distances of between 50 and 220 kilometres.
- The cost of main production inputs (electricity and chemicals) is rising fast due to performance of local economy relative to the global economy.
- Influence of politics on the water sector, especially inability of NWCPC to increase water tariffs at will.
- Reluctance of the World Bank to fund the new bulk water scheme that is urgently required, unless substantial private sector participation occurs.
- Competition for investment funds with other equally deserving sectors such as health, transport and education
- Subsidy that NWCPC Mombasa and coastal region gives to other regions

Institutional improvements would need to be made in order to address the weaknesses identified in the institutional analysis.

5.6.10 Summary of NWCPC’s institutional analysis

NWCPC’s main interest groups (or stakeholders) consist of the following:

- its employees who expect good salaries and allowances,
- its customers who expect good services at reasonable cost,
• its suppliers of goods and services (chemicals, electricity, pipes, fittings, stationery, etc) who expect continued business and prompt payments for goods supplied and services rendered, and

• The government (the shareholder) who expect NWCPC to provide reliable water services to existing customers at reasonable costs, and for NWCPC to extend water coverage to potential customers by financing new projects using profits made from its existing water supply infrastructure.

A look at NWCPC’s institutional analysis reveals that none of the above stakeholders are satisfied with its present performance. Each of the stakeholders wishes that NWCPC could improve its efficiency and effectiveness. NWCPC has a low efficiency of operation as indicated by performance indicators commonly used in the water sector. The customers’ perceptions of NWCPC are that service delivery is often characterised by water shortages, intermittent supply at low pressure or no water at all.

This perception points to the need for NWCPC to improve its efficiency and effectiveness. This can be done through institutional improvements.

The customer survey further revealed that only 46% of households in Mombasa receive water services directly from NWCPC and even these do not receive continuous supply of water. Of those who receive water directly from NWCPC,

• 46% receive for more than 4 hours
• 36% receive for 2 to 4 hours and
• 18% receive for less than 2 hours.

The average expenditure/total income ratio for NWCPC (including headquarters and all regions) over 4 years (1995 to 1999) is 121% while the average expenditure/collections for NWCPC Coast Region is 11% over the same period (NWCPC, 2000). This show that coast region is subsidising other regions. Despite the cross subsidy between regions, the overall financial status of NWCPC is not healthy (NWCPC, 2000). The shareholder (government) has to continue to finance new water projects instead of receiving dividends or similar inducements from NWCPC. It may be concluded from the foregoing that NWCPC is not meeting its objectives and there
is considerable room for improvement. It is therefore imperative that NWCPC develops an effective plan so as to safeguard its future.

5.6.11 Summary

This chapter has provided analysis of information on “where are we now “ in the Mombasa case study. It is evident from the survey that most of the existing and potential customers in Mombasa are not satisfied with existing water services. The survey shows that NWCPC has a big challenge in meeting the water requirements of existing and potential customers in Mombasa. There are however opportunities for the utility (NWCPC) to improve water services. The next chapter (6) addresses the discussion based on “where does the utility (NWCPC) want to be” and “how it might get there” using the MSSPD approach.
CHAPTER 6: Case study of Market Segmentation, Service and Price Differentiation (MSSPD) of water services in Mombasa, Kenya: The way forward

6.1 Chapter introduction and outline

This chapter is a continuation of the Mombasa case study that was introduced in chapter 5. Chapter 5 presented the context of the case study and a discussion on “where are we now” in Mombasa. In this chapter, discussion on “where do we want to be” and “how might we get there” (in the context of urban water services in Mombasa) is presented. A summary of the findings of the Mombasa case study is also presented.

6.2 Where does the utility (NWCPC) want to be?

6.2.1 Review of objectives

The aim of market segmentation, service and price differentiation of urban water services is to offer feasible service options, to obtain amounts that people are willing to pay and then to select the most popular service levels. The rationale is to give people what is possible, what they want and what they are willing to pay for. This management approach conforms to NWCPC’s objectives. NWCPC’s mission is stated as follows (NWCPC, 1995):

"The Corporation is committed to providing a regular supply of high-quality water to its customers at an affordable price and at a reasonable profit to the corporation."

In order for NWCPC to successfully work towards achieving its mission, it is necessary to improve the services it offers to customers, as they are important stakeholders. It is also necessary to extend water services to those within Mombasa that are not receiving services. This includes people living in informal settlements (slums) whose population is increasing. The reason for this is to enable NWCPC capture more of the water market and hence improve its financial position.
("reasonable profit to the corporation") and also for purposes of equity ("to provide a regular supply of high quality water to customers"). NWCPC should also improve its customer services. Since NWCPC faces severe infrastructure constraints, attainment of these objectives will require investment in new infrastructure for bulk supply and distribution.

Successful achievement of these objectives has a better chance when water services are differentiated and priced to suit the requirements of respective market segments. Different service options could be adopted for different market segments, and priced according to customers’ willingness to pay while taking into account the full cost of service provision.

A key area of improvement is customer services such as billing, revenue collection and general customer relations. These non-technical "software" issues ought to go hand in hand with infrastructure (technical) improvements and together constitute service quality. Improvements in service quality can result to enhancement of customers' perception of the value of the service. Customers are often willing to pay a premium for the increased service quality where service quality is defined as "the degree of excellence intended, and the control of variability in achieving that excellence, in meeting the customer's requirements" (Lovelock, 1992). Success in improvements in service delivery is dependent on NWCPC’s pricing policies, and these are considered in the next section.

6.2.2 Proposed pricing policies

The proposed pricing policy is derived from the utility’s objectives reflected in its mission statement. The part that is relevant to the pricing policy is the reference to “affordable price” and “reasonable profit”. An indication of “affordable price” is obtained from the customers’ willingness to pay (WTP). Whether or not the utility will make a “reasonable profit” will depend on how the total cost of providing water services to customers compares with the total revenue received by the utility from the sale of water to customers.
As discussed in chapter 2, financial objectives of a water utility determine the pricing policy and hence the tariff policy to be adopted. Development of a tariff policy requires consideration of the following key factors:

- Existing service levels,
- Existing tariffs and revenue,
- Water demand as demonstrated by customers' willingness to pay and
- Investment needs.

Conducting a customer survey helps reveal customers' preferences and perceptions on existing levels of service. The contingent valuation method can be used to determine the customers' willingness to pay (WTP). The Average Incremental Cost (AIC) method is considered suitable for determining levels of tariffs that a water utility such as NWCPC would need to charge in order to meet investment costs for improved water services.

By comparing WTP data with AIC data, a water utility can develop a tariff policy that aims to meet the twin objectives of acceptability by customers while enabling the utility to be financially sustainable. An effective tariff policy is that which results in a level of tariffs that the water utility could successfully implement and achieve financial sustainability.

It is prudent for a water utility to aim for full cost recovery as a way of meeting the challenge of water provision for the rising urban population. Where possible, cross subsidy could be applied between service levels, or between market segments.

Both the customer survey and the infrastructure analysis carried out show that Mombasa is a capacity constrained city. In addition to other measures, it is necessary to increase the capacity of the water supply infrastructure in order to improve customer services.

In order for water utilities to be self sustaining and sustainable in the long term, it is important that all costs of water provision are be recovered from the users. It is therefore expected that revenues generated by the sale of water to customers will meet
the full cost of improving the water supply infrastructure. It is therefore necessary to
determine the level of tariffs that would be applied in Mombasa to support the new
investment.

A water utility may base the level of tariffs on historical costs or future costs.
Historical costs may be determined easily from a water utility’s financial statements
and then tariffs set accordingly to meet the utility’s financial objectives. Future costs
are more difficult to determine. Engineering studies are necessary to enable definition
of future water projects whose costs and benefits are then estimated and tariff set
accordingly.

In order to be sustainable, it is expected that NWCPC would apply the principles of
project finance, that seek to set tariffs to recover operation and maintenance costs plus
full amortisation of the capital costs (O & M costs plus paying back any loans
including interest).

For the new water project in Mombasa, it is considered appropriate to use the average
incremental cost (AIC) method to calculate the future cost of water and hence set
tariffs accordingly. As stated in chapter 2, the AIC represents the average or long run
marginal cost over a longer period of time. For NWCPC, setting the tariff at AIC
means that the tariff is equal to the average cost of producing water from the next

6.2.3 Projected costs and tariffs

Projected costs and proposed tariffs are dependent on successful implementation of
the proposed project to improve water services in Mombasa and the coastal area.

Project components and costs

Recent engineering studies concluded that there was need to improve bulk water
supply and to strengthen the distribution network in Mombasa and the coastal area
(NWCPC, 1995-1997). Among other outputs, the studies defined two main project
components:
• Bulk water supply development for Mombasa and
• Improvements to water distribution network in Mombasa.

**Bulk supply component**
The total construction cost of the bulk supply component was estimated in 1996 at US$194.8 million, excluding land acquisition and consultancy services during construction (NWCPC, 1995-1997). Assuming a 10% increase in cost since then and a further 4% to cover minimal consultancy services, the cost of construction is now estimated at US$222.85 million.

The operation and maintenance costs for the bulk supply were estimated at US$1.82 million per year for a 1.0 m³/s capacity pipeline. It is assumed that these costs will remain constant for the life of the project since flow of water is by gravity throughout the 220km long pipeline.

**Improvements to water distribution network**
The construction cost for the component to improve the distribution network was estimated in 1996 at US$54.0 million, excluding land acquisition and consultancy services during construction (NWCPC 1995-1997). Assuming a 10% increase in cost since then and a further 4% to cover minimal consultancy services the cost of this component is now estimated at US$61.78 million.

Operation and maintenance costs of the reticulation system have been assessed using Malindi area data, as it is readily available from the ongoing management contract. It is also appropriate to use Malindi data because most supply areas in Mombasa and the coastal region are understaffed, under provided with transport and equipment and have significant deficits in supply. The data from Malindi was adjusted to make it relevant to other areas.

Analysis of various NWCPC's reports by consultants suggests that the optimal unit operation and maintenance cost for Baricho source bulk supply is US$0.59 per m³ (NWCPC, 1990-2000). The optimal operation and maintenance costs for Mombasa
distribution system with commercial management is estimated at about Ksh27/= (US$0.37) per m³.

Total capital costs for bulk supply and improvements in distribution network

The total capital costs to implement both the bulk supply component and improvements in distribution network is estimated at US$284.63 (about US$285 million).

Determination of Average Incremental Cost (AIC)

Basis of the Average Incremental cost calculation
As stated in chapter 2, the Average Incremental Cost (AIC) is determined by assuming that the most economic output is where Long Run Marginal Costs equal Long Run Marginal Revenue (Barker, 1993).

In the Mombasa case study, AIC was calculated by dividing the present value (PV) of all incremental capital, operating and maintenance costs (C) by the present value (PV) of the incremental consumption (W) over the design life of the facilities to be constructed (Barker, 1993).

\[
AIC = \frac{PV\ C(\$)}{PV\ W (m^3)}
\]

The present values were determined by discounting the cash flows and consumption quantities at a discount rate that equals the opportunity cost of capital to the national economy. The opportunity cost is taken to be the real value of resources used in the most desirable alternative. This formula was used to determine the AIC for different development scenarios for Mombasa and the coastal area.

Project Scenarios

Two different scenarios for determination of the average incremental cost (AIC) for Mombasa are considered. The scenarios are based on implementing the two project components recommended by the recent engineering studies. It is assumed that NWCPCT succeeds in obtaining low interest, long term investment capital to undertake
bulk supply development, transmission and distribution works. The following assumptions have been made to facilitate determination of AIC costs:

- Capital costs are only incurred at the end of construction period, after which the project starts to produce benefits.
- The only benefits delivered by the project are in form of revenue from sale of water. In practice, infrastructure projects, and more so water projects, deliver social and economic benefits, most of which cannot be easily quantified.
- Annual operation and maintenance (O & M) costs are constant. In many infrastructure projects, O & M costs increase over time as the infrastructure gets old. O & M costs could also reduce over time if management efficiency increases in the operations and maintenance phase of a project.
- The life of the project is assumed to be only 25 years for purposes of calculating the AIC. Most gravity based water projects deliver benefits for longer periods, sometimes as long as fifty to a hundred years. The existing Mzima pipeline water project is over 40 years old and still producing the same quantity of water it was producing 40 years ago at minimal operation and maintenance cost.
- The quantity of water produced by the infrastructure and sold to customers is constant throughout the life of the project. In conventional practice, some water projects operate at a low capacity on commissioning and achieve full production capacity a few years later as population and water demand increases. Since Mombasa is a capacity constrained city with suppressed demand, high willingness to pay but with problems of obtaining investment capital, it is assumed that the project now under consideration will be operated at full capacity soon after commissioning. Other projects will come on line after a few years to help meet the water demand of the growing population.

The total capital cost for both components is US$285 million. Provision for rehabilitation of the system is made at US$10 million. It is assumed that this amount will be spent in the 10th year after commissioning. It is assumed that the full costs of improving the water supply system will be met from water sales from the entire region. The following further assumptions are made:
• Financing is secured at 8% per annum with a grace period equal to the construction period so that repayments commence after commissioning when water is sold to customers.

• Management of the distribution system will be on commercial basis (The estimated costs assume that commercial management would be engaged).

The operation and maintenance cost for Sabaki (Baricho) water source has been estimated at US$0.59) per m³. It is assumed that Marere and Tiwi maintain production at capacities of 12,000 and 6,000 respectively and that Baricho source maintains its present contribution of 72,000m³/day. The total amount of water distributed by the strengthened network is assumed to be 176,400m³ (86,400+12,000+6,000+72,000).

Scenario 1 assumes a high level of management efficiency estimated at 15% unaccounted for water (UFW) and 90% bill collection efficiency. For this scenario, the average incremental cost of water is US$1.08 per m³. With the present exchange rate of KSh73/= to the US$, the Average Incremental Cost is about Ksh78.85/= per m³.

Scenario 2 assumes a lower level of management efficiency at 20% unaccounted for water (UFW) and 85% bill collection efficiency. For this scenario, the average incremental cost of water is US$1.21 per m³. With the present exchange rate of KSh73/= to the US$, the Average Incremental Cost is about Ksh88.30/= per m³.

Detailed calculations for each of the two scenarios are presented in appendix 6.

Selected scenario for tariff setting

For purposes of setting tariffs the worst case scenario in terms of management efficiency, that is scenario 2 at 20% UFW and 85% bill collection efficiency is selected. In order to break even, the average tariff should be set equal to the Average Incremental Cost (AIC), that is US$1.21 per m³ (Ksh88.30/= per m³).

Assuming that water is available throughout the day, a middle class person living in a bungalow or maisonette in a well-planned residential area of Mombasa with an individual house connection would probably consume about 150litres per day.
the average number of people in a household is six, the total monthly consumption for such a household 27m³ per month. Using the average tariff according to the AIC calculation, the household described here would pay the utility KSh2384/= per month as the monthly water bill.

From considerations of cost of water provision, an average tariff of US$1.21 per m³ (or Ksh88.30/= per m³) is sufficient for the utility to break even. Tariff design requires other considerations, such as customers' willingness to pay (WTP). Willingness to pay studies yield useful results when the bidding game starts at a level that reflects what is likely to be the cost covering tariffs. The results of this calculation were therefore used to inform the starting point of the bidding game. The monthly water bill for the highest level of service was set at KSh2500/= per month, a little (5%) higher than the estimated level of KSh2384/= per month.

The next section looks at the results of the willingness to pay (WTP) survey in order to develop the tariff policy.

6.2.4 Proposed and feasible options

It is proposed to offer different service options at different prices, to various market segments from the menu of options. The proposed service options offer varying levels of service with different management and payment systems.

Market segments 1 and 2: People who live in Bungalows, Maisonettes or Flats in planned areas.

Three levels of service (service levels 1, 2 and 3) were offered to households who live in a bungalow or maisonette constructed of permanent building materials, or in a flat, located in a well planned area, or in an area where the planning process is in progress. The building should either have a water connection with internal plumbing, or has the capacity for a water connection with internal plumbing in the future.
Service level 1: Continuous water supply to an individual house connection in a planned area with bungalows, maisonettes or flats

Good quality piped water through the customers’ individual house connection with adequate pressure to be able to reach second floor of a storey building, with continuous supply. The proposed price range is KSh1200/-to KSh2500/- per month (highest tariff informed by AIC calculation).

Service level 2: 12-Hour water supply to an individual house connection in a planned area with bungalows, maisonettes or flats

Good quality piped water through the customers’ individual house connection with adequate pressure to be able to reach a roof tank of a bungalow or maisonette, supplied on rationing basis, with about 12-hour water supply every day. The proposed price range is KSh800/-to KSh1200/- per month.

Service level 3: 4-Hour water supply to an individual house connection in a planned area with bungalows, maisonettes or flats

Good quality piped water through the customers’ individual house connection with adequate pressure to be able to reach a roof tank of a bungalow or maisonette, supplied on rationing basis, with at least 4-hours water supply every day, to be provided at suitable times in the morning and evening. The proposed price range is KSh500/-to KSh800/- per month.

Market segment 3: People who live in 1, 2 or 3 roomed dwellings and Swahili houses in planned areas

Four levels of service (service levels 4, 5, 6 and 7) are offered to households who live in shared buildings constructed of permanent or semi-permanent building materials and located in a planned area. This includes 1, 2 or 3 roomed dwellings and Swahili houses with or without internal plumbing located in planned areas of the city. Dwellings in this category do not have an individual water connection. Residents will
most likely have a yard tap serving a number of families who live in the shared building. Water services may be extended inside the dwellings when owners carry out internal plumbing in the future.

**Service Level 4: Continuous water supply to a shared yard connection in a planned area with 1, 2 or 3 roomed dwellings or Swahili Houses**

Good quality piped water through a shared yard connection with adequate pressure to be able to reach second floor of a storey building, with continuous supply providing enough water at the tap in the compound of the dwelling. Water is available continuously for 24 hours every day. Households obtain water from the tap in the compound any time of the day or night. Households may extend water inside their dwellings whenever they carry out plumbing.

The proposed price range is KSh1200/-to KSh2500/- per month.

**Service Level 5: Continuous water supply to a shared yard connection with storage tank in a planned area with 1, 2 or 3 roomed dwellings or Swahili Houses**

Good quality piped water through a shared yard connection providing enough water at the tap in the compound of the dwelling. The utility provides a storage tank next to the shared yard connection so that the tank receives and stores water. Households can draw water from the yard connection continuously even during the rationing hours because of the storage tank. When plumbing in the dwelling is done, water can be extended inside the dwelling.

The proposed price range is KSh1200/-to KSh2500/- per month.

**Service Level 6: 12-Hour water supply to a shared yard connection without storage tank in a planned area with 1, 2 or 3 roomed dwellings or Swahili Houses**

Good quality piped water through a shared yard connection providing water at a tap in the compound. Water is supplied on rationing basis for 12 hours every day. Households obtain water from the tap in the compound. Households can extend water inside the dwelling whenever plumbing in the dwelling is done.

The proposed price range is KSh800/-to KSh1200/- per month.
Service Level 7: 4-Hour water supply to a shared yard connection without storage tank in a planned area with 1, 2 or 3 roomed dwellings or Swahili Houses

Good quality piped water through a shared yard connection providing water at the tap in the compound. Water is supplied on rationing basis, in the morning and evening for a minimum period of 4 hours every day. Households can obtain water from the tap in the compound only in the mornings and evenings for a total of 4 hours. When plumbing in the dwelling is done, water can be extended inside the dwelling. The proposed price range is KSh500/-to KSh800/- per month.

Market segment 4: People living in informal settlements (slums)

Six levels of service (service levels 8, 9, 10, 11, 12 and 13) are offered to people living in informal settlements. This market segment consists of households who live in individual or shared dwellings constructed of temporary building materials such as recycled timber, packaging or mud walls with recycled corrugated iron sheet or polythene roof. Such dwellings are located in unplanned areas known as informal settlements or slums. Slums or informal settlements do not have infrastructure services such as roads and drainage. Dwellings do not have internal plumbing. Space for a yard tap and a storage tank (to be shared by about 10 dwellings) might be found if attempts are made to upgrade the slum and provide water services.

Service level 8: Continuous water supply to a shared yard connection with storage tank in an informal settlement

Good quality piped water through shared yard connection (shared by about 10 dwellings) providing water at the tap in the compound of the dwelling. The utility provides a pipeline, a storage tank, and a shared connection next to your dwelling so that the tank receives and stores water. Households share the connection and the storage tank and draw water from the yard connection continuously even during the rationing hours because of the storage tank. Because of this storage tank, households can obtain water from the tap in the compound for 18 to 24 hours a day. The proposed price range is KSh1200/-to KSh2500/- per month.
Service Level 9: 12-Hour supply to a shared yard connection in an informal settlement without tank

Good quality piped water through shared yard connection (shared by about 10 dwellings) providing water at the tap in the compound of the dwelling. The utility provides a pipeline that supplies water to the shared connection next to your dwelling on rationing basis for about 12 hours every day. Households obtain water from the tap in the compound shared with about 10 dwellings.

The proposed price range is KSh800/- to KSh1200/- per month.

Service Level 10: 4-Hour supply to a shared yard connection in an informal settlement without tank

Good quality piped water through shared yard connection (shared by about 10 dwellings) providing water at the tap in the compound of the dwelling. The utility provides a pipeline that supplies water to the shared connection next to your dwelling on rationing basis for 2 hours in the morning and 2 hours in the evening, a maximum period of 4 hours every day. Households obtain water from the tap in the compound shared with about 10 dwellings.

The proposed price range is KSh500/- to KSh800/- per month.

Service Level 11: Privately managed water kiosk with shelter and storage tank in an informal settlement

Good quality piped water through an improved water kiosk that is provided with a shelter (suitable building), a storage tank and several taps. The improved water kiosk obtains water from the utility’s pipelines. The kiosk is metered and is privately managed by an operator who pays the water bill for the water sold to NWCPC. The kiosk is open from 7 a.m. to 7 p.m. daily, and good quality water from the NW CPC pipeline is available throughout the day with adequate pressure.

The proposed price range is KSh3/- to KSh7/- per 20-litre container bought from the kiosk. (This price was informed by existing prices and is higher than AIC).
Service level 12: Community managed water kiosk with shelter and storage tank in an informal settlement

Good quality piped water through an improved water kiosk that is provided with a shelter (suitable building), a storage tank and several taps. The improved water kiosk obtains water from the utility’s pipelines. The kiosk is metered and is managed by a community group. The community group operates the kiosk and then pays water bills to NWCPC for the water consumed as measured by the water meter. The kiosk is open from 7 a.m. to 7 p.m. daily, and good quality water from the NWCPC pipeline is available throughout the day with adequate pressure.

The proposed price range is KSh1/-to KSh6/- per 20-litre container bought from the kiosk. (This price is higher than AIC; it was informed by existing prices).

Service level 13: Privately managed ordinary water kiosk without shelter or storage tank in an informal settlement.

Good quality piped water through an ordinary water kiosk (a tap without any storage tank or structure) supplied with water by NWCPC pipeline through a water meter to record consumption. An operator privately manages the water kiosk and sells water in units of 20litres and then pays water bills to NWCPC. The kiosk is open from 7 a.m. to 7 p.m. daily.

The proposed price range is KSh1/-to KSh4/- per 20-litre container bought from the kiosk. (This price was informed by existing prices and is higher than AIC).

6.2.5 Willingness to pay for selected options

A key aspect of the proposed service and price differentiation approach is to offer feasible service options in respective market segments, to obtain amounts that people are willing to pay and then to select the most popular service levels. The rationale is to give people what is possible, what they want and what they are willing to pay for.
Willingness to pay (WTP) using contingent valuation method (CVM)

A key aspect in pricing for water and setting tariffs is to predict what consumers are willing to pay for water. A key indicator for this aspect is "Willingness to pay" (WTP) that was discussed in chapter 2. In economic terms, WTP is the maximum value that consumers are willing to pay for improved water services. The contingent valuation method (CVM) is a survey technique that attempts to elicit information about individuals' or households' preference for a good or service, and was discussed in section 2.7.7 (chapter 2). As stated in chapter 2, the CVM has been the favoured demand assessment technique used in low-income countries for water and sanitation projects (Whittington et al, 1987, 1990 and 1991).

The contingent valuation method was used in Mombasa to estimate the amount of money that households are willingness to pay (WTP) for various service options. Different service options were offered to respondents according to their market segments and their willingness to pay was obtained. Market segmentation was done on the basis of type of dwelling. Combinations of quota, stratified and random sampling techniques were used to select the households to be interviewed. The 312 households interviewed were spread over the four geographical locations in Mombasa and represented all the four market segments. Respondents were requested to state the amount of money they are willing to pay for the stated service option.

The results of the willingness to pay studies reveal that both customers and potential customers are willing to pay substantial amounts for improved water services. Willingness to pay levels are generally much higher than the existing utility water tariffs. In addition, respondents were willing to pay for service levels higher than they are receiving at present. Data on willingness to pay study conducted using the contingent valuation method was analysed using the SPSS (version 10) computer software. The focus group discussions held in three informal settlements confirmed the results of the willingness to pay study that was also conducted in informal settlements. A summary of willingness to pay for different service options in different market segments is presented in the tables 5.14, 5.15 and 5.16.
Table 5.14: Willingness to pay (WTP) for different service options offered to people living in Bungalows, maisonettes and flats

<table>
<thead>
<tr>
<th>Service level (option)</th>
<th>Brief Description of service option</th>
<th>Market Segment</th>
<th>Percentage of respondents within market segment who bid for the stated service option</th>
<th>Weighted Mean WTP (KSh)</th>
<th>Amount above which 2/3 of respondents who bid are WTP (KSh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service level 1</td>
<td>Continuous supply at House connection</td>
<td>People living in Bungalows, Maisonettes and Flats</td>
<td>99%</td>
<td>1568</td>
<td>1217</td>
</tr>
<tr>
<td>Service level 2</td>
<td>12-Hr supply at House connection</td>
<td>Ditto</td>
<td>97%</td>
<td>858</td>
<td>850</td>
</tr>
<tr>
<td>Service level 3</td>
<td>4-Hr supply at House connection, rationing</td>
<td>Ditto</td>
<td>32%</td>
<td>341</td>
<td>250</td>
</tr>
</tbody>
</table>

Table 5.15: Willingness to pay (WTP) for different service options offered to people living in 1, 2 or 3 roomed dwellings and Swahili Houses

<table>
<thead>
<tr>
<th>Service level (option)</th>
<th>Brief Description of service option</th>
<th>Market Segment</th>
<th>Percentage of respondents within market segment who bid for the stated service option</th>
<th>Weighted Mean WTP (KSh)</th>
<th>Amount above which 2/3 of respondents who bid are WTP (KSh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service level 4</td>
<td>Continuous supply at yard connection</td>
<td>People in 1, 2 or 3 Roomed dwellings &amp; Swahili Houses</td>
<td>100%</td>
<td>1124</td>
<td>834</td>
</tr>
<tr>
<td>Service level 5</td>
<td>Continuous supply with storage tank at shared yard connection</td>
<td>Ditto</td>
<td>100%</td>
<td>1023</td>
<td>800</td>
</tr>
<tr>
<td>Service level 6</td>
<td>12-Hr supply at shared yard connection</td>
<td>Ditto</td>
<td>62%</td>
<td>537</td>
<td>447</td>
</tr>
<tr>
<td>Service level 7</td>
<td>4-Hr supply at shared yard connection</td>
<td>Ditto</td>
<td>54%</td>
<td>395</td>
<td>336</td>
</tr>
</tbody>
</table>
Table 5.16: Willingness to pay (WTP) for different service options offered to people living in informal settlements

<table>
<thead>
<tr>
<th>Service level (option)</th>
<th>Brief Description of service option</th>
<th>Market Segment</th>
<th>Percentage of respondents within market segment who bid for the stated service option</th>
<th>Weighted Mean WTP (KSh)</th>
<th>Amount above which 2/3 of respondents who bid are WTP (KSh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service level 8</td>
<td>Continuous supply with storage tank at shared yard connection (about 10 dwellings)</td>
<td>People living in dwellings in informal settlements (slums)</td>
<td>98%</td>
<td>1103</td>
<td>592</td>
</tr>
<tr>
<td>Service level 9</td>
<td>12-Hour supply at shared yard connection (about 10 dwellings), rationing</td>
<td>Ditto</td>
<td>95%</td>
<td>610</td>
<td>500</td>
</tr>
<tr>
<td>Service level 10</td>
<td>Ditto but 4-Hour supply</td>
<td>Ditto</td>
<td>63%</td>
<td>302</td>
<td>236</td>
</tr>
<tr>
<td>Service level 11</td>
<td>Privately managed kiosk with shelter and tank</td>
<td>Ditto</td>
<td>54%</td>
<td>3/50 per 20-litre container</td>
<td>3/25 per 20-litre container</td>
</tr>
<tr>
<td>Service level 12</td>
<td>Community managed kiosk with shelter &amp; tank</td>
<td>Ditto</td>
<td>48%</td>
<td>3/= per 20-litre container</td>
<td>2/65 per 20-litre container</td>
</tr>
<tr>
<td>Service level 13</td>
<td>Privately managed kiosk, no shelter or tank</td>
<td>Ditto</td>
<td>10%</td>
<td>1/50 per 20-litre container</td>
<td>1/60 per 20-litre container</td>
</tr>
</tbody>
</table>

Tables 5.14, 5.15 and 5.16 show that existing and potential customers are willing to pay different amounts for different service options or levels. In particular, households are willing to pay substantially higher amounts for higher service levels than for lower service levels. Data analysis also shows that the more affluent market segments display a higher willingness to pay than less affluent market segments. Within each market segment, variation of willingness to pay for a particular service option is minimal. These findings confirms that people are willing to pay different amounts for different service options, hence validating the concept of market segmentation, service and price differentiation.
Estimate of willingness to pay (WTP) using focus group discussions

In addition to the willingness to pay study using the contingent valuation method, focus group discussions were held in three informal settlements in order to obtain customers' perceptions of existing water services and their preferences for improved service options. Participants of the focus group discussions were drawn from different parts of the informal settlement. In order to create a relaxed environment, men and women held separate group discussions to discuss the same issues in each informal settlement. Each group had a facilitator, an assistant, a reporter and a water engineer to explain the menu of water service options. A menu of service options priced at different levels were offered to the focus groups and discussed. The groups discussed advantages and disadvantages of each service option as well as the cost attached to the option.

**Group ranking of priced service options by all participants (consensus)**
The focus groups ranked the options in order of preference, with the most preferred being ranked 1st position and least preferred 6th position. The following table shows the results of group ranking of service options by each of the three informal settlements and by gender. Table 5.17 shows that customers have greater preference for community and privately managed kiosks than for shared yard connections.
Table 5.17: Group ranking of priced service options by informal settlement and by gender

<table>
<thead>
<tr>
<th>Service option</th>
<th>Kisumu Ndogo (men)</th>
<th>Kisumu Ndogo (women)</th>
<th>Muoroto Paradise (men)</th>
<th>Muoroto paradise (women)</th>
<th>VOK (men)</th>
<th>VOK (women)</th>
<th>Overall ranking of option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Level 8</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Shared yard connection with storage 18-24 hrs. KSh1200/= per month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service level 9</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Shared yard connection with no storage, 12 hrs supply KSh800/= per month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service level 10</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Shared yard connection with no storage, 4 hrs supply KSh500/= per month</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service level 11</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Privately managed water kiosk with storage KSh3/= per 20 litre container</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service level 12</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Community managed water kiosk with storage KSh2/= per 20 litre container</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service level 13</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Privately managed ordinary water kiosk KSh2/50 per 20 litre container</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Individual ranking of priced service option through voting by each participant (secret ballot)

After the group ranking, individual participants were also given an opportunity to rank the options individually by secret ballot. Each participant was given three ballots: large, medium and small. Participants were requested to vote for the most preferred option using the large ballot (3 points) and for the second and third most preferred using the medium (two points) and small (one point) ballot respectively.
The votes given by participants to each option were added together and the options ranked, with the most preferred option being ranked 1st position and least preferred 6th position.

Table 5.18 shows that community and privately managed kiosks are in higher demand than shared yard connections. The following table shows the results of individual ranking of service options by participants in each of the three informal settlements and by gender. The results of individual ranking were different from those of the group ranking.

Table 5.18: Individual ranking of priced service options by informal settlement and by gender

<table>
<thead>
<tr>
<th>Service option</th>
<th>Kisumu Ndogo (men)</th>
<th>Kisumu Ndogo (women)</th>
<th>Muoroto Paradise (men)</th>
<th>Muoroto paradise (women)</th>
<th>VOK (men)</th>
<th>VOK (women)</th>
<th>Overall ranking of option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Level 8 Shared yard connection with storage 18-24 hrs. KSh1200/= per month</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Service level 9 Shared yard connection with no storage, 12 hrs supply KSh800/= per month</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Service level 10 Shared yard connection with no storage, 4 hrs supply KSh500/= per month</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Service level 11 Privately managed water kiosk with storage KSh3/= per 20 litre container</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Service level 12 Community managed water kiosk with storage KSh2/= per 20litre container</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Service level 13 Privately managed ordinary water kiosk KSh2/50 per 20litre container</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Selection of service and management options

In selecting which service options to provide to which market segment, it is important to consider existing service levels and willingness to pay for each segment. The existing service levels are summarised in table 5.19.

Table 5.19

**Water supply frequency * Market Segment by type of dwelling Crosstabulation**

% within Market Segment by type of dwelling

<table>
<thead>
<tr>
<th>Water supply frequency</th>
<th>Market Segment by type of dwelling</th>
<th>1,2 or 3 Roomed hse or Swahili Hse</th>
<th>Dwelling in Informal settlement or Slum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bungalows/ Maisonnettes</td>
<td>Don't receive water directly from NWCPC</td>
<td>34.6%</td>
<td>17.2%</td>
<td>57.7%</td>
</tr>
<tr>
<td></td>
<td>Once a day</td>
<td>17.9%</td>
<td>25.9%</td>
<td>19.6%</td>
</tr>
<tr>
<td></td>
<td>Twice a day</td>
<td>9.0%</td>
<td>13.8%</td>
<td>4.1%</td>
</tr>
<tr>
<td></td>
<td>Once in 2 or 3 days</td>
<td>6.4%</td>
<td>8.6%</td>
<td>4.1%</td>
</tr>
<tr>
<td></td>
<td>Once a week</td>
<td>1.3%</td>
<td></td>
<td>13.4%</td>
</tr>
<tr>
<td></td>
<td>Continuous</td>
<td>29.5%</td>
<td>31.0%</td>
<td>13.4%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1.3%</td>
<td>3.4%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 5.19 shows that about 30% of people living in bungalows, maisonettes and flats are receiving a continuous supply of water. Since willingness to pay for continuous supply of water is high, it is proposed to offer this service to customers in the first two market segments. In order to reduce the risks associated with promising a high level of service, it is proposed to redefine a continuous water service to be that service where water is available for between 12 and 24 hours. It is possible for the utility to provide this service since most customers (79%) already have individual water storage that can last for 2 days or more. Table 5.20 shows that 79% of households have 2 days water storage or more. This is substantial investment by customers in their efforts to improve water services.
Table 5.20

<table>
<thead>
<tr>
<th>Water storage time in days</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 5 days</td>
<td>60</td>
<td>19.2</td>
<td>19.3</td>
<td>19.3</td>
</tr>
<tr>
<td>5 days</td>
<td>14</td>
<td>4.5</td>
<td>4.5</td>
<td>23.8</td>
</tr>
<tr>
<td>4 days</td>
<td>19</td>
<td>6.1</td>
<td>6.1</td>
<td>29.9</td>
</tr>
<tr>
<td>3 days</td>
<td>60</td>
<td>19.2</td>
<td>19.3</td>
<td>49.2</td>
</tr>
<tr>
<td>2 days</td>
<td>92</td>
<td>29.5</td>
<td>29.6</td>
<td>78.8</td>
</tr>
<tr>
<td>1 day</td>
<td>66</td>
<td>21.2</td>
<td>21.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>311</td>
<td>99.7</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>312</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.20 also shows that it not necessary for the utility to provide additional storage at the point of consumption and that the usual storage provided for strategic reasons and balancing flows in the city is perhaps adequate. In order to further increase reliability of water services, the utility could provide a storage tank at the yard connection to store water and enable customers to draw water from the tank even when there is no water in the pipeline.

Results of willingness to pay studies show that there is considerable demand for 9 out of the 13 service options offered to customers. Detailed results of analysis of willingness to pay (WTP) for each of the 13 service options offered to existing and potential customers were carried out using SPSS (version 10) computer software. A summary of the results was presented in tables 5.14, 5.15 and 5.16 (section 5.7.5). The 9 service options with considerable demand are as follows:

1. Service level 1: Continuous water supply to an individual house connection in a planned area with bungalows, maisonettes or flats
2. Service level 2: 12-Hour water supply to an individual house connection in a planned area with bungalows, maisonettes or flats
3. Service Level 4: 24-Hour supply at yard connection
4. Service Level 5: 24-Hour supply at yard connection (with storage tank)
5. Service Level 6: 12-Hour supply at yard connection (without storage tank)
6. Service Level 8: 18-24 Hour supply at yard connection with storage tank shared by about 10 dwellings in informal settlements
7. Service Level 9: 12 Hour supply at yard connection shared by about 10 dwellings in informal settlements
8. Service Level 11: Privately managed water kiosk with shelter, storage tank and several taps
9. Service Level 12: Community managed water kiosk with shelter, storage tank and several taps

It is proposed that a service option for which willingness to pay (WTP) is low should not be offered. The following 5 out of 13 service levels offered are not popular as they only have minimal demand:

1. Service Level 3: 4-Hour supply at individual house connection (with rationing) to people living in bungalows, maisonettes and flats
2. Service Level 7: 4-Hour supply at yard connection (with rationing) to people living in 1, 2 or 3 roomed dwellings and Swahili houses.
3. Service Level 10: 4-Hour supply at yard connection shared by about 10 dwellings in informal settlements
4. Service Level 13: Privately managed ordinary water kiosk without shelter or storage tank.

Results of willingness to pay study show substantial demand for yard connections in informal settlements. During the focus group discussions conducted in the informal settlements, all the groups expressed reservations about management of shared yard connections. Participants said that there would be disagreements on how to share the bill, since consumption would vary from one household to the other and there would be no control over use of water. For this reason and also considering environmental factors (such as drainage), shared yard connections will be offered only to suitably selected locations in informal settlements.

It is further proposed to merge some service levels and provide the following service options:

1. Service level 1: 12-24 Hour supply at individual house connection to people living in bungalows, maisonettes and also in flats (former service levels 1 and 2 merged into one service).
2. Service level 2: 12-24 Hour supply at shared yard connection with a storage tank in 1,2 or 3 roomed dwellings and Swahili houses.

3. Service level 3: 12-24 Hour supply at shared yard connection (without storage) in 1,2 or 3 roomed dwellings and Swahili houses, and also in informal settlements.

4. Service level 4: 12-24 Hour supply at shared yard connection with a storage tank shared by about 10 dwellings in informal settlements. This service to be offered at suitably selected areas in informal settlements taking environmental considerations into account. (Former service levels 8 and 9 merged)

5. Service level 5: 12-24 Hour supply at improved water kiosks (storage and structure provided) in areas with 1,2 or 3 roomed dwellings and Swahili houses and also in informal settlements for sale through privately managed kiosks. (Former service level 11)

6. Service level 6: 12-24 Hour supply at improved water kiosks (storage and structure provided) in areas with 1,2 or 3 roomed dwellings and Swahili houses and also in informal settlements for sale through community managed kiosks. (Former service level 12)

6.2.6 Estimates for options take-up

Estimates for option take up are made on the basis of population distribution and customers' willingness to pay, which is an indication of demand for service options.

**Population distribution in Mombasa**

According to results of the 1999 census, Mombasa population is estimated at 700,000, and the population distribution according to market segments is estimated to be as follows (MFP, Kenya, 2000):

- Proportion of population living in Bungalows & Maisonettes = 25%
- Proportion of population living in flats = 15%
- Proportion of population living in 1,2 or 3 roomed dwellings & Swahili Houses = 40%
- Proportion of population living in informal settlements = 20%

Population is concentrated in the low-income areas. Global trends and data on the country's economic indicators show that the above population distribution is likely to remain as it is in the medium and long term (MFP, Kenya, 2000).
Estimates for options take-up (Product positioning)

On the basis of the survey findings, the following estimates for take-up of service and management options are proposals are made.

*Service level 1: 12-24 Hour supply at individual house connection.*

This service will be offered to people living in market segments 1 and 2 (those living in bungalows, maisonettes and also in flats)
Based on the results of the willingness to pay study, it is estimated that all (100%) customers in these two market segments will take up this service option.

*Service level 2: 12-24 Hour supply at shared yard connection*

This service will be offered to people living in 1, 2 or 3 roomed dwellings and Swahili houses. The service will also be offered to people living in selected parts of informal settlements, taking environmental factors into account. It is estimated that 90% of customers in 1, 2 or 3 roomed dwellings and Swahili houses will take up this service option. It is further estimated that 10% of customers living in informal settlements will take up this service option.

*Service level 3: 12-24 Hour supply at privately or community managed improved kiosks*

There are a few customers living in 1, 2 or 3 roomed dwellings and Swahili houses who do not wish to share connections and thus pay monthly water bills. It is proposed that the utility will provide water to improved water kiosks in this market segment to serve such customers. Private operators or community groups may manage the kiosks. It is estimated that 10% of customers living in 1, 2 or 3 roomed dwellings and Swahili houses would meet their water requirements through kiosks.

It is proposed that the utility will extend water pipelines to viable parts of informal settlements to sell water to improved water kiosks. The water kiosks would then serve as water distribution points with the aim of reaching all customers in informal
settlements. Private operators or community groups may manage the kiosks according to demand. It is estimated that 90% of customers in informal settlements would meet their water requirements through kiosks.

The estimates for options take-up in each market segment are summarised in table 5.21.

Table 5.21: Take up of service options by Market segment

<table>
<thead>
<tr>
<th>Market segment by type of dwelling</th>
<th>Percentage of population in market segment</th>
<th>Estimated Population in Market segment</th>
<th>Service options and proportion of take-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bungalows &amp; Maisonettes</td>
<td>25%</td>
<td>175,000</td>
<td>12-24 Hour supply at individual house connection (100%)</td>
</tr>
<tr>
<td>Flats</td>
<td>15%</td>
<td>105,000</td>
<td>1. 12-24 Hour supply at individual connection (80%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. 12-24 Hour supply through shared connection (20%)</td>
</tr>
<tr>
<td>1, 2 or 3 roomed dwellings &amp; Swahili Houses</td>
<td>40%</td>
<td>280,000</td>
<td>1. 12-24 Hour supply at individual connection (25%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. 12-24 Hour supply at shared yard connection (30%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. 12-24 Hour supply at shared yard connection with Swahili storage tank (30%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Privately managed kiosks with storage (10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. Community managed kiosks with storage (5%)</td>
</tr>
<tr>
<td>Informal settlements (Slums)</td>
<td>20%</td>
<td>140,000</td>
<td>1. 12-24 Hour supply at shared yard connection (10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. 12-24 Hour supply at shared yard connection with Swahili storage tank (10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Privately managed kiosks with storage (40%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Community managed kiosks with storage (40%)</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>700,000</td>
<td></td>
</tr>
</tbody>
</table>

6.2.7 Projected revenues

Projected revenues are calculated from consumption estimates, assumed take up of service options, proposed tariffs based on willingness to pay, equity and the need for financial sustainability.
Estimated consumption

It is assumed that consumption will vary with the service option provided to the market segment and the segment’s willingness to pay. As billing will be based on metered consumption, the water tariff will also influence the actual consumption. It is estimated that people living in bungalows and maisonettes, and who are supplied with water for 12-24 hours at individual house connections (100%) will consume an average of 150 litres/capita per day.

It is further estimated that people living in flats and supplied with water for 12-24 hours at individual connections (80%) will consume an average of 100 litres/capita per day. Those living in flats and with shared connections (20%) are also expected to consume an average of 100 litres/capita per day.

People living in 1, 2 or 3 roomed dwellings and Swahili houses and supplied with water for 12-24 hours through individual connections (25%) will also consume an average of 100 litres/capita per day while those with shared yard connections (60%) will consume an average of 60 litres/capita per day. It is estimated that people living in this market segment and who will obtain water from privately or community managed water kiosks (15%) will consume an average of 20 litres/capita per day.

People living in dwellings in informal settlements who will be supplied with water for 12-24 hours through shared yard connections (20% of market segment) are also estimated to consume an average of 60 litres/capita per day. It is estimated that the balance of 80% of people living in dwellings in informal settlements who will obtain water from privately or community managed water kiosks will consume an average of 20 litres/capita per day. Consumption estimates are based in part by on the results of the customer survey carried out in Mombasa.

The volume of water sold through each of the service options to different market segments can be calculated using the population distribution, assumed option take up and the above consumption estimates. This calculation is moderated using the results of willingness to pay study.
Proposed tariffs
Based on the discussion presented in section 2.7 on pricing urban water services, and in order to meet the full costs of acceptable water services in Mombasa while taking into account customers’ willingness to pay and equity, the following tariffs are proposed:

1. 12-24 Hour supply at individual house connection: KSh60/m³
2. 12-24 Hour supply at shared house (flat) connection: KSh55/m³
3. 12-24 Hour supply at shared yard connection with storage: KSh50/m³
4. 12-24 Hour supply at shared yard connection (no storage): KSh45/m³
5. 12-24 Hour supply at improved water kiosks for resale: KSh25/m³ (resale tariff to be determined by the market)
6. 12-24 Hour supply to commercial, industrial or institutional customers: KSh120/m³

Projected revenue
Detailed calculations of the projected revenue for each service option are presented in appendix 7. A summary of the financial aspects of this plan is presented in appendix 8. The summary of the projected revenue is presented in Table 5.22.

<table>
<thead>
<tr>
<th>Proposed water supply options</th>
<th>Expected volume of water sold and paid for (m³/yr)</th>
<th>Proposed water tariffs based on WTP survey (KSh/m³)</th>
<th>Projected income from each service option (KSh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-24 Hour supply at individual House connection</td>
<td>14,691,250</td>
<td>60</td>
<td>881,475,000</td>
</tr>
<tr>
<td>12-24 Hour supply at shared House (Flat) connection</td>
<td>766,500</td>
<td>55</td>
<td>42,157,500</td>
</tr>
<tr>
<td>12-24 Hour supply at yard connection with utility storage tank</td>
<td>2,146,200</td>
<td>50</td>
<td>107,310,000</td>
</tr>
<tr>
<td>12-24 Hour supply at yard connection (no utility tank)</td>
<td>2,146,200</td>
<td>45</td>
<td>96,579,000</td>
</tr>
<tr>
<td>12-24 Hour supply at water kiosks with storage and structure (privately or community managed)</td>
<td>1,124,200</td>
<td>25</td>
<td>28,105,000</td>
</tr>
<tr>
<td>12-24 Hour supply to commercial, industrial and institutional customers</td>
<td>22,925,650</td>
<td>120</td>
<td>2,751,078,000</td>
</tr>
<tr>
<td>A1.1 Total</td>
<td>43,800,000 m³</td>
<td></td>
<td>KSh3,906,704,500</td>
</tr>
</tbody>
</table>

Table 5.22 shows that the total projected revenue for the utility is KSh3,906,704,500 per annum. The proposed average water tariff is KSh89/20 (about US$1.20) per m³.
Assuming that the total annual costs to cover both capital and recurrent expenditure remains at the estimated amount of KSh3,854,400,000, then the utility can make a modest profit amounting to KSh52,304,500 (about US$716,500) per annum. This profit is in conformity with the utility’s mission statement that specifies a “reasonable profit”, and this can be used to improve water services in other areas. The utility can therefore meet the requirements of customers and still be financially sustainable.

6.3 How might the utility (NWCPC) get there?

The Mombasa study shows that in order for NWCPC to meet its objectives (such as improving customer services and attaining financial sustainability), there is need for investment in new infrastructure and improvements in management.

6.3.1 Infrastructure improvements

Analysis of the existing situation carried out in Mombasa through market segmentation, and presented in section 5.6 showed that improvement of services is hampered by inadequate water supply infrastructure. In order for the utility to provide services adequately and reliably, it is necessary to invest in new infrastructure, especially new sources of water. Recent engineering studies commissioned by the utility confirmed that Mombasa was experiencing severe water shortages, mainly because the existing water supply infrastructure does not meet the water requirements of customers. Several international consultancy firms undertake engineering studies and defined the next investment project for Mombasa. The studies concluded that there was need to improve bulk water supply to the city and also to strengthen the distribution network. Among other outputs, the studies defined two main project components (NWCPC, 1995-1997):

- Bulk water supply development for Mombasa and
- Improvements to water distribution network in Mombasa.
Bulk supply development for Mombasa
The most feasible bulk supply investment for Mombasa was identified to be the second Mzima pipeline. The second Mzima pipeline was proposed as the most favourable short/medium term solution to satisfy the growing water demand at Mombasa and in the coastal region on the basis of cost, reliability and simplicity of operation. The amount of water abstraction for the second Mzima pipeline project was set at 1.0 m$^3$/s (86,400 m$^3$/day) in order to meet environmental considerations. The project comprises abstraction works (the Sourceworks), the main 220km long transmission pipeline to Mazeras, additional storage and the extension pipelines for bulk distribution of supplies to Mombasa (NWCPC, 1995-1997).

Improvements to water distribution network in Mombasa
Apart from improving bulk supply of water to Mombasa, it is necessary to rehabilitate and strengthen the distribution system to allow efficient distribution of the additional bulk supply and also to reduce unaccounted for water (UFW). The engineering studies assessed the existing distribution system and proposed improvements aimed at

- Providing adequate supply to all customers with a distribution network that can satisfy target water demand (2020)
- Reducing water losses

Improvements to sewerage infrastructure in Mombasa
It is good environmental engineering practice to improve the sewerage system whenever any improvements in bulk supply and water distribution are being considered. Provision of additional water to customers invariably leads to additional wastewater that needs to be collected, treated and disposed of.

This plan assumes that the costs of improving the water system include those for improving the sewerage system. Similarly, since current water bills in Mombasa already include a component for sewerage charges (based on a percentage of water consumption), the projected revenue will cater for both water and sewerage. This assumption is made on the basis that separate billing for sewerage is not considered feasible as no sanctions can reasonably be effected if customers default in payments for sewerage services.
Criteria for selection of infrastructure investment project

There are technical, environmental and economic reasons for selection of the bulk supply source (NWCPC 1995-1997). Detailed justification of the selected option is beyond the scope of this case study (Project details can be found in consultancy reports on the recently concluded Second Mombasa and Coastal Water Supply: Engineering and Rehabilitation project). The selected development option is the most feasible technically and economically and it also meets environmental considerations.

It is assumed that the utility will be able to secure the required funding (US$285million) for bulk supply development, transmission and improvements to the distribution system. It is further assumed that for reasons of equity, all utility's customers in coast region will contribute to financing of this development project. In order to finance this investment successfully, NWCPC will need to charge an average tariff of Ksh88.30/= per m3 to customers in Mombasa and the coastal area. Apart from improving the water supply infrastructure, NWCPC also needs to market services to existing and potential customers.

6.3.2 Marketing strategies for water services: The seven Ps (marketing mix)

Improvements in management of water services include marketing of water services in all market segments. The basis of marketing is market segmentation, service and price differentiation, which have been described in the previous sections. After segmenting the market, the next task is to make an appropriate choice of marketing activities that actually deliver services that customers perceive to be of value. The means by which such ideas are turned into reality is what is known as the marketing mix. The marketing mix or the 7p's of marketing (product, price, promotion, place, people, process and presence) are key aspects to be reviewed by the utility in order to respond adequately to demand in respective market segments. A typical marketing mix for the water sector is shown in table 5.23 below.
Table 5.23: A typical Marketing Mix (7 P’s) for a water utility
(Adapted from Booms and Bitner, 1981 cited by Brassington and Pettitt, 2000)

<table>
<thead>
<tr>
<th>Product</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer options menu (inc. technology, service level, price, management arrangements, payment choices based on consumer preferences and utility ability to deliver)</td>
<td>Tariff structure</td>
</tr>
<tr>
<td></td>
<td>Discounts for shared management schemes</td>
</tr>
<tr>
<td></td>
<td>Profitability</td>
</tr>
<tr>
<td></td>
<td>Competitiveness</td>
</tr>
<tr>
<td></td>
<td>Incentives</td>
</tr>
<tr>
<td></td>
<td>Willingness to pay</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Promotion</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising (paper based, loudspeaker, radio, press releases)</td>
<td>Market segmentation plan</td>
</tr>
<tr>
<td></td>
<td>Ability to supply target group</td>
</tr>
<tr>
<td></td>
<td>Local external influences and/or political dynamics</td>
</tr>
<tr>
<td></td>
<td>Local competitive advantage</td>
</tr>
<tr>
<td></td>
<td>Local logistical support (decentralised O&amp;M, payment schemes and customer services)</td>
</tr>
<tr>
<td></td>
<td>Different products in different market segments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>People</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of customer relationship</td>
<td>Agreeing the 7P’s</td>
</tr>
<tr>
<td>Two-way communication structures and mechanisms</td>
<td>Quality control</td>
</tr>
<tr>
<td>Development of trust</td>
<td>Service delivery reliability and consistency</td>
</tr>
<tr>
<td>Understanding perceptions and expectations</td>
<td>Streamlined services (connections, customer inquiries, complaints, re-connection)</td>
</tr>
<tr>
<td>Loyalty to existing / potential service provider</td>
<td></td>
</tr>
<tr>
<td>Customer feedback</td>
<td></td>
</tr>
<tr>
<td>HRD/capacity building</td>
<td></td>
</tr>
<tr>
<td>Liaison and partnerships with civil society, NGO’s, donors</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Premises (decentralised/centralised)</td>
<td></td>
</tr>
<tr>
<td>Accessibility of utility to customers</td>
<td></td>
</tr>
<tr>
<td>Customer service office (location, atmosphere, image, accessibility, ease of use)</td>
<td></td>
</tr>
<tr>
<td>Local liaison teams/officers</td>
<td></td>
</tr>
<tr>
<td>Corporate image</td>
<td></td>
</tr>
</tbody>
</table>
Marketing has been defined earlier as being about satisfying customer requirements profitably. In the water sector, this concept is increasingly expressed as being “demand responsive”, which implies moving away from the traditional “supply driven” method of designing water supply projects according to some preconceived ideas (“standards”) about customer requirements. Many water supply projects designed using the traditional supply driven method have often proved unsustainable. Being demand responsive involves the development of a process approach to service delivery that is based on effective dialogue, communication and trust between the water supplier (utility) and the customer, not consumer, where the customer is the household and/or community. Since different segments of customers have different requirements and capabilities (such as willingness to pay), there is need for the water utility to get the appropriate marketing mix, hence effective service and price differentiation.

The “mix” in marketing is crucial because satisfying customers’ requirements is dependent on adequate attention to all the elements of the marketing mix (product, price, promotion, place, people, process and presence). For instance, the introduction of “improved community managed water kiosks” that are supplied with portable water by the utility (product) will be more effective if there is good communication (people and promotion), and in appropriate market segments or areas (place), at competitive and fair tariffs that people are willing to pay (price), through a process where trust develops between all parties resulting in a win-win outcome for all. Adequate presence of the utility is also important in terms of accessibility to the utility for customers and other key stakeholders, as well as a positive image projected by the utility of itself as a capable organisation devoted to service improvement for all customer groups. Some of the prerequisites for achieving an optimum marketing mix are briefly discussed in the preceding sections.

**People dwelling in bungalows and maisonettes**

Almost all customers (94%) in this market segment have individual connections. NWCPc is currently the main source of water to 59% of customers in this market segment. 25% use private wells or boreholes as their main source of water because water supply by NWCPc is insufficient. NWCPc clearly has a competitive advantage
in this market segment. 35% of customers do not receive water directly from NWPC. Only 30% of customers receive a continuous supply of water. These figures show that the main marketing strategy for NWPC is to increase water supply to customers while promoting the quality aspects of the water. In order for NWPC to utilise its competitive advantage in this market segment and improve its revenue position, it needs to improve water services.

The water utility (NWPC) should:

- Increase the quantity of water and also pressure; this calls for additional investment in source-works (water production), transmission and distribution.
- Read meters regularly and bill customers on actual meter readings (consumption)
- Prepare and despatch water bills to customers promptly
- Repair or replace broken down meters
- Improve general customer service (this could be done by training all NWPC staff who have contact with customers on customer service, relations and management).

People living in Flats

NWPC is the main source of water to 83% of customers in this market segment. NWPC has limited competition in this market segment from handcart vendors (7%), water kiosks (7%) and public boreholes and wells (3%). 17% of customers do not receive water directly from NWPC. Only 31% of customers receive a continuous supply of water. NWPC could utilise its competitive advantage in this market segments by:

- In the short term, invest in construction of water kiosks at strategic locations in order to sell water to those who cannot receive it in their flats through their individual connections due to low pressure. The kiosks could be improved by provision of a storage tank to enable drawing of water using multiple taps and hence reduce queues.
- Read meters regularly and bill customers on actual meter readings (consumption)
- Prepare and despatch water bills to customers promptly
- Repair or replace broken down meters
• Improve general customer service (this could be done by training all NWCPC staff who have contact with customers on customer service, relations and management).
• Increase the quantity of water and also pressure; this calls for additional investment in source-works (water production), transmission and distribution.

People living in Swahili houses

NWCPC is the main source of water to 40% of customers in this market segment. 44% of customers use kiosks as their main source of water while 14% use boreholes and wells. Some of the water sold through kiosks comes from NWCPC. Boreholes and wells are the main competitors of NWCPC in this market. Customers perceive borehole water to be of low quality, and they use this source mainly because water supply by NWCPC is insufficient. NWCPC clearly has a competitive advantage in this market segment. Of those who receive water directly from NWCPC, only 13% receive it continuously. These figures show that the main marketing strategy for NWCPC is to increase water supply to customers while promoting the quality aspects of the water. In order for NWCPC to utilise its competitive advantage in this market segment and improve its revenue position, it needs to improve water services.

In addition to the above measures the water utility (NWCPC) should provide more water and construct improved kiosks at strategic locations in this market segment.

People living in informal settlements (slums)

Most customers (94%) in this market segment do not have any water connections; NWCPC directly serves only about 6% of customers in this segment. Competitor analyses show that kiosks are the main source of water for 70% of customers. The strategy here is for NWCPC to ensure that all water sold through kiosks is billed for and payments made based on actual meter readings. Since 75% of customers are satisfied with drawing water from kiosks, NWCPC should extend water pipelines and construct more kiosks at suitable locations in this market segment. 34% of customers who are not satisfied with services from kiosks cite inadequate quantity or pressure
and 53% cite cost as the cause for their dissatisfaction. This means that if NWCP can construct more kiosks with a storage tank provided, more customers will be satisfied. An increase in the number of improved kiosks will result in a reduction of the cost of water to customers. The price of water per 20litre container (currently an average of KSh3/10 during normal times and KSh5/80 during shortages) is likely to go down. With reduced prices, customers are more likely to use more water; thus NWCP can increase sales and hence obtain more revenue.

An important aspect in this market segment is for the utility to allow, and even promote on-selling of water. Those who have connections should be encouraged to sell to others. In this way, water consumption would increase (with easier access to water), and the total amount of water sold in this segment will increase. As the water is metered, the revenues will increase from increased sale.

NWCP should also promote the high quality of its water delivered through kiosks. Such promotion is likely to result in more sales as customers abandon low quality untreated water obtained from boreholes and wells in favour of piped water obtained from NWCP. NWCP has the potential to capture the 22% market share currently taken by boreholes and wells in this market segment.

As it is not cost effective for NWCP to directly manage water kiosks, it is proposed to let private operators or community groups (where they exist) to manage kiosks on a franchise from NWCP.

Marketing of water services in this market segment requires effective dialogue with people living in informal settlements. This can be done through focus group discussions involving all stakeholders. Social workers from the Municipal council have good working relationships with the community and are an important entry point. Communities living in informal settlements also have their leaders who are often influential and can be useful for the utility to work with. It is suggested that NWCP should utilise these existing contacts and engage the community in meaningful dialogue at all stages of the project to improve water services in informal areas, and thereafter during the operational phase.
6.3.3 Improved customer relations/satisfaction

Various studies conducted in the water sector worldwide (such as Whittington et al, 1987, 1990, and 1991) show that households are willing to pay higher tariffs for water services if they perceive the service quality of the services to be good. Research in services management show that in order to add value to engineering-based service offerings whose products are governed by fixed standards, the utility needs to differentiate the products with functional quality attributes. For water utilities, such attributes include customer care by front desk staff and field staff, efficiency in billing, complaints monitoring and rapid response. Other attributes are service recovery period after service failure and office physical environment (Kayaga and Sansom, 2001).

Apart from the technical function of supplying water to customers, NWCPC therefore needs to pay attention to the manner in which it interacts with customers in the course of billing, revenue collection and other related activities. Due to the central role that water plays in peoples' daily lives, it is important that NWCPC communicates effectively with customers in a proactive way. As a start, NWCPC should deal with all customers in a courteous manner. Technology being what it is, it is inevitable that there will at times be interruptions in water supply or errors in billing. It is important for NWCPC to maintain an open channel of communication with customers at all times. Whenever interruptions in water supply occur, customers should be promptly advised.

An effective way of enabling NWCPC to improve customer relations is to train all members of staff to be customer orientated. An organisation that is customer orientated places the customer above all else and considers the customer to be king and not a water consumer. All activities of the organisation are then centred on the customer. Changes in tariff should be preceded or accompanied by effective information flow between the utility and customers, with explanation given for the need to revise tariffs. Customers should be treated with respect whenever they contact or visit NWCPC offices. All staff should answer customers' enquiries or queries promptly, accurately and fairly.
Recent research on customer service quality carried out in Kampala show that even when customers are satisfied with the technical attributes of water services (pressure, reliability, water quality), they can be dissatisfied with service attributes such as the complaint monitoring system at the utility's office and the high response time to billing complaints among other complaints (Kayaga and Sansom, 2001).

6.3.4 Utility institutional improvements

The SWOT analysis of NWCPC revealed its strengths, weaknesses, opportunities and threats. Analysis of NWCPC's financial performance and customers' perceptions show that NWCPC is not meeting its objectives and there is considerable room for improvement. It is therefore imperative that NWCPC develops a strategy to correct its weaknesses. Such a strategy has the potential to enable NWCPC to use its strengths and to take advantage of its numerous opportunities in order to achieve its stated objectives.

NWCPC was set up with the intention that it would provide water services in an efficient manner and on commercial basis. These intentions are well stipulated in the legislation establishing NWCPC. It is therefore crucial that the institution's structure reflects the stated objectives and for all staff to be commercially orientated. Staff who may still harbour public service attitudes should be identified and trained in commercial methods of water service delivery. A thorough audit of staff with details of the skills they possess should be undertaken to serve as the basis of human resources development.

A suitable management structure with clear lines of command should be followed with the Board of Directors giving the Managing Director a free hand to manage the corporation and meet the stated objectives without undue interference. Key tasks should be identified and allocated to suitably qualified and skilled staff. Where necessary, skills that are found lacking among existing staff should be procured from outside the utility. Appropriate delegation of authority and responsibility should be undertaken with necessary support, from top management to senior and middle management. Staff should be remunerated according to current market rates for commercially orientated organisations.
It is important that NWCPC should develop an organisational culture that is customer responsive. Strong organisational leadership is required to turn traditional product/production orientated ("supply driven") engineering based organisations such as NWCPC into customer orientated organisations. Some of the steps recommended are (Kayaga and Sansom, 2001):

- Basing recruitment of frontline staff on customer service orientation;
- Basing rewards/disincentives criteria on customer service enhancement;
- Training of staff in customer service;
- Internal customer care should be enhanced, since the customer contact staff will provide the same type of care to customers as they have received from their fellow staff or superiors;
- Making the organisational structure leaner in order to make it more responsive to the needs of the market;
- Strengthening the management information system and enhancing interdepartmental communication for the benefit of smooth information flow about, from and to the market;
- Setting up a marketing information system that will provide information for taking strategic decisions. This includes routine customer surveys, focus group discussions, market intelligence systems, stakeholder perceptions and opinions and public image perceptions;
- In order to make rapid progress in service coverage of low-income segments of the city, it may be necessary to appoint persons (s) with relevant specialisation in the social dynamics of low-income communities. The officer (s) would be in charge of liaison of the utility with the different communities, the city council officers, non-governmental organisations, community-based organisations and any other relevant stakeholders.

In addition, NWCPC should identify the core activities that must be carried out in-house by suitably skilled staff. Non-core activities or tasks that are more cost effectively and efficiently carried out by specialised firms should be contracted out to suitable private operators. Contracting out of services should be done competitively in an open and transparent manner in order to reap full benefits.
6.3.5 Partnerships with other stakeholders

A useful approach for the utility is to engage in partnerships with other stakeholders. Such stakeholders include community groups, co-operatives, religious groups, NGOs and the small-scale water providers. These partnerships have the potential to create additional viable management options, where the utility provides water in bulk for distribution by the stakeholders. Through appropriate partnerships, water can be extended to areas where the utility may find difficult to operate. By using appropriate tariff structure, the utility can meet its equity objectives of supplying water to all while recovering the costs of provision. In some instances, stakeholders can often manage water services at less cost than the utility, and this is additional incentive for the utility to forge viable partnerships.

6.4 Evaluation of benefits and risks of the plan

6.4.1 Benefits

The improvements proposed in this plan have potential to result in major benefits for NWCPC, its customers and other stakeholders.

Improvements in water services to customers living in all market segments will enhance equity as all customers could benefit from improved health, convenience and general wellbeing. In particular, benefits to potential customers who are currently not served include saving in time as a result of better accessibility to improved water services. The time that would otherwise be spent in collecting water from more distant water points would now be used in other productive activities that promote the economy of the country. Convenience for the customers is also a benefit that is difficult to quantify in monetary ways.

Potential health benefits from good quality water services include reduction of morbidity and mortality: Economic productivity of customers of piped water is enhanced due to better health, and also savings in medical expenses as a result of improved health. Other potential benefits to customers include creation of community
based employment as more people are employed in the various low-income community based service options, in partnership with the water utility for mutual benefit. Improvement of water services in low-income areas has the potential to facilitate creation of small-scale industries, which benefit the local people and the country as a whole through reduced unemployment.

Partnerships with people in low-income settlements has the potential to reduce illegal connections, and hence unaccounted for water, since a win-win situation is likely to result from service and price differentiation of services. In addition, reduction of unaccounted for water ensures more efficient economic use of water resources.

With all customers receiving improved water services, their willingness to pay and sustain payments will increase, and this could result in improved cashflow for NWPC. NWPC’s financial sustainability is likely to improve with the increase in its revenue base.

A financially healthy Mombasa and coast region is good news for other regions of NWPC and the rest of the country. This is because any profits from Mombasa could contribute to improvements of water services in other areas as provided for in NWPC’s mandate. A financially healthy NWPC is also good for the government since the exchequer would not need to finance the operations of NWPC. This saving could be used in other sectors of the economy for the good of the country.

Availability of reasonably priced water supply is an important input for industry (especially tourism) and commerce. Mombasa is an important seaport that serves not only Kenya but also other eastern and central African countries such as Uganda, Rwanda, Burundi, and the Democratic Republic of Congo. Mombasa’s strategic location as a seaport and a favourite holiday destination makes it important for Kenya’s economy. In recent years, the economic growth of Mombasa has been adversely affected by the frequent water shortages. Improvements in water services will therefore contribute to the economic growth of Mombasa and the coastal area and benefit the entire country. Above all, success of the plan has the potential to make NWPC financially sustainable, and thus ensure that it survives and thrives. The plan can enable NWPC to achieve its stated objective “to provide a regular supply of
high-quality water to its customers at an affordable price and at a reasonable profit to the corporation”.

6.4.2 Risks

All human activities are prone to risks, and this includes implementation of projects. Vickridge (in Smith (Ed), 1995) states that implementation of development projects in developing countries is particularly challenging because funding for projects is scarce, loan finance difficult to obtain and resources scarce. The plan outlined in this case study is based on forecasts of quantifiable variables such as demand, costs, water availability, institutional capacity and an enabling macro-environment. The values of different variables used in the case study were derived from field research and records held in the utility. Many factors may act to influence the outcome of any plan, however well researched and implemented. This section briefly discusses the risks that are inherent in the implementation of the plan, and which are relevant to the entire project. Comprehensive risk assessment and analysis, which considers the probability that changes in major quantifiable variables will actually occur, is beyond the scope of this case study.

In general, the risks inherent in the implementation of this strategic marketing plan include the following:

- Management risks (such as staff resistance to proposed organisational changes to embrace a marketing orientation, non-supportive organisational structure, inadequate technical and financial management capacity to manage the proposed plan);
- Financing risks (such as failure to secure funds at the expected concessionary rates of interest and repayment period);
- Construction risks (such as delays in construction periods);
- Political risks (such as political instability, changes in legal status of the utility and adverse political interference);
- Environmental risks (such as deterioration of raw water quality leading to higher water production costs and reduced yield of water sources);
- Social risks, such as poor participation by different market segments; and
• Economic risks, such as low economic growth rates, reduced levels of income and high rates of inflation.

During implementation of the plan, specific risks should be identified and allocated to the party best able to manage them. The most significant risks are likely to be management risks. Success of the plan therefore largely depends on suitably motivated top management who can articulate the benefits to be realised from implementation of the plan and win the support and confidence of the Board of Directors. The Board of Directors can successfully manage the political risks. With support by the Board of Directors, the top management can successfully carry out the necessary management improvements, seek long term finance from lenders to finance bulk supply and distribution network improvement project, and successfully implement the project.

6.4.3 How can the utility (NWCPC) ensure success of the plan?

This strategic marketing plan was prepared using commercial marketing approach to management of water services. Marketing principles have been successfully applied and used widely in different sectors. The approach has been piloted in places such as Durban, Republic of South Africa with successful results. It is therefore suggested that NWCPC should consider the ideas in this plan and implement with changes where appropriate.

Upon implementation of the plan, an efficient monitoring system with a feedback mechanism should be adopted to ensure continued benefits. The lessons learnt in Mombasa and the coastal area can be used to adapt the strategy and implement plans in other regions of NWCPC. It is expected that this approach has the potential to improve water services in all regions of NWCPC.

A summary of the Mombasa case study is presented in the next section.
6.5 Summary of Mombasa case study

The purpose of the Mombasa case study presented in chapters 5 and 6 was to provide answers to the following subsidiary questions that are relevant for this research:

7. What is the existing situation with regard to management of urban water services in Mombasa?
8. Are existing and potential customers in Mombasa satisfied with the existing water services?
9. How can water utilities such as NWCPC (Kenya) implement service and price differentiation of water services in Mombasa?
10. Are existing and potential customers living in the city of Mombasa willing to pay (WTP) for differentiated water services if marketed by the water utility at different prices?
11. Can urban water utilities such as NWCPC in Mombasa meet the costs of providing differentiated water services with prices set taking into account the customers' willingness to pay levels?

In this and the previous chapter, attempt has been made to answer the subsidiary research questions by presenting a detailed case study on market segmentation, service and price differentiation of water services in Mombasa. The Mombasa case study has provided an institutional analysis of the water utility mandated to manage water services in Mombasa, the National Water Conservation and Pipeline Corporation (NWCPC). The analysis included an assessment of the utility's existing water services. The case study presented and discussed findings of fieldwork research including results of a comprehensive customer survey and willingness to pay study carried out in Mombasa during August 2000.

The case study showed that the water utility is neither meeting its stated objectives, nor is it meeting the expectations of its stakeholders. In particular, the case study has showed that most of the existing and potential customers in Mombasa are not satisfied with the water services currently provided by the water utility (NWCPC). Many potential customers are not served by NWCPC and have resorted to alternative sources. Service delivery is often characterised by water shortages, intermittent supply
at low pressure or no water at all. This situation has resulted to a thriving water market in Mombasa. The study revealed that NWCPC faces a big challenge in meeting the water requirements of customers in Mombasa and the coastal area in a financially sustainable manner.

The results of the comprehensive customer survey and willingness to pay study for improved water services provided through different service options offered to respective market segments were analysed and presented in this chapter. A particularly useful and significant finding of the study is that existing and potential customers are willing to pay substantial amounts for improved water services.

The case study has showed how market segmentation, service and price differentiation can be used to improve water services in a financially sustainable manner. The case study has been presented in the form of a plan that water utilities can use to structure service delivery according to the requirements of the market segment and achieve financial sustainability. The case study has demonstrated that market segmentation, service and price differentiation is feasible in an infrastructure-constrained city such as Mombasa.

The Mombasa case study presented in this and the previous chapter has investigated the existing situation regarding water services to customers in Mombasa, and utility finances using in-depth interviews, observations, utility’s database and questionnaires. The plan shows that the utility can improve water services to existing and potential customers, meet its costs and achieve financial sustainability.

The next chapter reviews the findings of both the Durban and Mombasa case studies and concludes the thesis.
CHAPTER 7: Conclusions and Recommendations

7.1 Chapter outline

This chapter concludes the thesis by reflecting on the original aims and objectives of the research and makes conclusions based on the research findings. Implications of the research findings on management of water services in Sub-Saharan Africa are provided, limitations of the research are stated and suggestions for further research presented.

7.2 Conclusions and review of key objectives

7.2.1 Original aim and objectives

This research has examined the suitability and appropriateness of using a systematic approach consisting of market segmentation, service and price differentiation as a method of managing urban water services in Sub-Saharan Africa. In doing so, the thesis aims to provide water utilities with a holistic, systematic and flexible approach that can be used to provide improved water services to existing and potential customers, and achieve financial sustainability.

The problem of how to improve urban water services in the context of Sub-Saharan Africa was studied and understood from a number of different perspectives. A comprehensive literature review facilitated the process of defining gaps in existing knowledge and practice, with regard to holistic and effective approaches to improved management of urban water services in Sub-Saharan Africa. The literature review identified the key challenges facing urban water utilities in Sub-Saharan Africa. Existing key approaches in managing urban water services, including on-going reforms were identified and reviewed. The review highlighted doubts in the ability of water utilities in Sub-Saharan Africa to meet current challenges (and in particular keep up with the water requirements of the rising urban population), using existing conventional (supply driven) management approaches. The review confirmed that existing knowledge was weakest in relation to how water utilities could achieve the
twin objectives of improving urban water services (and also increasing water coverage to un-served areas) while also achieving financial sustainability, in Sub-Saharan Africa. In particular, the review identified the need for a holistic approach to management of urban water services in Sub-Saharan Africa, hence providing justification for the research reported in this thesis.

The central focus of the research was therefore to investigate how urban water services in Sub-Saharan Africa could be improved by following a holistic, systematic and flexible approach consisting of market segmentation, service and price differentiation.

The governing hypothesis of the thesis guided the research to investigate application of market segmentation, service and price differentiation in the context of managing urban water services in Sub-Saharan Africa. A key aspect of the research is the structuring of service delivery to provide water at appropriate service levels through feasible service options that meet the different needs of existing and potential customers (including low-income groups) at a price that they are willing to pay. Key subsidiary research questions focused on a number of issues such as customers' perceptions on the existing water services and their willingness to pay for differentiated services, with prices set at different levels. The governing hypothesis and research questions dictated the use of a mix of research methods within the overall methodological design of a case study research. Two cities in Sub-Saharan Africa (Durban and Mombasa) were considered in order to improve reliability of the findings. The analysis and presentation of the data from the Mombasa case study was done in a systematic manner, in accordance with the management approach under investigation in this research.

7.2.2 Findings and answers to research questions

Analysis of data from both the Durban and Mombasa case studies provide complementary findings and answers to the supplementary research questions framed to guide the research. The findings can be viewed at both general and specific levels. At their broadest level, the results and answers to the research questions provide a
useful insight into various issues around management of urban water services in Sub-Saharan Africa. Some of these are:

- There are different approaches currently employed to manage urban water services in Sub-Saharan Africa. Institutional options range from centralised government management to decentralised municipal management, often in combination with community management. Various forms of private sector participation (PSP) have increasingly been adopted as a way of improving services. Despite these approaches, service levels in many areas (especially in the low-income areas) are generally poor and coverage is low.

- There are huge disparities in levels of water services in Sub-Saharan Africa. Large proportions of the urban population (about 54% in Mombasa) are not served directly by the utilities. There is urgent and dire need for improving urban water services, especially coverage.

- Many existing and potential customers are dissatisfied with services provided by water utilities.

- Market segmentation, service and price differentiation can be implemented by water utilities in Sub-Saharan Africa. A useful and practical criterion that water utilities can use to segment the water market is to use the type of dwelling, which is easily identifiable and defines specific customer segments or groups.

- Stakeholders have different perceptions of the market segmentation, service and price differentiation (MSSPD) approach. Many customers show enthusiasm to the idea of actually selecting their preferred costed service options and readily provided responses during the customer survey and willingness to pay (WTP) study and also during focus group discussions. Utility managers and engineers who participated in the piloting of the approach were generally enthusiastic about the new approach.

- Existing and potential customers are willing to pay substantial amounts for improved water services. Higher service levels attracted higher WTP amounts.

- It is possible for water utilities to meet the costs of water provision with water prices set taking into account the customers' willingness to pay (WTP) levels.

Some of the specific findings are:

- People have different preferences for provision of water services. Service differentiation with suitable, appropriately priced service options aimed at
providing services that people need and can afford, is a suitable method of extending water services, particularly to poor sections of the urban community.

- Poor urban residents are willing to pay substantial amounts for improved water services
- A flexible project design based on limiting household consumption, hence minimising capital costs to the water utility, enables the utility to recover capital costs through cross-subsidy while charging the poor for the full operation and maintenance costs.
- It is possible for water utilities to improve services in informal areas through partnerships with small-scale private operators. This method has potential for effective and efficient management of water services at minimum cost to the utility.
- An important ingredient for success of service differentiation is political acceptance and dialogue with potential customers through appropriate communication channels.
- A suitable pricing policy, appropriate tariff structure and provision for flexible payment systems (such as prepayment) is essential for sustainable cost recovery and overall financial sustainability of differentiated services.

7.2.3 Main finding and conclusion

Taken together, the findings from the research show that the market segmentation, service and price differentiation (MSSPD) approach has the potential to enable water utilities in Sub-Saharan Africa to improve services to both existing and potential customers, in a financially sustainable manner. By using the MSSPD approach, utilities can potentially extend services to un-served areas, meet the requirements of the customers (including the poor) and improve cost recovery. Appropriate pricing is however a key ingredient for success of this approach.

The main finding is that by using the market segmentation, service and price differentiation (MSSPD) methodology, urban water utilities can improve water services to existing and potential customers and achieve financial sustainability. The finding leads to the conclusion that market segmentation, service and price
differentiation is an appropriate strategy that urban water utilities in Sub-Saharan Africa could use to improve water services to existing and potential customers, and achieve financial sustainability.

This research therefore offers a methodology that utilities can use to structure their service delivery to provide water at appropriate service levels through feasible service options that meet the different needs of existing and potential customers, at a price that they are willing to pay. The research contributes to advancement of knowledge on management of urban water services in Sub-Saharan Africa, which may also be applicable to similar regions of the developing world.

7.3 Implications of research findings

7.3.1 A new holistic management approach

To substantially improve water services and the financial situation in Sub-Saharan African water utilities is a substantial challenge that calls for change in management strategies. The research has essentially examined how to mainstream improved water services for all consumer groups including the poor, into an overall effective utility management framework. The MSSPD approach is designed to help water utilities in Sub-Saharan Africa achieve the twin objectives of improving urban water services while also achieving financial sustainability.

Among the key findings of the research was that the MSSPD approach offers a framework for water utilities to structure their service delivery with appropriate pricing and serve more customers (including people living in informal settlements) at affordable cost, while achieving financial sustainability. The proposed method is to categorise customers into segments and provision of different appropriately priced levels of service that correspond to the water requirements of respective customer segments, taking into account their willingness to pay.
7.3.2 Implications of the new approach

There are a number of implications of adopting the use of this approach, to different stakeholders in the water sector including utilities, governments, donors and customers.

**Implications to water utilities**

Market segmentation, service and price differentiation (MSSPD) is a radically different approach to management of urban water services in relation to what is done by many utilities. Since this approach is customer focused, a key implication of the approach is for utility managers to ensure that people are at the centre of all activities, irrespective of the management option adopted by a given city. It is therefore necessary for water utilities to make changes in the way they are managed in order to successfully implement MSSPD. This calls for dynamic leadership and progressive management of the utility. Technical, institutional, managerial, social and financial skills are required for successful implementation of this approach.

**Institutional framework**

It is recognised that MSSPD requires a progressive utility, that is ready and willing to put the customer at the centre of its activities. It requires the involvement and support of all employees at all levels of the utility management. There may be need for utilities to change the way they are organised and managed. In order for MSSPD to be successfully implemented, it should be accompanied by institutional reform and organisational change at all levels. Appropriate policies, attitudes and skills should be in place at different levels to support the approach. Professionals involved include utility managers, engineers, economists, social development, health, institutional development and environmental experts.

The approach implies a new way of providing water supply services, paying more attention to customers and allowing appropriate incentives that elicit appropriate responses from a wide range of stakeholders. The approach implies that engineers adopt a more participatory approach to design of water services. An implication of this approach is that since willingness to pay (WTP) is determined first in order to inform design of service options, some conventional design parameters or standards
such as consumption rates will need to be reconsidered in the light of the influence of tariff on consumption.

There may be need to develop appropriate service options, tariff structures and mechanisms for effective communication with existing and potential customers as well as other stakeholders. It is important to ensure that customers make informed choices based on viable service options in order to enhance sustainability of service delivery.

Another implication of this approach is that "water consumers" are now to be viewed as "customers". This calls for change in engineers' attitude who traditionally follow a supply driven method of design, on the basis that engineers are the ones who know the water service levels that people require. With the MSSPD approach, the key issue for water utility managers is to ensure that people are at the centre of all the changes, irrespective of the management option adopted by a given city. In particular, the approach implies that utilities and their staff change the way they operate.

Water utilities should:

- Engage in effective communication with existing and potential customers in each segment and present different technical and management options, with matching prices and details of how the services will be delivered. Advantages and disadvantages of each option should be explained to the households. This could be done through focus group discussions using participatory tools where people discuss the benefits and constraints themselves. In order to enable the customers to make informed choices, utility engineers should learn from the customers about what customers considers appropriate for their particular area and circumstances.
- Establish credibility that service improvements can be delivered
- Change culture from infrastructure provision to providing a service of an agreed standard that users are willing to pay for, and be responsive to customers
- Integrate consultation processes (including demand assessment and participatory methodologies) into preparation processes for all investment projects
- Establish effective customer friendly billing, revenue collection and enforcement procedures
• Maintain dialogue and establish a strong capacity for monitoring and responding to customers' requirements and views.

Among the implications of adopting the MSSPD approach is that utility managers and water engineers should:

• Provide customers with a range of technical and management options or service levels with their associated costs rather than supplying a pre-defined non-negotiable single solution, option or service level. The options should include how the service will be delivered;
• Change their attitudes from being supply driven to being customer-focused and demand responsive;
• Employ technical flexibility and adaptability in their work;
• Obtain information on consumer demand in order to respond to actual demonstrated demand;
• Develop their capacity to offer options and facilitate informed decision making;
• View users as customers;
• Work more closely with other professionals including social intermediaries and be willing to accept non-technical issues in the determination of options; and
• Develop expertise in the use of demand assessment techniques.

There may be need for Engineers, the principal professionals involved in the water sector, to develop expertise in the use of demand assessment techniques and to work with other disciplines in ensuring a holistic approach to project development. Besides responding to present and future demand in their design and support systems, Engineers should design systems that are sufficiently flexible to accommodate a number of different service levels to match demand. Communication and consultation with customers should be ensured throughout the process of informing, assessing and responding to demand.

The implication of the foregoing is that the role of the utility manager and engineer is different in comparison with the supply-driven approach, where the level of service is fixed and the planning and implementation is top-down. Determining and presenting a
number of feasible options (rather than a single option) is likely to require increased engineering inputs, which in turn could increase costs.

The MSSPD approach is typically demand led and customer focused. Besides utility managers, engineers and other staff, this approach has different implications on different stakeholders including governments, customers and lenders/donors.

**Implications to governments**
Governments should:
- Provide enabling environment to support the approach at various levels;
- Promptly approve appropriate cost recovery tariffs, as they would be based on costs of provision and willingness to pay levels. Such approval would enhance investment planning;
- Undertake policy and institutional reform to improve cost recovery; and
- Ensure consistency in water sector policy, and treat water as an economic as well as a social good.

**Implications to customers**
Customers should:
- Be prepared to state preferences and link the level of service with cost of service;
- Accept that this approach may take time; and
- Believe that utilities can improve services if the customers meet their part of the bargain, especially at the beginning

**Implications to lenders and donors**
Donors should:
- Accept that this approach takes time as it is both participatory and iterative;
- Accept that the approach involves risks and that project details may not be accurately known at the start of the process;
- Modify project development process to make it more interdisciplinary and participatory; and
- Assist in building capacity of utility staff to use the techniques outlined in this approach.
7.4 Recommendations

This research has investigated how water utilities in the context of Sub-Saharan Africa can apply market segmentation, service and price differentiation (MSSPD) approach to improve water services to existing and potential customers in a financially sustainable manner.

It is recommended that water utilities in Sub-Saharan Africa should consider adopting this approach, as it has the potential to help utilities achieve the twin objectives of improving urban water services while also achieving financial sustainability.

7.5 Limitations

As in most research projects, time and funds were a limitation in this research. For instance, available budget for fieldwork in Durban (South Africa) provided for two weeks (15 days), during which all data had to be collected. Exploratory research fieldwork to Swaziland, Lesotho, Uganda and Tanzania was limited to one week. It was however possible to make two research field visits to Kenya, and this enabled a pilot survey and a comprehensive survey to be undertaken during the first and second visits respectively. A total of six weeks was spent collecting data in Mombasa, and one week in Nairobi. This enabled the Mombasa case study to be considerably detailed, and therefore capture many dimensions of the issues under investigation.

This research benefited from useful feedback from sector professionals in Africa and elsewhere. Preliminary research findings were presented and shared with sector professionals at a regional conference on water sector reforms (held in Kampala, Uganda), and useful comments were received. The author was able to interview several top managers of water utilities in Africa and obtain useful comments on the approach under investigation in this research. It was however not possible to get feedback or comments from every country in Sub-Saharan Africa.

There exists differences in the set up of urban areas in Sub-Saharan Africa, with regard to factors such as culture, level of development, literacy levels and levels of
income. Service options will therefore need to be developed taking city specific factors into account. The MSSPD approach is however flexible enough to be applicable and useful in the urban context.

The limitations of the MSSPD approach may be summarised by quoting Alaerts et al (1999):

"Whether we wish to apply technological and management solutions or economic solutions to improve the performance of the water sector, we should realise that these interventions can be applied successfully only if the overall institutional setting is correct, and individuals are able and willing to do what is required, and organisations with the right mandate and well led, and other institutional arrangements and structures in place that are conducive for timely conception and implementation of the plans. The sector's performance strongly depends on the external institutional and political situation" (Alaerts et al, 1999).

The technological and management solutions recommended in the MSSPD approach consists of appropriate technical and management options, while the economic solutions consist of appropriate pricing and marketing.

Despite these few limitations, the data obtained from the research provide a clear insight into the subject under investigation, from which key findings, conclusions and implications were made.

7.6 Further research

This research found that large proportions of the urban population (about 54% in Mombasa) are not served directly by the utilities. There is evidence from this research that informal small-scale water providers or vendors have moved in to fill the gap left by utilities. Further research needs to be carried out to investigate mechanisms through which water utilities and vendors can form beneficial exchange relationships with each other, for improved water services to customers, and with all parties achieving their objectives.
This research used the type of dwellings that households live in as the criterion for segmenting the market. There are other criteria that could be used such as geographical location and income levels. There may be need to investigate the suitability of using the MSSPD approach when market segmentation is undertaken on the basis of other criteria such as income and geographical location.

This research focused on improvement of urban water services, although it included the costs associated with wastewater collection, treatment and disposal. The customer survey did not include questions on improvements in sanitation. This is an aspect that should be studied next. It is important to know customer perceptions and willingness to pay for different sanitation systems. In particular, the appropriateness of the MSSPD approach could be tested for use in improvement of sanitation services.

This research produced a practical methodology that a water utility can use to improve urban water services. In particular, the Mombasa case study was presented in a manner that could be of interest to the water utility (NWCPC) in Mombasa. The author intends to follow up with NWCPC or its successor (institutional changes for utility management in Mombasa are under discussion) and check the likely impact of using the methodology and data, on water services in the city.
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Appendix 1: Customer survey & willingness to pay (WTP) questionnaire used in Mombasa (August 2000)
Pricing and Service Differentiation of Utility Water Services in Urban Areas

Mombasa Customer Survey and Willingness-to-pay Questionnaire

TO THE ENUMERATOR: Please read the following statement to each customer/potential customer before you ask the questions.

My name is .................................................... and I am working for a Research Project being conducted by Eng. Cyrus Njiru at the Water, Engineering and Development Centre (WEDC), Loughborough University, UK. The Researcher is investigating how urban water utilities such as the National Water Conservation and Pipeline Corporation (NWCPC) can provide and maintain improved water services to existing and new customers in a financially sustainable manner.

We would like you to assist us by taking time to answer the following questions. If you do not wish to answer a particular question please leave it out. You have been chosen to take part in the survey on a purely random basis. Your name will not be indicated in this questionnaire and your answers will be treated confidentially.

We have received permission to conduct this study from the Permanent Secretary, Office of the President, Provincial Administration and Internal Security. Thank you for your co-operation.

The language used for the interview is ................. Survey date .................. Time:.............

Section 1: General Details about where you live:

1a) Part of City where you live
   A) Mombasa Island
   B) Mombasa North Mainland
   C) Mombasa West Mainland
   D) Mombasa South Mainland

1b) Local name of Area: ........................................................................................

1c) Type of dwelling (Enumerator to indicate here the Market segment of the household)
   A) Bungalows or Maisonettes
   B) Flats
   C) 1, 2, or 3 roomed house or Swahili house
   D) Dwelling in an informal settlement or slum

1d) How long have you lived in this dwelling? .....................................................
Section 2: Your current water supplies (for all water users)

2a) Where do you and other members of your household obtain water? (Please tick all the water sources that you use)

A) Your own (individual) piped water connection
B) A shared water connection next to your dwelling
C) We obtain water from the Water Kiosk
D) We obtain water from the Hand Cart Water Vendors
E) We obtain water from the Private water tanker
F) We obtain water from a public bore-hole or well
G) We obtain water from a private bore-hole or well
H) We have our own Private bore-hole or well in our compound

2b) What is your main source of water supply?

A) Your own (individual) piped water connection
B) A shared water connection next to your dwelling
C) Water purchased from a Water Kiosk
D) Water purchased from hand-cart water vendors
E) Private water tanker
F) Water obtained from a public bore-hole or well
G) Water obtained from a private bore-hole or well
H) We have our own Private bore-hole or well in our compound

2c) Do you use NWCPC water and also water from other sources?

A) YES       B) NO

2d) Water Storage: What methods of water storage do your household use?

A) Roof tank       B) Underground or ground level tank outside the house
C) Water tank in the house       D) Small containers & jerricans

2e) How many days can your water storage last when there is no water supply?

A) One day
B) Two days
C) Three days
D) Four days
E) Five days
F) More than five days

2f) Piped connections: Which of the following statements best describes your household's situation with regard to piped water connections?
A) We have our own individual house connection

B) We have a shared piped connection

C) We do not have any piped connection.

2g) Have you applied to NWCPC for a water connection?

A) Yes

B) No

2h) To whom do you pay for water? (More than one box can be ticked if applicable)

A) Water utility (NWCPC)

B) water kiosk operator

C) Hand cart water vendors

D) private water tanker

E) Landlord

F) Buy from bore-hole or well

G) We have our own Borehole

H) Obtain free water from Borehole or well

I) We do not pay for water

Section 3: Piped water received directly from NWCPC's pipelines:
If your household obtains water from NWCPC through taps in the house or from a yard tap (shared water connection)- please answer the following questions from 3.1 to 3.3

NOTE FOR ENUMERATOR: IF THE RESPONDENT DOES NOT RECEIVE NWCPC PIPED WATER PLEASE MOVE TO SECTION 4.

3.1 Water service levels provided by NWCPC

a) Supply frequency - On average how frequently do you receive piped water from NWCPC?

A) Once a day

B) Twice a day

C) Once in 2 or 3 days

D) Once a week

E) Continuous

F) Other (please state) .........

b) Reliability: Does the water supply reliably arrive at the frequency you have stated?

A) Yes

B) No

C) Sometimes

c) Supply duration - How many hours of water supply do you usually receive on average from NWCPC each time the piped water arrives?

A) Less than 2 hours

B) 2 to 4 hours

(C) More than 4 hours each time

d) Timing- At what times of the day do you usually receive piped water from NWCPC?

A) Mornings only

B) Evenings only

C) Both Mornings & Evenings

D) All day

E) All Night

F) All day and Night

e) Are these times convenient for you?

A) Yes

B) No

f) If NWCPC has to ration water to customers and supply water only once in a day for a few hours, at which of the following time would you wish to receive water?

A) Mornings

B) Evenings

C) Other (Please state)
g) Water pressure: Does the water you receive from NWCPC's connection have enough pressure to reach and enter a roof tank or elevated tank?
A) Yes □   B) No □   C) Sometimes □   D) I am not sure _

h) Quantity: - Do you receive enough (sufficient) piped water from the water utility (NWCPC) for your use?
A) Yes □   B) No □
C) Do not receive piped water from utility (NWCPC) directly □

i) Quality: - How would you generally rate the appearance of water supplied by NWCPC?
A) Good quality water (Clear and colourless) most of the time □
B) Poor quality water (Muddy/brown) most of the time □

j) Water Treatment: What type of water treatment do you carry out on the water from NWCPC?
A) Do not treat □   B) boil drinking water □   C) use water filter or purifier □   D) Other □

k) Overall are you satisfied with the piped water supply from NWCPC?
A) YES □   B) NO □

l) Why?
A) Inadequate quantity or pressure □
B) Costly (too expensive) □
C) Low in Quality (colour/turbidity etc) □

3.2 Billing and payment of Water Charges (for NWCPC customers)
a) Do you receive a water bill from NWCPC?
A) Yes □   B) No □

b) Do you have a water meter?
A) Yes □   B) No □

c) How are you billed for water charges?
A) By flat rate charge because I have no water meter □
B) Based on meter readings since I have a meter and it is read regularly □
C) By meter reading estimate (because my meter is not read) □
D) By meter reading estimate (because my meter does not work) □
E) I do not know □

d) How much do you pay to NWCPC for water on average each month? .................
e) How much did you pay for the piped connection charges? .................
f) How often do you receive a water bill from the water utility (NWCPC)?
A) Every month □   B) Once in 2 or 3 months or even more □
C) I never receive water bills from NWCPC □   D) Other □ (Please state) .................
g) How often do NWCPC meter readers read your water meter?
A) Every month ☐ B) Once in 2 months ☐ C) Once in 3 months ☐
D) Once in 4 to 6 months ☐ E) Once a year ☐ F) Never read ☐

h) How do you pay for your water bills?
A) Cash or cheque to NWCPC’s cashiers office ☐ B) cheque by post ☐
C) NWCPC officers collect the cheque ☐ D) I pay the meter reader ☐
E) I do not pay ☐ F) I pay the landlord.

i) Do you understand the water bills that are sent to you?
A) Yes ☐ B) No ☐

j) Is the water bill that you receive reasonable?
A) Yes ☐ B) No ☐

k) How often do you pay the water bills for your household?
A) Every month ☐ B) Whenever I receive bills ☐
C) Once in 2 or 3 months ☐ D) Other (specify) ............................................

l) Do you have any complaints about the present billing system?
Yes ☐ No ☐

3.3 Customer Services provided by NWCPC

a) When you find a problem with your water services do you make a complaint to NWCPC?
A) Yes ☐ B) No ☐

b) When you have a problem with your water supply or billing etc., who do you complain to?
A) The local NWCPC area office ☐ B) The Regional NWCPC office ☐
C) Other, please specify ...........................................................................

c) When you have a complaint or query with your water supply or billing etc., how do you contact NWCPC?
A) Visit in person ☐ B) By post (letter) ☐ C) By telephone ☐

d) How many times have you or a member of your household visited the NWCPC offices to make a request or complaint over the last one year? ..............

e) Do you consider the NWCPC offices to be accessible (distance, opening times, friendly etc.) to you?
A) Yes ☐ B) No ☐
f) How would you rate the customer services provided by NWCPC for the following aspects: (Please tick the most appropriate box from good to poor)

<table>
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<tr>
<th>Good</th>
<th>average</th>
<th>poor</th>
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i) Process for obtaining a new water connection

ii) Complaints on over billing

iii) Complaints on irregular delivery of bills

iv) Complaints for service interruptions such as lack of water

g) Overall, how would you rate the general customer service that the NWCPC representatives give you?

A) Good ☐ B) Average ☐ C) Poor ☐

Section 4: Alternative Water Sources

4.1 CUSTOMERS WHO OBTAIN WATER DIRECTLY FROM WATER KIOSKS (either always or sometimes)

If you use water directly from Water Kiosks please answer the following questions:

a) Are the water kiosks, that you use, managed by

A) A private vendor ☐ B) the NWCPC ☐ C) A community group ☐

b) Do you or members of your household collect water from the kiosk(s), or do you have it delivered to your house?

A) Collected by a member of your household ☐ B) Delivered to your house ☐

C) Some delivered and some collected ☐

If you ticked boxes A) or C) please answer questions c) and d) below

c) How far is the water kiosk (that you use) from your house?

A) Less than 100m ☐ B) Between 100 - 200m ☐ C) more than 200m ☐

d) How long does it usually take to collect water from the kiosk each time (one round trip)?

.....................................................

e) Timing. In general, can you obtain water from the kiosk at convenient times of the day?

A) Yes ☐ B) No ☐

f) Supply frequency - If you wanted, are you able to obtain water from this water kiosk?

A) Continuous (all the time) ☐ B) Once a day ☐ C) Twice a day ☐

D) Once in 2 or 3 days. ☐ E) Once a week ☐

g) Reliability: Does this water kiosk reliably provide water at the frequency you have stated?

A) Yes ☐ B) No ☐

h) Quantity: Do you receive enough (sufficient) water from the water kiosk for your use?

A) Yes ☐ B) No ☐

i) How many (20 litre) containers does your household usually use from kiosks in a day?.....
j) Quality: - How would you generally rate the appearance of water you obtain from the water kiosk?
A) Good quality water (Clear and colourless) most of the time
B) Poor quality water (Muddy/brown) most of the time

k) Water Treatment: What type of water treatment do you carry out on the kiosk water?
A) Do not treat
B) Boil drinking water
C) Use water filter or purifier

l) Costs: How much do you pay for a 20litre container of water obtained from the kiosk?
A) During normal time when there are no water shortages
B) When there are water shortages

m) Overall are you satisfied with the water supply from the water kiosk?
A) YES
B) No

n) If not satisfied, why?
A) Inadequate quantity or pressure
B) Costly (too expensive)
C) Low in Quality (colour/turbidity etc)

do) Do you think NWCPC should provide more water kiosks in your area?
A) Yes
B) No

4.2 Alternative Water Sources: If you use water from other sources (other than NWCPC water and kiosks) such as boreholes, open wells or from water vendors, please answer the following questions:

a) What alternative water sources do you use?
A) Boreholes
B) Open well
C) Rainwater
D) Hand cart water vendors
E) Water tankers
F) Other (Please specify here)

b) Is this water source that you use, managed by;
A) A private vendor
B) the NWCPC
C) A community group
D) Your household
E) Other (Please specify here)

c) Do you or members of your household collect water from this source, or do you have it delivered to your house?
A) Collected by a member of household
B) Delivered to your house

If you ticked boxes i) or iii) please answer questions c) and d)

d) How far is the water source (that you use) from your house?
A) Less than 100m
B) Between 100 -200m
C) more than 200m

e) How long does it take to collect water from this source each time (round trip)?
Timing. In general, can you obtain water from this source at convenient times of the day?
A) Yes  
B) No  

g) Supply frequency - If you wanted, are you able to obtain water from this source?
A) Continuous (all the time)  
B) Once a day  
C) Twice a day  
D) Once in 2 or 3 days  
E) Once a week  
F) Other (please describe)  

h) Reliability: Does this water source reliably provide water at the frequency you have stated?
A) Yes  
B) No  

i) Quantity: - Do you receive enough (sufficient) water from this source for your use?
A) Yes  
B) No  

i) How many (20 litre) containers of water do you use from this source in a day? ..................  

k) Quality: - How would you generally rate the appearance of water from this source?
A) Good quality water (Clear and colourless) most of the time  
B) Poor quality water (Muddy/brown) most of the time  
C) Other (Please specify)  

l) Water Treatment: What type of water treatment do you carry out on this water?
A) Do not treat  
B) boil drinking water  
C) use water filter or purifier  
D) Other (Please specify)  

m) Costs: How much do you pay for a 20 litre container (jerrican) of water from this source during normal time when there are no water shortages?  
n) How much do you pay for a 20 litre container (jerrican) of water from this source when there are water shortages?  
o) Overall are you satisfied with the water supply from this source?
A) YES  
B) NO  
p) If not satisfied, Why?
A) Inadequate quantity or pressure  
B) Costly (too expensive)  
C) Low in quality (colour, turbidity, etc)  
D) Opening times  
E) Long queues  
F) Other (Please state)  

Mombasa Customer Survey & WTP Questionnaire, July 2000
**4.3 Water from Vendors: if you use water supplied by vendors (either sometimes or always), please answer the following questions:**

**a)** Do you know the sources from which Hand-cart vendors obtain water?

A) Yes  
B) No  

**b)** If you know, where does the water vendors who supply your household obtain water from?

A) Borehole  
B) Open well  
C) NWCPK Water kiosk  
D) Rainwater  
E) Streams/Springs  
F) NWCPK individual connection  
G) A combination of sources (please specify)  

**c)** How much do you pay for a 20litre container of water brought to you by the Hand-cart water vendor during normal time when there are no water shortages?  

**d)** How much do you pay for a 20litre container of water brought to you by the Hand-cart water vendor during times when there are water shortages?  

**e)** Why do you prefer to buy water from a water vendor instead of collecting the water directly from the sources where the vendor obtains water?  

**f)** Why do you obtain water from other sources instead of using NWCPK water?

A) I do not have a water connection  
B) I have a connection but NWCPK water is not enough  
C) NWCPK water is costly (too expensive) compared with other sources  
E) Other reasons (Please specify)  

**g)** If NWCPK could provide a water kiosk near your area with water available most of the time, would you buy water from the NWCPK water kiosk instead of buying water from vendors?

A) Yes  
B) No  

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Mombasa Customer Survey & WTP Questionnaire, July 2000
Section 5 - Socio-Economic Aspects

5.1 Are you (the respondent)
   A) Male □   B) Female □

5.2 Are you (the respondent)
   A) Head of household □   B) Spouse □   C) Other □

5.3 Is the head of the Household
   A) Male □   B) Female □

5.4 Please give the total number of people (including children) who live in your household (dwelling)............................

5.5 How many rooms does your dwelling have?............................

5.6 If renting, how much money is the rent for your dwelling per month? ...................

5.7 What is the ownership status of the dwelling (premises) occupied by your household?
   A) Privately owned by my family □
   B) Provided to family by Employer (e.g. Government, Council or a Company) □
   C) Privately rented to our family by a private landlord □
   D) Other (please specify) .....................................................................................

5.8 Do you have Electricity in your dwelling?
   A) Yes □   B) No □

If the answer is "No", then move to part B

If the answer is "Yes", continue with questions 5.9 to 5.11 and then move to part B

5.9 How much is your monthly electricity bill? KSH............................

5.10 Do you consider your monthly electricity bill to be reasonable?
   A) Yes □   B) No □

5.11 Who pays your monthly electricity bills?
   A) Head of household □   B) Employer (e.g. Company, council etc) □
   C) Other □ (Please describe)........................................................................

Mombasa Customer Survey & WTP Questionnaire, July 2000
PART B: WILLINGNESS TO PAY SURVEY

OPENING STATEMENT TO THE BIDDING GAME

(To the enumerator: Please read this statement slowly to the respondent)

As you may know, there is a growing deficiency of clean water not only in Kenya, but in the whole world. The available surface water is often polluted and not suitable for human consumption in its present form. Water from the Indian Ocean is salty and would require a lot of money to treat it and make it suitable for human consumption. NWCPC spends a lot of money on electricity, chemicals, pipes, pumps, motors, and other equipment including staff salaries in order to purify the water, store it and transport it to your homes with pipes. Water utilities such as NWCPC should be able to cover all operation and maintenance costs with some money left to finance improvements in water supply. In the past NWCPC has not had enough funds to be able to cover all operating and maintenance costs or even to finance improvements in water supply. This is the main reason why water supply to your house may not be reliable, sometimes resulting in serious water shortages in Mombasa and the surrounding coastal areas.

I will describe the nature of different types of possible service options to you and then ask whether you would like to have the services at a suggested price. During this procedure you shall have to think about the advantages of each type of water service to your household.

NWCPC has the intention of ensuring that each household should pay for water according to the type of service they receive and the amount of water used. Those who use more should pay more. Furthermore NWCPC water tariff entails that those households that use most water pay more per quantity of water than those who use less.

Before NWCPC carries out any improvements to the water services, it is important to know what type of water services people want, and how much money people are willing to pay for each type of improved service. With this information, NWCPC can then plan to give people the type of water service that the people want and are willing to pay for.

Now I am going to ask you some questions to learn whether your household would be willing to pay more money in order to improve the water supply in Mombasa. It is important that you answer questions, as truthfully as you can so that we can know the amount you are willing to pay for an improved supply of water to your household.
BIDDING GAME

To the enumerator:
The bidding game is targeted to three types of respondents, depending on the type and location of the house they reside in (market segment). Please decide in which category (market segment) the respondent belongs. Then under each category several service levels have been specified, starting with the highest service level. Please guide the respondent through the bidding game, starting with the highest set price. When the respondent chooses a price please tick in the box against that bid, and stop the exercise. Otherwise go through the various service levels in the respondents’ category.

CATEGORY I: INDIVIDUAL HOUSE CONNECTION

(FOR A RESPONDENT WHO LIVES IN A BUNGALOW OR MAISONETTE CONSTRUCTED OF PERMANENT BUILDING MATERIALS, OR IN A FLAT, LOCATED IN A WELL PLANNED AREA, OR IN AN AREA WHERE THE PLANNING PROCESS IS IN PROGRESS. THE BUILDING SHOULD EITHER HAVE A WATER CONNECTION WITH INTERNAL PLUMBING, OR HAS THE CAPACITY FOR A WATER CONNECTION WITH INTERNAL PLUMBING IN THE FUTURE.)

Service level I

Assume that you will be receiving clean piped water through your individual connection with adequate pressure to be able to reach second floor of a storey building, with a continuous 24-hour water supply

1. Would you be willing to pay a water bill of KSh2,500/- per month? If 'Yes' – Willingness to Pay is KSh2,500/- ... END
   If 'No' go to (2)

2. Would you be willing to pay a water bill of Ksh. 2,000/- per month? If “Yes”-Willingness to pay is KSh. 2,000/-.......END
   If "No" go to (3)

3. Would you be willing to pay a water bill of KSh 1,800/- per month? If 'Yes' – Willingness to Pay is KSh 1,800/- ..........END
   If 'No' go to (4)

4. Would you be willing to pay a water bill of Ksh. 1,600/- per month? If “Yes”-Willingness to pay is KSh. 1,600/- .........END
   If "No" go to (5)

5. Would you be willing to pay a water bill of KSh 1,400/- per month? If 'Yes' – Willingness to Pay is KSh 1,400/- ...........END
   If 'No' go to (6)

6. Would you be willing to pay a water bill of KSh 1,200/- per month? If 'Yes' – Willingness to Pay is KSh 1,200/- ..........END
   If "No" go to (7)

7. What is the maximum amount of money per month you are willing to pay for a continuous water supply, 24 hours every day (service level 1)?

I would be willing to pay a maximum of KSh..................................per month for water service level (1).
Now go to Next Service Option.
(8) Would you be willing to pay a water bill of KSh 1,200/- per month?  
If 'Yes' – Willingness to Pay is KSh 1,200/- ..........END
If 'No' go to (9)

(9) Would you be willing to pay a water bill of KSh 1,000/- per month?  
If 'Yes' – Willingness to Pay is KSh 1,000/- ..........END
If 'No' go to (10)

(10) Would you be willing to pay a water bill of KSh 800/- per month?  
If 'Yes' – Willingness to Pay is KSh 800/- ..........END
If 'No' go to (11)

(11) What is the maximum amount of money per month you are willing to pay for 12 hours of water supply every day (service level 2)?
I would be willing to pay a maximum of KSh.................per month for water service level (2).

All respondents in this market segment whose willingness to pay for service level (2) is less than KSh.800/- per month should be requested to answer questions under SERVICE LEVEL 3 below. These are the respondents whose answer to question number 11 is less than KSh.800/- per month.

Now go to Next Service Option for respondents whose willingness to pay is less than KSh.800/-per month.
If you have already got two “Yes” responses from the respondent, end the bidding game now.
If not go to Next Service Option

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(12) Would you be willing to pay a water bill of KSh 800/- per month?  
If 'Yes' – Willingness to Pay is KSh 800/- ..........END
If 'No' go to (13)

(13) Would you be willing to pay a water bill of KSh 700/- per month?  
If 'Yes' – Willingness to Pay is KSh 700/- ..........END
If 'No' go to (14)

(14) Would you be willing to pay a water bill of KSh 600/- per month?  
If 'Yes' – Willingness to Pay is KSh 600/- ..........END
If 'No' go to (15)

(15) Would you be willing to pay a water bill of KSh 500/- per month?  
If 'Yes' – Willingness to Pay is KSh 500/- ..........END
If "No" go to (16)
What is the maximum amount of money per month you are willing to pay in order to receive at least 4 hours water supply every day (service level 3)?

I would be willing to pay a maximum of KSh........................... per month for water service level (3).

**CATOGORY II: THOSE LIVING IN SHARED BUILDINGS IN FORMAL (PLANNED) AREAS (SWAHILI HOUSES, 1, 2 OR 3 ROOMED DWELLINGS WITHOUT INTERNAL PLUMBING LOCATED IN PLANNED AREAS OF THE CITY)

(FOR A RESPONDENT WHO LIVES IN A SHARED BUILDING E.G. SWAHILI HOUSE, CONSTRUCTED OF PERMANENT OR SEMI-PERMANENT BUILDING MATERIALS, AND LOCATED IN A FORMALLY PLANNED AREA. THE BUILDING DOES NOT HAVE AN INDIVIDUAL WATER CONNECTION WITH INTERNAL PLUMBING, NEITHER DOES IT HAVE CAPACITY FOR A WATER CONNECTION WITH INTERNAL PLUMBING IN THE FUTURE. INSTEAD RESIDENTS WILL MOST LIKELY HAVE A YARD TAP SERVING A NUMBER OF FAMILIES WHO LIVE IN THE SHARED BUILDING)

**Service Level 4**
Assume that you will be receiving clean piped water through a shared yard connection with adequate pressure providing enough water at the tap in the compound of the house where you stay. Assume that the water is available continuously for 24 hours every day. Assume that your household is able to obtain enough water from the tap in the compound any time of the day or night. Whenever you wish you can also carry out plumbing in your house and extend the water inside your house.

(17) Would you be willing to contribute KSh.2,500/- per month towards the water bills for the tap?
If 'Yes' – Willingness to Pay is KSh.2,500/- ...........END
If 'No' go to (18)

(18) Would you be willing to contribute KSh.2,000/- per month towards the water bill for the tap?
If 'Yes' – Willingness to Pay is KSh.2,000/- ...........END
If 'No' go to (19)

(19) Would you be willing to contribute KSh.1,800/- per month towards the water bill for the tap?
If 'Yes' – Willingness to Pay is KSh.1,800/- ...........END
If 'No' go to (20)

(20) Would you be willing to contribute KSh.1,600/- per month towards the water bill for the tap?
If 'Yes' – Willingness to Pay is KSh.1,600/- ...........END
If "No" go to (21)

(21) Would you be willing to contribute KSh.1,400/- per month towards the water bill for the tap?
If "Yes" - Willingness to pay is KSh.1,400/.........END
If "No" go to (22)

(22) Would you be willing to contribute KSh1,200/- per month towards the water bill for the tap?
If "Yes" - Willingness to pay is KSh.1,200/- ...........END
If "No", go to (23)
(23) What is the maximum amount of money per month you are willing to contribute towards the water bill for the tap in your compound in order to get a continuous water supply at good pressure 24 hours every day?

I would be willing to pay a maximum of KSh................ per month for water service level 4.

All respondents in this market segment whose willingness to pay is less than KSh.1,200/- should be requested to answer questions under SERVICE LEVEL 5 below.

Now go to the Next Service Option.

Service Level 5

Assume that you will be receiving clean piped water through a shared yard connection providing enough water at the tap in the compound of the house where you stay. Assume that NWGPC has provided a storage tank next to the existing connection that you share with your neighbours and that the tank receives and stores water so that you can draw the water from your yard connection continuously even during the rationing hours. Assume that because of this storage tank, your household is able to obtain enough water from the tap in the compound any time of the day or night. Whenever you wish you can also carry out plumbing in your house and extend the water inside your house.

(17) Would you be willing to contribute KSh.2,500/- per month towards the water bills for the tap and the storage tank?
If ‘Yes’ – Willingness to Pay is KSh.2,500/- ............END
If ‘No’ go to (18)

(18) Would you be willing to contribute KSh.2,000/- per month towards the water bill for the tap and the storage tank?
If ‘Yes’ – Willingness to Pay is KSh.2,000/- ............END
If ‘No’ go to (19)

(19) Would you be willing to contribute KSh.1,800/- per month towards the water bill for the tap and the storage tank?
If ‘Yes’ – Willingness to Pay is KSh.1,800/- ............END
If ‘No’ go to (20)

(20) Would you be willing to contribute KSh.1,600/- per month towards the water bill for the tap and the storage tank?
If ‘Yes’ – Willingness to Pay is KSh.1,600/- ............END
If “No” go to (21)

(21) Would you be willing to contribute KSh.1,400/- per month towards the water bill for the tap and the storage tank?
If “Yes” - Willingness to pay is KSh.1,400/.........END
If “No” go to (22)

(22) Would you be willing to contribute KSh1,200/- per month towards the water bill for the tap and the storage tank?
If “Yes” - Willingness to pay is KSh.1,200/- ...........END

If “No”, go to (23)
(23) What is the maximum amount of money per month you are willing to contribute towards the water bill for the tap and the storage tank in your compound that will enable you to get a continuous water supply at any time of the day or night?
I would be willing to pay a maximum of KSh................................per month for water service level 5.

Now go to the Next Service Option.

Service Level 6

Assume that you will be receiving clean piped water through a shared yard connection providing enough water at the tap in the compound of the house where you stay. Assume that the water is supplied on rationing basis, but with good pressure, for 12 hours every day. Assume that your household is able to obtain enough water from the tap in the compound. Whenever you wish you can also carry out plumbing in your house and extend the water inside your house.

(24) Would you be willing to contribute KSh.1200/- per month towards the water bills for the tap?
If ‘Yes’ – Willingness to Pay is KSh.1200/- ..........END
If ‘No’ go to (25)

(25) Would you be willing to contribute KSh.1,000/- per month towards the water bill for the tap?
If ‘Yes’ – Willingness to Pay is KSh.1000/-...........END
If ‘No’ go to (26)

(26) Would you be willing to contribute KSh.800/- per month towards the water bill for the tap?
If ‘Yes’ – Willingness to Pay is KSh.800/-.........END
If ‘No’ go to (27)

(27) What is the maximum amount of money per month you are willing to contribute towards the water bill for the tap in order to receive 12 hours of water supply every day (service level 5)?
I would be willing to pay a maximum of KSh................................per month for water service level 6.

All respondents in this market segment whose willingness to pay for service level (5) is less than KSh.800/- per month should be requested to answer questions under SERVICE LEVEL 6 below. These are the respondents whose answer to question number 27 is less than KSh.800/- per month.

Service Level 7

Assume that you will be receiving clean piped water through a shared yard connection providing enough water at the tap in the compound of the house where you live. Assume that the water is supplied on rationing basis, in the morning and evening for a minimum period of 4 hours every day and that your household is able to obtain water from the tap in the compound only in the mornings and evenings for a total of 4 hours. Whenever you wish you can also carry out plumbing in your house and extend the water inside your house.
(28) Would you be willing to contribute KSh 800/- per month towards the water bills for the tap?
If 'Yes' – Willingness to Pay is KSh 800/- ..........END
If 'No' go to (29)

(29) Would you be willing to contribute KSh 700/- per month towards the water bill for the tap?
If 'Yes' – Willingness to Pay is KSh 700/- ..........END
If 'No' go to (30)

(30) Would you be willing to contribute KSh 600/- per month towards the water bill for the tap?
If 'Yes' – Willingness to Pay is KSh 600/- ..........END
If 'No' go to (31)

(31) Would you be willing to contribute KSh 500/- per month towards the water bill for the tap?
If 'Yes' – Willingness to Pay is KSh 500/- ..........END
If "No" go to (32)

(32) What is the maximum amount of money per month are you willing to contribute towards the water bill for the tap in order to receive 4 hours of water supply every day at your compound (service level 6)? (Remember that you may also extend the water to your house when you carry out plumbing inside your house).

I would be willing to pay a maximum of KSh ................................per month for water service level 7.

CATEGORY III: PEOPLE LIVING IN INFORMAL SETTLEMENTS

(FOR A RESPONDENT WHO LIVES IN A SHARED HOUSE OR INDIVIDUAL SHACK, CONSTRUCTED OF SEMI-PERMANENT OR TEMPORARY BUILDING MATERIALS, AND LOCATED IN AN INFORMAL AREA OR SLUM. SUCH A BUILDING WILL NOT HAVE INTERNAL PLUMBING. SPACE FOR A YARD TAP AND A STORAGE TANK MIGHT BE FOUND IF THE SLUM IS UPGRADED.

Service Level 8 (Shared yard connection with storage tank, 18-24 hour supply)

Assume that you will be receiving clean piped water through a shared yard connection (shared by about 10 dwellings) providing enough water at the tap in the compound of the dwelling where you stay. Assume that NWCPC has provided a pipeline, a storage tank, and a shared connection next to your dwelling. Assume that you are sharing the connection and the storage tank with your neighbours and that the tank stores water so that you can draw the water from your yard connection continuously even during the rationing hours. Assume that because of this storage tank, your household is able to obtain enough water from the tap in the compound for 18 to 24 hours a day.

(33) Would you be willing to contribute KSh.2500/- per month towards the water bills for the tap and the storage tank?
If 'Yes' – Willingness to Pay is KSh.2500/- ..........END
If 'No' go to (34)

(34) Would you be willing to contribute KSh.2,000/- per month towards the water bill for the tap and the storage tank?
If 'Yes' – Willingness to Pay is KSh.2000/- ..........END
If 'No' go to (35)
Would you be willing to contribute KSh.1,800/- per month towards the water bill for the tap and the storage tank?
If ‘Yes’ – Willingness to Pay is KSh.1800/- ..........END
If ‘No’ go to (36)

Would you be willing to contribute KSh.1,600/- per month towards the water bill for the tap and the storage tank?
If ‘Yes’ – Willingness to Pay is KSh.1600/- ..........END
If “No” go to (37)

Would you be willing to contribute KSh.1,400/- per month towards the water bill for the tap and the storage tank?
If “Yes” - Willingness to pay is KSh.1400/-..........END
If “No” go to (38)

Would you be willing to contribute KSh.1,200/- per month towards the water bill for the tap?
If ‘Yes’ – Willingness to Pay is KSh.1200/- ..........END
If ‘No’ go to (41)

Would you be willing to contribute KSh.1,000/- per month towards the water bill for the tap?
If ‘Yes’ – Willingness to Pay is KSh.1000/- ..........END
If ‘No’ go to (42)

Would you be willing to contribute KSh.800/- per month towards the water bill for the tap?
If ‘Yes’ – Willingness to Pay is KSh.800/- ..........END
If ‘No’ go to (43)

What is the maximum amount of money per month you are willing to contribute towards the water bill for the tap and the storage tank in your compound that will enable you to get a continuous water supply at any time of the day or night?
I would be willing to pay a maximum of KSh............................ per month for water service level 8.

All respondents in this market segment whose willingness to pay is less than KSh.1200/- should be requested to answer questions under SERVICE LEVEL 9 below.

Now go to the next service option (Service level 9 below)

Service Level 9 (Shared yard connection without storage tank, 12 hour supply)
Assume that you will be receiving clean piped water through a shared yard connection (shared by about 10 dwellings) providing water at the tap in the compound of the dwelling where you stay. Assume that NWCPC does not provide a storage tank next to the connection. Assume that the water is supplied on rationing basis for about 12 hours every day. Assume that your household obtains water from the tap in the compound, that you share with about 10 other dwellings.

Would you be willing to contribute KSh.1,200/- per month towards the water bills for the tap?
If ‘Yes’ – Willingness to Pay is KSh.1200/- ..........END
If ‘No’ go to (41)

Would you be willing to contribute KSh.1,000/- per month towards the water bill for the tap?
If ‘Yes’ – Willingness to Pay is KSh.1000/- ..........END
If ‘No’ go to (42)

Would you be willing to contribute KSh.800/- per month towards the water bill for the tap?
If ‘Yes’ – Willingness to Pay is KSh.800/- ..........END
If ‘No’ go to (43)
(43) What is the maximum amount of money per month you are willing to contribute towards the water bill for the tap in order to receive 12 hours of water supply every day (service level 9)?

I would be willing to pay a maximum of KSh.......................... per month for water service level (9).

All respondents in this market segment whose willingness to pay for service level (9) is less than KSh. 800/- per month should be requested to answer questions under SERVICE LEVEL 10 below. These are the respondents whose answer to question number 43 is less than KSh. 800/- per month.

**Service Level 10 (Shared yard connection without storage tank, 4-hour supply)**

Assume that you will be receiving clean piped water through a shared yard connection (shared by about 10 dwellings) providing water at the tap in the compound of the house where you live. Assume that NWCPC does not provide a storage tank next to the connection. Assume that the water is provided on rationing basis for 2 hours in the morning and 2 hours in the evening, a maximum period of 4 hours every day. Assume that your household obtains water from the tap in the compound, that you share with about 10 other dwellings.

(44) Would you be willing to contribute KSh 800/- per month towards the water bills for the tap?

If 'Yes' – Willingness to Pay is KSh 800/- ........... END  
If 'No' go to (45)

(45) Would you be willing to contribute KSh 700/- per month towards the water bill for the tap?

If 'Yes' – Willingness to Pay is KSh 700/- ........... END  
If 'No' go to (46)

(46) Would you be willing to contribute KSh 600/- per month towards the water bill for the tap?

If 'Yes' – Willingness to Pay is KSh 600/- ........... END  
If 'No' go to (47)

(47) Would you be willing to contribute KSh 500/- per month towards the water bill for the tap?

If 'Yes' – Willingness to Pay is KSh 500/- ........... END  
If "No" go to (48)

(48) What is the maximum amount of money per month are you willing to contribute towards the water bill for the tap in order to receive 4 hours of water supply every day at your compound (service level 10)?

I would be willing to pay a maximum of KSh.......................... per month for water service level (10).

Now go to the next service option (Service level 11 below)
Service level 11 (Privately managed water kiosk with shelter and storage tank)

Assume that you obtain water from an Improved Water Kiosk that is provided with a shelter (suitable building), a storage tank and several taps. The improved water kiosk obtains water from NWCPC's pipelines. The kiosk is metered by NWCPC and is privately managed by an operator who pays the water bill for the water sold to NWCPC. Assume that this kiosk is open from 7 a.m. to 7 p.m. daily, and good quality water from the NWPCP pipeline is available throughout the day with adequate pressure.

(49) Would you be willing to pay KSh.7/- per 20-litre container of water bought from the improved water kiosk?
If 'Yes' – Willingness to Pay is KSh.7/- ..........END
If 'No' go to (50)

(50) Would you be willing to pay KSh.6/- per 20-litre container of water bought from the improved water kiosk?
If 'Yes' – Willingness to Pay is KSh.6/- ..........END
If 'No' go to (51)

(51) Would you be willing to pay KSh.5/- per container of water bought from the improved water kiosk?
If 'Yes' – Willingness to Pay is KSh 5/- ..........END
If "No" go to (52)

(52) Would you be willing to pay KSh 4/-per 20-litre container of water bought from the improved water kiosk?
If 'Yes' – Willingness to Pay is KSh 4/-..........END
If 'No' go to (53)

(53) Would you be willing to pay KSh 3/- per 20-litre container of water bought from the improved water kiosk?
If 'Yes' – Willingness to Pay is KSh 3/-.........END
If 'No' go to (54)

(54) What is the maximum amount of money you are willing to pay for a 20-litre container of good quality water obtained from an improved water kiosk where water is available at good pressure throughout the day?

I would be willing to pay a maximum of KSh..........................per 20-litre container of good quality water from a privately managed water kiosk with shelter and storage tank.

Now go to the next service option (service level 12 below)

Service level 12 (Community managed water kiosk with shelter and storage tank)

Assume that you obtain water from an Improved Water Kiosk that is provided with a shelter (suitable building), a storage tank and several taps. The improved water kiosk obtains water from NWPCP's pipelines. The kiosk is metered by NWPCP and is managed by a community group. The community group operates the kiosk and then pays water bills to NWPCP for the water consumed as measured by the water meter. Assume that this kiosk is open from 7 a.m. to 7 p.m. daily, and good quality water from the NWPCP pipeline is available throughout the day with adequate pressure.
(55) Would you be willing to pay KSh 6/- per 20-litre container of water bought from the community managed water kiosk?
If 'Yes' – Willingness to Pay is KSh 6/- END
If 'No' go to (56)

(56) Would you be willing to pay KSh 5/- per 20-litre container of water bought from the community managed water kiosk?
If 'Yes' – Willingness to Pay is KSh 5/- END
If 'No' go to (57)

(57) Would you be willing to pay KSh 4/- per 20-litre container of water bought from the community managed water kiosk?
If 'Yes' – Willingness to Pay is KSh 4/- END
If 'No' go to (58)

(58) Would you be willing to pay KSh 3/- per 20-litre container of water bought from the community managed water kiosk?
If 'Yes' – Willingness to Pay is KSh 3/- END
If 'No' go to (59)

(59) Would you be willing to pay KSh 2/- per 20-litre container of water bought from the community managed water kiosk?
If 'Yes' – Willingness to Pay is KSh 2/- END
If 'No' go to (60)

(60) Would you be willing to pay KSh 1.50 per container of water bought from a community managed water kiosk?
If 'Yes' – Willingness to Pay is KSh 1.50 END
If 'No' go to (61)

(61) Would you be willing to pay KSh 1/- per container of water bought from a community managed water kiosk?
If 'Yes' – Willingness to Pay is KSh 1/- END
If 'No' go to (62)

(62) Would you be willing to pay K-cents 50 per 20-litre container of water bought from the community managed water kiosk?
If 'Yes' – Willingness to Pay is K-Cents 50 END
If 'No' go to (63) all the same.

(63) What is the maximum amount of money you are willing to pay for a 20 litre container of water obtained from a community managed water kiosk with shelter and storage tank that is open from 7.00 am to 7.00 pm?
I would be willing to pay a maximum of KSh.......................... per 20 litre container of water from a community managed water kiosk.

(64) In order to make the cost of water to members of the community group affordable, it is proposed that each community group member should contribute KSh200/- per month towards the cost of employing a kiosk attendant. Once each group member pays Ksh200/- per month, group members would pay reduced charges for each 20-litre container bought from the community water kiosk. Would you be willing to contribute KSh200/- per month to the cost of employing a kiosk attendant?
A) Yes B) No

Now go to the next service option (Service level 13 below)
Service level 13 (Privately managed water kiosk without shelter or storage tank)

Assume that you obtain water from an ordinary Water Kiosk (this is a tap without any shelter or a storage tank) supplied with water by NWCPC pipeline through a water meter to record consumption. An operator, who sells water in units of 20 litres and then pays water bills to NWCPC, privately manages the Water Kiosk. Assume that this kiosk is open from 7 a.m. to 7 p.m. daily. Sometimes times the pressure of water is low, as there is no storage tank next to the water kiosk.

(65) Would you be willing to pay KSh 4/- per 20-litre container of water bought from the water kiosk?
If ‘Yes’ – Willingness to Pay is KSh 4/- ..........END
If ‘No’ go to (66)

(66) Would you be willing to pay KSh 3/- per 20-litre container of water bought from the water kiosk?
If ‘Yes’ – Willingness to Pay is KSh 3/- ..........END
If ‘No’ go to (67)

(67) Would you be willing to pay KSh 2/- per container?
If ‘Yes’ – Willingness to Pay is KSh 2/- ..........END
If “No” go to (68)

(68) Would you be willing to pay KSh 1.50 per container of water bought from the privately managed water kiosk?
If ‘Yes’ – Willingness to Pay is KSh 1.50 ..........END
If “No” go to (69)

(69) Would you be willing to pay KSh 1/- per container of water bought from the privately managed water kiosk?
If ‘Yes’ – Willingness to Pay is KSh 1/- ..........END
If “No” go to (70)

(70) What is the maximum amount of money you are willing to pay for a 20-litre container of water obtained from an ordinary privately managed water kiosk? The water kiosk is managed by a private person and is open from 7 a.m. to 7 p.m.

I would be willing to pay a maximum of KSh.......................... per 20 litre container of water from an ordinary privately managed water kiosk.

Now, finish the bidding game

END OF QUESTIONNAIRE.

Please thank the respondent for his/her time spent with you.

Time questionnaire completed-----------------------
To the Enumerator:

Please make any comments you wish regarding the interview with this respondent, or about any part of this questionnaire, in the space provided below.

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Name of Enumerator: ................................................................................................................

(Enumerator please sign) ........................................................................................................

Date questionnaire completed: ............................................................................................

Name of Supervisor: ...........................................................................................................

Supervisor checked completed form (please sign) ............................................................

Date supervisor checked completed form: ........................................................................

Thank you for your assistance in carrying out this field research work.

Appendix 2: Research authorisation in Kenya
Cyrus Njiru,
Water, Engineering Development
Centre (WEDC),
Civil & Building Eng. Dept.,
Loughborough University,
Leicestershire,
LE 11 3TU,
UK.

Dear Sir,

RESEARCH AUTHORIZATION

Following your application for authority to conduct research on "Pricing and Service Differentiation of Utility Water and Sanitation Services for the Urban Poor", I am pleased to let you know that your application has been considered and approved. Accordingly you are authorized to conduct research in Mombasa District as from 23rd June, 1999 to 30th June, 2002.

You are advised to pay a courtesy call on the District Commissioner, Mombasa before embarking on your research project. This office expects to receive two bound copies of your final research report upon completion of your research project.

Yours faithfully,

[Signature]

J. E. EKIRAPA
FOR: PERMANENT SECRETARY/ PROVINCIAL ADMINISTRATION

cc: The District Commissioner, MOMBASA.
This is to certify that:

Mr. CYRUS NJIRU

of (Address) P.O. BOX 56224 

NAIROBI

has been permitted to conduct research in:

MOMBASA Province,

COAST District,

on the topic PRICING AND SERVICE 
DIFFERENTIATION OF UTILITY WATER 
AND SANITATION SERVICES FOR THE 
URBAN POOR

for a period ending 30TH JUNE, 1999

KSHS. 1000=-
OFFICE OF THE PRESIDENT

All District Officers,

MOMBASA DISTRICT

RE: REQUEST FOR AUTHORIZATION

Mr. S. Mather

The above named has been authorised to carry out a research on "Pricing and Service Differentiation of Utility water and sanitation services for the Urban Poor" in this District.

His permit is valid between 23rd June, 1993 and 30th June, 1994.

Kindly accord him the necessary assistance when he calls on you, to enable him succeed.

Thank you.

S. S. CADIAN

F. S. MATHER (MSc.)

FOR: DISTRICT COMMISSIONER

MOMBASA

Scc.

Cyrus Hjiru

[Handwritten note]
Eng. Cyrus NJIRU
Water Engineering and Development Centre (WEDECO),
Civil & Building Engineering Dept.,
Leicester University,
Leicestershire,
LE1 7TU,
UK

5th August 1999

In Whom It May Concern

Funding and Laboratory Experience of Unity Water Services in Mombasa

This is to confirm that the following persons have been nominated to assist Eng. Cyrus NJIRU with Customer Survey and Data Collection in Mombasa as part of fieldwork research being conducted by Eng. Cyrus NJIRU in Mombasa which has been authorised by the Office of the President, Provincial Administration and Internal Security (see letter Ref. OEP/13.00/LDC 90/2 of 29th June, 1999).

1. MR. ALL AMANU, Customer Relations Officer, National Water Conservation & Pipeline Corporation, to co-ordinate with the Researcher (Eng. Cyrus NJIRU).

2. MR. ZACHARY ONYANGO BWANA, Lecturer, Mombasa Polytechnic.

3. MR. FANUEL ONYANGO OPONGO, Lecturer, Mombasa Polytechnic.

4. MR. PETER KIPKOCHO TEREHUDU, Lecturer, Mombasa Polytechnic.

Please accord the nominated persons any necessary assistance. Necessary authorisations for this research work are attached.

[Signature]

ENG. CYRUS NJIRU
Appendix 3: Research authorisation in South Africa
TO WHOM IT MAY CONCERN;

RE: LETTER OF AUTHORITY - METRO WATER - THREE LEVELS OF SERVICE

I hereby confirm that Metro Water has Authorised a research project to investigate the three levels of service that are currently on offer. To this end, Cyrus Njiru and Sam Kayaga from Loughborough University UK and their agents will be conducting surveys in July 1999 to complete their project.

Please contact the writer on the above telephone number if you have any queries.

Yours faithfully

S R SCRUTON
MANAGER
WATER RESEARCH, PLANNING & DEVELOPMENT
Appendix 4: Customer questionnaire used in Durban
Appendix 4: Durban Domestic Customer Questionnaire

To the Enumerator: Please read the following statement to each customer before you ask the questions.

My name is .................................................... and I am working for a Research Team at the Water, Engineering and Development Centre (WEDC), Loughborough University, England. The Research Team is looking at how water companies like Durban Metro Water, meet the needs of their customers. As part of this research we are conducting an informal evaluation of the recent changes in the water supply service that Durban Metro Water offers to customers like yourself. We would like you to assist us by taking time to answer the following questions. If you do not wish to answer a particular question please leave it out. Your answers will be treated confidentially.

We have received permission from Durban Metro Water Services to conduct this study.

Section One: This section asks you very general questions about your current water supply, where you live and about yourself.

General Questions about your current water supply

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the main source of water supply for your domestic requirements?</td>
<td>Communal water pipe, Bailiff operated kiosk, Ground Tank, Roof Tank, Other (please specify)</td>
</tr>
<tr>
<td>Where else do you get water from (the source/supplier)?</td>
<td></td>
</tr>
<tr>
<td>How much do you pay for the alternative water supply?</td>
<td></td>
</tr>
</tbody>
</table>

General Details about where you live:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area name</td>
<td>Type of house</td>
</tr>
<tr>
<td>House No.</td>
<td>No. of residents</td>
</tr>
</tbody>
</table>

General details about you:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Are you:</td>
<td>Male, Female</td>
</tr>
<tr>
<td>b) Are you a member of a community organisation?</td>
<td>Yes, No</td>
</tr>
</tbody>
</table>

Durban Customer Questionnaire, July 1999
Section Two: This section asks you about the water supply that you received before you changed to your current water supply (Current supply: the Durban roof tank/ground tank/kiosk).

2.a) What was your main source of water before you changed to your current supply?

2.b) What didn't you like about your previous water supply?

2.c) On average how regularly did you receive water through your previous supply? (e.g. daily, twice a day, every alternate day etc.)

2.d) i) At what time of day did you usually receive the water?

ii) Was this a convenient time for you? YES ☐ NO ☐

iii) Why?

2.e) i) Overall were you happy with the previous supply? YES ☐ NO ☐

ii) Why? (e.g. reliability, quantity, cost etc.)

2.f) How much did you pay for your previous water supply?

2.g) How did you make this payment?

2.h) How often was this payment made?

2.i) Did you get water from any other source in addition to, or to supplement your previous supply? Yes ☐ No ☐

If yes, what were these alternative sources of water?

If yes, how much did you pay for this alternative water supply?
Section Three: This section asks you about how you changed to your current water supply.

3.a) How did you find out that it was possible to have a different type of water supply?

3.b) i) Were you given a choice of different service and/or technology options?
   Yes ☐ No ☐

   ii) What choices were you offered?

3.c) Describe briefly what you or another member of your household did leading up to your decision to have a different water supply.

   Saw demonstration of service technology type ☐
   Attended a community meeting ☐ Compared costs ☐
   Discussed with my household/neighbours ☐ Read a leaflet/poster ☐
   Other? (please state) ________________________________

3.d) What type of information were you given before you decided to have the different water service?
   (e.g. cost, service options, how to pay, methods of payment etc.)

3.e) What type of supply and/or service did you choose?

3.f) What was it that you liked about this choice as opposed to the others?

3.g) How would you describe the application procedure for a new supply?
   Easy ☐ Reasonable ☐ Difficult ☐

3.h) Once you decided to change your water supply how long did it take to obtain the new supply?
Section Four: This section asks you about your experience with your current water supply.

4a) What is your current water supply?
   - Ground Tank [ ]
   - Roof Tank [ ]
   - Water Kiosk (operated by a bailiff) [ ]
   - Communal Standpipe [ ]
   - Other (please state) [ ]

4b) i) How often do you receive your current water supply?
   - Yes [ ]
   - No [ ]
   - Sometimes [ ]

4b) ii) Is it regular?  Yes [ ]  No [ ]  Sometimes [ ]

4c) Are the timings of your current water supply convenient to your household?
   - Yes [ ]
   - No [ ]

4d) Do you usually have enough water?
   - Yes [ ]
   - No [ ]
   - Sometimes [ ]
   
   If 'no' or 'sometimes', what do you do to make sure you get enough water?

4e) Do you have enough water in the dry season?
   - Yes [ ]
   - No [ ]

4f) What do you like most about your current water supply?
   
   

4g) Are there any problems with your current water supply? If so what are they?
   
   

4h) How could your water supply be improved?
   
   

4i) Do you wish to upgrade your current water supply to something better, e.g. a roof tank or full pressure?
   - Yes [ ]
   - No [ ]
   - Not Sure [ ]

4j) How much did you pay to have your water connection (fittings and water tank)?

4k) Do you think all the costs were reasonable?
   - Yes [ ]
   - No [ ]
   - Some [ ]
   
   Which and Why?

Durban Customer Questionnaire, July 1999
4.1) Do you pay for water regularly?
Yes ☐ No ☐
If "No", why not?

4.m) What other costs have you incurred other than your ongoing regular payment (e.g. deposit etc.)?

4.n) i) How much do you regularly pay for your current water supply?

ii) Are you happy with this amount?
Yes ☐ No ☐

iii) Why?

4.o) What method of payment do you use?

Section Five: This section asks you about the customer service (complaints etc.) you receive from your supplier.

5.a) i) Who do you most often meet who represents the water supplier?

ii) Why do you have to meet them?

5.b) How would you rate the customer service that the representative(s) gives you?

Excellent ☐ Good ☐ Average ☐
Poor ☐ It changes ☐

5.c) How do you think the customer service you receive from your water supplier could be improved?

Durban Customer Questionnaire, July 1999
5. 

d) How often do you visit the office or customer office of your water supplier?

- Regularly
- Not Often
- Rarely
- Never
- It Changes

5. 

e) What is usually the purpose of your visit?

5. 

f) i) Do you consider this office to be accessible (distance, opening times, friendly etc.) to you?

- Yes
- No
- Sometimes

5. 

g) How often do you have to make a complaint about your water supply?

- Very Often
- Sometimes
- Rarely

5. 

h) Who do you usually make the complaint to?

5. 

i) What do you most often complain about?

5. 

j) How quickly is your complaint usually sorted out to your satisfaction?

Section Six: In April 1998, Durban Metro Water Services revised the water tariffs. This section seeks to obtain your views regarding the new tariff structure.

6. 

a) Prior to the tariff revision, did you consider the original water tariff to be affordable?

6. 

b) Do you consider the present water tariff to be affordable?

6. 

c) If not, why?
Section Six Continued

6: d) If you receive water from the ground tank, do you find the amount of water you receive everyday (i.e. 200 litres) enough for your household requirements?

Yes [ ] No [ ]

6: e) If you receive water from a roof tank (semi-pressure system), do you find the water pressure adequate?

Yes [ ] No [ ]

6: f) The water that the consumer receives at his/her household or from the communal stand pipe nearby has been purified and transported by Durban Metro Water Services at a cost. In your view, should the consumer meet the costs of provision of water?

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6: g) If the consumer should meet the cost of provision of water services, what in your view is the fair amount of money that consumers should pay per month for each of the following levels of service?

1. Communal Standpipe .................................................................

2. Water Kiosk (operated by a Bailiff) .............................................

3. Ground tank .............................................................................

4. Roof Tank ..............................................................................

5. Full Pressure system ...............................................................

Section Seven: This section invites you to tell us anything else regarding the water services in Durban Metro that we have not yet asked you. Please feel free to make suggestions or comments about the water service in the space below.

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Section Eight: To help us with future questionnaires please answer the following questions.

8.a) How much time did you spend answering this questionnaire?

8.b) Did you understand all the questions?
   Yes [ ] No [ ] Mostly [ ] Some [ ]

8.c) How can we improve our questionnaires?

8.d) Was this questionnaire relevant to you?
   Yes [ ] No [ ] Parts [ ]
   Why? ____________________________________________

Please make any other comments about any part of this questionnaire in the space below:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Thank you for completing this questionnaire.

Cyrus Njiru, Principal Researcher, PSDP research project
The PSDP Research Team, WEDC, Loughborough University, UK.
July 1999

To the Enumerator:
Your Name: _____________________________ Date completed: ________________

To the Supervisor:
Please indicate your comments here
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Name _____________________________ Date _____________________________
Appendix 5: Calculations for performance indicators

The billing for Mombasa and Coast Region (average for July to December 1998) is:

Average water sold in = 1,864,093 m³ per Month
Average water sold (monthly billing) in = KSh56,655,193 per Month
Current annual water sold (billing) = KSh679,862,316/year
Annual water sold = 1,864,093 × 12 = 22,369,116 m³/year
Current average tariff = KSh679,862,316/22,369,116 m³ = KSh30.40 per m³

Unaccounted for water = (water produced - water sold) / (water produced)
= (34,310,000 - 22,369,116) / (34,310,000)
= 0.348
= 35%

Summary of revenue collection in Mombasa and Coastal Region (average for July to December 1998) is:

Average revenue collection = KSh38,570,117 per Month
Average water sold (billing) = KSh56,655,193 per Month
Bill collection efficiency = (average revenue collection) / (average billing)
= KSh38,570,117 / 56,655,193
= 0.6807
= 68%

Outstanding arrears (cumulative since 1989) = 795,404,683 (includes disputed bills)

The average revenue collected per unit volume of water sold is
38,570,117/1,864,093 = KSh20.70 (US$0.30) / m³.
This is effectively the current average tariff as it takes into account operating management efficiency.

Current volume of water sold per annum = 22,369,116 m³/year
Current annual billing (potential revenue) = KSh679,862,316/year
Current average annual revenue (actual revenue collected) = KSh462,841,404
(Before implementation of the 1999 tariff)
Current average tariff (based on actual revenue collected) = KSh21/m³
Current bill collection efficiency = 68%
Current unaccounted for water (UFW) = 35%

Water connections (for Mombasa and coast region)
Number of connections 59,330
Number of working meters 47,449 (80%)
Number of non-working meters 11,881 (20%)

STAFF
Total number of staff in Coast Region 596 (460 permanent and 136 temporary employees)
Number of employees per 1000 connections 10

Average number of people per connection = \(\frac{15,000,000}{50,000} = 30\)

Current water consumption per category
There are presently three categories of customers with estimated consumption as follows:

Residential (individual connections or yard connections) = 14,092,543 m³ (63%)
Kiosks or public = 1,565,838 (7%)
Industrial = 6,710,735 (30%)

Average total amount sold per year = 22,369,116 m³ per year

Some institutional customers such as hotels are included in the category of residential customers. Due to current water shortages, many customers use alternative sources of water. Many industrial, commercial and institutional customers have invested in alternative sources such as boreholes and wells.

Assuming that 70% of the water sold is currently used for domestic consumption by a population of about 1,500,000 in Mombasa and coastal area, the current average per capita consumption is about \(\frac{(22,369,116 \times 70/100)}{(365 \times 1,500,000)} = 29\) litres per capita per day.

1997/1998 financial year
Billing for the 1997/1998 financial year = KSh405,742,032
Revenue collection for the 1997/1998 financial year = KSh356,823,793
Bill collection efficiency = \( \frac{356,823,793}{405,742,032} \) = 88%

1998/1999 financial year
Billing for the 1998/1999 financial year = KSh \( 677,695,470 \)
Revenue collection for the 1998/1999 financial year = KSh \( 430,328,755 \)
Bill collection efficiency = \( \frac{430,328,755}{677,695,470} \) = 64%

1999/2000 financial year
Billing for the 1999/2000 financial year = KSh \( 732,179,338 \)
Revenue collection for the 1999/2000 financial year = KSh \( 566,805,552 \)
Bill collection efficiency = \( \frac{566,805,552}{732,179,338} \) = 77%

Average bill collection efficiency = \( \frac{88 + 64 + 77}{3} \) = 76%

Summary of financial ratios (for NWCPC Coast Region)

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<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Water Revenue Billing</td>
<td>405,742,032</td>
<td>677,695,470</td>
<td>732,179,338</td>
<td>Increasing</td>
</tr>
<tr>
<td>Water Revenue Collection</td>
<td>356,823,793</td>
<td>430,328,755</td>
<td>566,805,552</td>
<td>Increasing</td>
</tr>
<tr>
<td>Bill collection efficiency</td>
<td>88%</td>
<td>64%</td>
<td>77%</td>
<td>76%</td>
</tr>
<tr>
<td>(*)Recurrent Expenditure</td>
<td>153,928,925</td>
<td>201,197,356</td>
<td>197,775,828</td>
<td>43,124,916</td>
</tr>
<tr>
<td>Ratio (Expenditure/Collections)</td>
<td>43%</td>
<td>47%</td>
<td>35%</td>
<td>42%</td>
</tr>
</tbody>
</table>

*Recurrent expenditure does not include loan repayments and depreciation.

Source: Adapted from NWCPC audited financial accounts, calculations by the author.

Although recurrent expenditure shown in the above table does not include loan repayments and depreciation, it is likely that NWCPC Mombasa is able to balance its books and achieve financial sustainability.

1999/2000 data (This data is suspected to have errors due to billing system failure)
Volume of water sold per annum = 18,522,444 m$^3$/year
Annual billing (potential revenue) = KSh 732,179,338/year
Average annual revenue (actual revenue collected) = KSh 566,805,552/year
(includes billing before implementation of the 1999 tariff)
Current average tariff (based on actual revenue collected) = KSh 21/m$^3$
(about US$0.30/m$^3$)
Bill collection efficiency = 77%
Unaccounted for water (UFW) = 46%
Appendix 6: Calculations for Average Incremental Cost (AIC)
Appendix 6: Calculations for Average Incremental Cost (AIC)

SCENARIO 1: AIC calculation based on full costs of improvements and entire capacity of water distribution network contributing to new investment with high efficiency.

Scenario 1 assumes that financing will be available to finance bulk supply and improvements to the distribution network. The total capital cost for both components is US$285 million. Provision for rehabilitation of the system is made at US$10 million. It is assumed that this amount will be spent in the 10th year after commissioning. It is assumed that the full costs of improving the water supply system will be met from water sales from the entire region. A high level of management efficiency is assumed at 15% unaccounted for water (UFW) and 90% bill collection efficiency.

The following further assumptions are made:

- Financing is secured at 8% per annum with a grace period equal to the construction period so that repayments commence after commissioning when water is sold to customers.
- Unaccounted for water is 15% so that 85% of water produced is sold (billed for).
- Revenue collection efficiency of the water utility is 90% (with commercial management). This means that 90% of the water sold is actually paid for.
- Management of the distribution system will be on commercial basis (The estimated costs assume that commercial management would be engaged).
- The life of the project is assumed to be only 25 years for purposes of calculation of AIC: It is known that such projects have a much longer life span. (The existing First Mzima Pipeline project is over 45 years and still performing well while Sabaki Transmission Pipeline is over 20 years)

The operation and maintenance cost for Sabaki (Baricho) water source has been estimated at US$0.59 per m³. Assuming that Marere and Tiwi maintain production at their full capacities of 12,000 and 6,000 respectively and that Baricho source
maintains its present contribution of 72,000m³/day, then the total amount distributed by the strengthened network is 86,400+12,000+6,000+72,000=176,400m³.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (USD)</th>
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<td>Total Capital Cost of the second Mzima pipeline, storage, &amp; distribution</td>
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<tr>
<td>Annual O &amp; M cost (Mzima bulk supply, 86400m³/day)</td>
<td>2,000,000/yr</td>
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<tr>
<td>Annual O &amp; M cost (Baricho &amp; Tiwi bulk sources, 78,000@US$0.59)</td>
<td>16,797,000/yr</td>
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<tr>
<td>Annual O &amp; M costs (distribution system with commercial management)</td>
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<td>Total operation and maintenance costs</td>
<td>26,797,000/yr</td>
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<tr>
<td>Annual water produced 176,400m³/day</td>
<td>64,386,000m³/yr</td>
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<tr>
<td>Annual water sold (@15%UFW)</td>
<td>54,730,000m³/yr</td>
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<td>Annual water sold and paid for (@90% bill collection efficiency)</td>
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<td>Discount Rate</td>
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With these assumptions, the average incremental cost for the 2nd Mzima water supply project for Mombasa is calculated as shown below.
Scenario 1: AIC calculation for 2nd Mzima water project (bulk supply, distribution network and commercial management of the system), high efficiency at 15% UFW

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<th>Discount Factor at 8% Discount Rate</th>
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<th>Water sold and paid for in '000m³/yr</th>
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</table>

Average Incremental Cost = \( \frac{\text{Present Value of Total Costs}}{\text{Present Value of water sold and paid for}} \)

= US$545,312,000/503,336,000m³

= US$1.08 per m³

In this scenario, the average incremental cost of water is US$1.08 per m³. With the present exchange rate of KSh73/= to the US$, the Average Incremental Cost is about Ksh78.85/= per m³

In order to break even, the average tariff would be set at US$1.08 per m³.
Scenario 2: AIC calculation based on full costs of improvements and entire capacity of water distribution network contributing to new investment, at modest efficiency

Scenario 2 is similar to scenario 1 above but at a lower level of management efficiency. In this scenario, the AIC is calculated assuming that UFW is 20% and bill collection efficiency is 85%.

Total Capital Cost of the second Mzima pipeline, storage, & distribution US$285,000,000
Annual O & M cost (Mzima bulk supply, 86400m³/day) US$2,000,000/yr
Annual O & M cost (Baricho & Tiwi bulk sources, 78,000@US$0.59) US$16,797,000/yr
Annual O & M costs (distribution system with private sector management) US$8,000,000/yr
Total operation and maintenance costs US$26,797,000/yr
Annual water produced 176,400m³/day 64,386,000m³/yr
Annual water sold (@20%UFW) 51,510,000m³/yr
Annual water sold and paid for (@85% bill collection efficiency) 43,800,000m³/yr
Discount Rate 8%

With these assumptions, the average incremental cost for the 2nd Mzima water supply project for Mombasa is calculated as shown below.
Scenario 2: AIC calculation for 2nd mzima water supply project (bulk supply, distribution network and commercial management of the system) with modest efficiency at UFW 20%

<table>
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<th>Capital Costs in '000 US$</th>
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<th>Total Costs in '000 US$</th>
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<th>Water sold and paid for in '000m³/yr</th>
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Average Incremental Cost = (Present Value of Total Costs)/(Present Value of water sold and paid for)

= US$545,312,000/449,186,000m³

= US$1.21 per m³

In this scenario, the average incremental cost of water is US$1.21 per m³. With the present exchange rate of KSh73/= to the US$, the Average Incremental Cost is about Ksh88.30/= per m³.
Appendix 7: Calculations for projected revenue in Mombasa
Appendix 7: Calculations for projected revenue in Mombasa, from proposed water supply options

It is proposed to supply water through seven service options. Revenue obtained from each service option is estimated as shown in the following calculations.

5.7.1. Service option 1: 12-24 Hour supply at individual House connection

Market segment: Bungalows & maisonettes
Population=175,000
Consumption rate=150 litres/capita per day
Annual Consumption = (175,000 x 150) x 365/1000 = 9,581,250 m³

Market segment: Flats
Population=105,000 (80% with individual flat connections)
Consumption rate=100 litres/capita per day for individual connections
Annual Consumption = 80/100 x (105,000 x 100) x 365/1000 = 3,066,000 m³

Market segment: 1,2 or 3 roomed dwelling and Swahili houses
Population=280,000 x 25% = 70,000
Consumption rate=80 litres/capita per day for individual connections
Annual Consumption = (70,000 x 80) x 365/1000 = 2,044,000 m³

Total consumption for service option = (9,581,250 + 3,066,000 + 2,044,000) = 14,691,250 m³
Tariff for service option = KSh60/m³
Projected income from service option = 14,691,250 x 60 = KSh881,475,000

5.7.2. Service option 2: 12-24 Hour supply at shared flat connection

Market segment: Flats
Population=105,000 (20% with shared flat connections)
Consumption rate=100 litres/capita per day for shared flat connections
Annual Consumption = \(\frac{20}{100} \times (105,000 \times 100) \times \frac{365}{1000} = 766,500 \text{ m}^3\)

Total consumption for service option = 766,500 m\(^3\)

Tariff for service option = KSh55/m\(^3\)

Projected income from service option = 766,500 \times 55 = KSh42,157,500

5.7.3. Service option 3: 12-24 Hour supply at yard connection with utility storage tank

Market segment: 1, 2 or 3 roomed dwelling and Swahili houses
Population = 280,000 \times 30\% = 84,000

Consumption rate = 60 litres/capita per day

Annual Consumption = \(\frac{84,000 \times 60}{1000} \times 365 = 1,839,600 \text{ m}^3\)

Market segment: Informal settlements
Population = 140,000 \times 10\% = 14,000

Consumption rate = 60 litres/capita per day

Annual Consumption = \(\frac{14,000 \times 60}{1000} \times 365 = 306,600 \text{ m}^3\)

Total consumption for service option = (1,839,600 + 306,600) = 2,146,200 m\(^3\)

Tariff for service option = KSh45/m\(^3\)

Projected income from service option = 2,146,200 \times 45 = KSh97,010,000

5.7.4. Service option 4: 12-24 Hour supply at yard connection without utility storage tank (ordinary yard connection)

Market segment: 1, 2 or 3 roomed dwelling and Swahili houses
Population = 280,000 \times 30\% = 84,000

Consumption rate = 60 litres/capita per day

Annual Consumption = \(\frac{84,000 \times 60}{1000} \times 365 = 1,839,600 \text{ m}^3\)

Market segment: Informal settlements
Population = 140,000 \times 10\% = 14,000

Consumption rate = 60 litres/capita per day

Annual Consumption = \(\frac{14,000 \times 60}{1000} \times 365 = 306,600 \text{ m}^3\)
Total consumption for service option \(= (1\,839\,600 + 306\,600) = 2\,146\,200\,\text{m}^3\)

Tariff for service option = KSh45/\text{m}^3

Projected income from service option \(2\,146\,200 \times 45 = \text{KSh96}\,579\,000\)

5.7.5. Service options 5 and 6: 12-24 Hour supply at privately and community managed water kiosks with storage and structure

Market segment: 1, 2 or 3 roomed dwellings and Swahili houses

Population = 280,000 \times 15\% = 42,000

Consumption rate = 20 litres/capita per day

Annual Consumption = \((42000 \times 20) \times 365/1000 = 306\,600\,\text{m}^3\)

Market segment: Informal settlements

Population = 140,000 \times 80\% = 112,000

Consumption rate = 20 litres/capita per day

Annual Consumption = \((112,000 \times 20) \times 365/1000 = 817\,600\,\text{m}^3\)

Total consumption for service option \(= (306\,600 + 817\,600) = 1\,124\,200\,\text{m}^3\)

Tariff for service option = KSh25/\text{m}^3

Projected income from service option \(1\,124\,200 \times 25 = \text{KSh28}\,105\,000\)

Domestic Consumption

Total domestic consumption \(= (14\,691\,250 + 766\,500 + 2\,146\,200 + 2\,146\,200 + 1\,124\,200) = 20\,874\,350\,\text{m}^3\)

Total amount of water available for sale = 43,800,000 \text{m}^3

Amount available for sale to industrial, commercial and institutional customers = \((43\,800\,000 - 20\,874\,350) = 22\,925\,650\,\text{m}^3\)
5.7.6. Service option 7: 12-24Hour supply to institutional and business customers

Market segment: Commercial, industrial and institutional customers
Estimated total consumption for service option = 22 925 650 m³
Tariff for service option = KSh120/m³
Projected income from service option = 22 925 650 x 120 = KSh2 751 078 000

5.7.7 Total projected revenue for all service options

The total projected revenue from all service options is KSh814 750 000 + KSh42 157 500 + KSh107 310 000 + KSh 96 579 000 + KSh 28 105 000 + KSh 2 751 078 000 = KSh3 906 704 500

The proposed average tariff = KSh3 906 704 500 / 43,800,000 m³
= KSh89/20 per m³
Proposed profit = Total projected revenue less required annual revenue
=(KSh3 906 704 500 - KSh3 854 400 000)
=KSh52 304 500
=US$716 500 per annum
Appendix 8: Summary of financial aspects of the marketing plan for NWCPC, Mombasa
Appendix 8: Summary of financial aspects of the marketing plan for NWCPC, Mombasa

A summary of the key financial aspects of the plan is presented in this section.

5.8.1 Current NWCPC water services

There are presently three categories of customers, these being residential, kiosks (or public) and industrial (or commercial). Consumption for each of these categories is estimated as follows:

Residential (individual connections or yard connections) = 14,092,543 m$^3$ (63%)
Kiosks or public = 1,565,838 m$^3$ (7%)
Industrial = 6,710,735 m$^3$ (30%)

(Although metering is 100%, only about 56% of billed consumption is based on actual meter reading. This is because meters are either not functional or not read. Some institutional customers such as hotels are included in the category of residential customers.)

Current volume of water sold per annum = 22,369,116 m$^3$/year
Current annual billing (potential revenue) = KSh679 862 316/year
Current average annual revenue (actual revenue collected) = KSh462 841 404
Current average tariff (based on actual revenue collected) = KSh21/m$^3$ (about US$0.30/m$^3$, before implementation of the November 1999 tariff)
Current bill collection efficiency = 68%
Current unaccounted for water (UFW) = 35%

Existing services are inadequate and the utility is not meeting its financial and other objectives.

5.8.2 Adequate and sustainable water services

Amount of water to be produced, sold and paid for per annum= 43,800,000 m$^3$
Estimated annual operations & maintenance expenditure = KSh1, 956,181,000
Required average tariff to cover O & M only = KSh45/m$^3$
Required average tariff to cover all costs (based on AIC) = KSh88/m$^3$
Required average annual revenue = KSh3,854,400,000

Adequate and sustainable water services represent the improvements that are needed to meet the customer requirements expressed through willing to pay studies, and the revenue that would meet the utility’s financial objectives as stated in its mission statement (NWCPC, 1999).

5.8.3 Proposed scenario and projected income

It is proposed to implement the 2nd Mzima project consisting of new bulk supply development and improvements to the distribution system. The capital requirement for implementation of bulk supply and improvements to the distribution system is US$285 million. Another US$10 million may be required for rehabilitation of the system in the 10th year after commissioning. It is assumed that funding for the full costs of improving the water supply system will be secured at 8% interest repayable in 25 years from commissioning. It is further assumed that loan repayments will be met entirely from water sales in Mombasa and the coastal region.

Management improvements to ensure commercial management will be undertaken and proposed service options promoted in respective market segments. A modest level of management efficiency is assumed at 20% unaccounted for water (UFW) and 85% bill collection efficiency. The proposed scenario and income is summarised in the table below.
Table 6.22: Proposed service options and projected revenue

<table>
<thead>
<tr>
<th>Proposed water supply options</th>
<th>Expected volume of water sold and paid for (m$^3$/yr)</th>
<th>Proposed water tariffs based on WTP survey (KSh/m$^3$)</th>
<th>Projected income from each option (KSh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-24 Hour supply at individual House connection</td>
<td>14 691 250</td>
<td>60</td>
<td>881 475 000</td>
</tr>
<tr>
<td>12-24 Hour supply at shared House (flat) connection</td>
<td>766 500</td>
<td>55</td>
<td>42 157 500</td>
</tr>
<tr>
<td>12-24 Hour supply at yard connection with utility storage tank</td>
<td>2 146 200</td>
<td>50</td>
<td>107 310 000</td>
</tr>
<tr>
<td>12-24 Hour supply at yard connection (no utility tank)</td>
<td>2 146 200</td>
<td>45</td>
<td>96 579 000</td>
</tr>
<tr>
<td>12-24 Hour supply at water kiosks with storage and structure (privately or community managed)</td>
<td>1,124,200</td>
<td>25</td>
<td>28,105,000</td>
</tr>
<tr>
<td>12-24 Hour supply to commercial, industrial and institutional customers</td>
<td>22 925 650</td>
<td>120</td>
<td>2 751 078 000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>43,800,000m$^3$</strong></td>
<td></td>
<td><strong>KSh3 906 704 500</strong></td>
</tr>
</tbody>
</table>

The table shows that the total projected revenue for the utility is KSh3 906 704 500 per annum. The proposed average water tariff is KSh89/20 (about US$1.20) per m$^3$.

Assuming that the total annual costs to cover both capital and recurrent expenditure remains at the estimated amount of KSh3, 854,400,000, then the utility can make a modest profit amounting to KSh52 304 500 (about US$716 500) per annum.

This profit can be used to improve water services in other areas. The utility can therefore meet the requirements of customers and still be financially sustainable.
Appendix 9: List of publications

