Capacity building and knowledge enhancement for rural water supply and sanitation in Sofala, Mozambique

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David Clement

Betreuer: Univ.Prof. Dipl.-Ing. Dr. nat. techn. Haberl Raimund
Dipl.-Ing. Jung Helmut

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Dedicada a mi genitûrs Valeria y Otto Clement
Abstract

The Millennium Development Declaration aims to halve, by 2015, the proportion of world's population living in extreme poverty. Therein, one of the most important targets is to increase access to safe drinking water and sanitation. It was demonstrated, that the improvement of the water sector in developing countries requires infrastructural support, institutional development as well as capacity building and knowledge enhancement. This thesis focuses on the latter issues, analysing the Mozambican rural water sector with respect to its needs and potential regarding human capacity and knowledge building. Proposals for a capacity building and research program are presented for the province of Sofala.

Problems of the Mozambican rural water sector were depicted and the resulting needs for capacity building and research elaborated. The approach was based on a comparison of "normative" and "expressed" needs. Normative needs resulted from the analysis of official documents. Expressed needs, on the contrary, were gained through interviews and focus group discussions with various stakeholders of the rural water sector. The interviews were also used to identify the potential for capacity building and research focusing on institutions situated in Sofala province.

The results show a good concordance between the expressed and the normative needs. Problems of the rural water sector are related to the deficits in human capacity. Inadequate operation and maintenance of water and sanitation infrastructure, missing management, PR and planning skills, absent environmental and hygienic awareness affect negatively the water sector from the national down to the province, district, and community level. The lack of a knowledge system producing and spreading out applied knowledge impedes the development of the rural water sector in line with the particular requirements of the population. The decentralisation process taking place in the Mozambican water sector requires the improvement of human capacity at province, but especially at district and community level. The primary needs are vocational training for district technicians, community agents, public administration, private enterprises, and the water committees. The water users/communities must be included in the capacity building process, educating them particularly in hygiene and sanitation issues. Applied research must be targeted to the practical problems of the rural water
sector.
Training of individuals cannot respond to the needs emerging from the study. In fact, capacity building has to switch from single training actions to a capacity building program approach. The program has to be continuous and demand driven in order to respond constantly to the emerging needs of the rural water sector. The four program proposals show how a donor can intervene initiating the capacity building and applied research process in the rural water sector of Sofala. Thereby, the most important feature is the task repartition between different institutions. It has to be assured that the taken actions correspond to the real needs of the water sector. Finally, suggestions for guiding the way forward to a program implementation are presented.


Ausbildungsinitiativen für den ländlichen Wassersektor dürfen nicht individuell auf die Ausbildung einzelner Personen angelegt sein. Es müssen Ausbildungsprogramme initiiert werden, die eine breitere Schicht an Fachkräften ausbilden. Diese Programme müssen kontinuierlich sein und ihr Angebot nach der Nachfrage ausrichten, damit der tatsächliche Bedarf des ländlichen Wassersektors gedeckt wird.

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<td>AD</td>
<td>Administração Distrital (District Administration)</td>
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<td>ADA</td>
<td>Austrian Development Agency</td>
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<td>ADC</td>
<td>Austrian Development Cooperation</td>
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<td>ARA</td>
<td>Administração Regional de Águas (Regional Water Board)</td>
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<tr>
<td>CFP</td>
<td>Centro de Formação Profissional (Vocational Training Centre)</td>
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<tr>
<td>CFPAS</td>
<td>Centro de Formação Profissional de Água e Saneamento (Vocational Training Centre for Water and Sanitation)</td>
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<tr>
<td>CM</td>
<td>Conselho Municipal</td>
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<td>CNA</td>
<td>Conselho Nacional de Águas</td>
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<tr>
<td>CRA</td>
<td>Conselho Regulatorio de Águas</td>
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<tr>
<td>DANIDA</td>
<td>Danish International Development Agency</td>
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<td>DAR</td>
<td>Departamento de Água Rural</td>
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<tr>
<td>DAS</td>
<td>Departamento de Água e Saneamento</td>
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<tr>
<td>DES</td>
<td>Departamento de Saneamento</td>
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<tr>
<td>DGRH</td>
<td>Departamento de Gestão de Recursos Hídricos (Department for Water Resources Management)</td>
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<tr>
<td>DNA</td>
<td>Direcção Nacional de Águas (National Water Directory)</td>
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<tr>
<td>DPOPH</td>
<td>Direcção Provincial de Obras Públicas e Habitação (Provincial Directory for Public Works and Housing)</td>
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<tr>
<td>EcoSan</td>
<td>Ecological Sanitation</td>
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<tr>
<td>EDR</td>
<td>Estratégia de Desenvolvimento Rural (Rural Development Strategy)</td>
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<td>EPAR</td>
<td>Estaleiro Provincial de Água Rural (Provincial Rural Water Workshop)</td>
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<tr>
<td>ESA</td>
<td>Escola Superior de Ambiente (Environment High School)</td>
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<tr>
<td>FIPAG</td>
<td>Fundo de Investimento e Património de Abastecimento de Água. (Water Supply Investment Fund)</td>
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<tr>
<td>FRELIMO</td>
<td>Frente da Libertação de Moçambique</td>
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<td>GoM</td>
<td>Government of Mozambique</td>
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<tr>
<td>GTZ</td>
<td>Gesellschaft fuer Technische Zusammenarbeit</td>
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<tr>
<td>IIM</td>
<td>Instituto Industrial de Moçambique</td>
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<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>IMF</td>
<td>International Monetary Fund</td>
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<td>INE</td>
<td>Instituto Nacional de Estatística</td>
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<td>IRC</td>
<td>International Water and Sanitation Centre</td>
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<td>Abbreviation</td>
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<tr>
<td>ISPU</td>
<td>Instituto Universitario Politecnico Superior</td>
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<tr>
<td>ITN</td>
<td>International Training Network</td>
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<td>IWRM</td>
<td>Integrated Water Resources Management</td>
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<td>IWSD</td>
<td>Institute of Water and Sanitation Development</td>
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<td>MCA</td>
<td>Millennium Challenge Account</td>
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<td>MCC</td>
<td>Millennium Challenge Corporation</td>
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<td>MDG</td>
<td>Millennium Development Goals</td>
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<td>MINED</td>
<td>Ministry of Education</td>
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<td>MINTEC</td>
<td>Ministry of Technology</td>
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<td>MOPH</td>
<td>Ministry of Public Works and Housing</td>
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<td>MoU</td>
<td>Memorandum of Understanding</td>
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<td>NETWAS</td>
<td>Network for Water and Sanitation</td>
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<td>OE</td>
<td>Ordem de Engenheiros</td>
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<td>PARPA</td>
<td>Plano de Acção Para Redução da Pobreza Absoluta (Absolute Poverty Reduction Plan)</td>
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<td>PAARSS</td>
<td>Plano de Apoio a Água e Saneamento em Sofala (Support Program for Rural Water and Sanitation in Sofala)</td>
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<td>PBLA</td>
<td>Problem Based Learning Approach</td>
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<td>PESA-ASR</td>
<td>Plano Estratégico de Água e Saneamento Rural (Strategic Plan for Rural Water and Sanitation)</td>
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<td>PIREP</td>
<td>Programa Integrado de Reforma da Educação Profissional (Professional and Technical Education Reform Program)</td>
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<td>PNA</td>
<td>Política Nacional de Águas</td>
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<td>RENAMO</td>
<td>Resistencia Nacional de Moçambique</td>
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<tr>
<td>SAREC</td>
<td>Swedish Department for Research Cooperation</td>
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<tr>
<td>SDC</td>
<td>Swiss Agency for Development and Cooperation</td>
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<tr>
<td>SNQF</td>
<td>Sistema Nacional de Qualificações e Formação</td>
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<tr>
<td>SWAP</td>
<td>Sector Wide Approach to Planning</td>
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<tr>
<td>UCM</td>
<td>Universidade Católica de Moçambique</td>
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<td>UEM</td>
<td>Universidade Edoardo Mondlane</td>
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<td>UJP</td>
<td>Universidade Jean Piaget</td>
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<td>UP</td>
<td>Universidade Pedagógica</td>
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<td>WB</td>
<td>World Bank</td>
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<td>Zamwat</td>
<td>Zambezi Water Project</td>
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Chapter 1

Introduction

1.1 Settings

Experiences in developing countries have shown that the build-up of the water sector has to go hand in hand with the development of human capacity. Programs have tried to address the lack of capacity in the water sector by training individuals. Exchange programs were and are organised, giving students an academic education at universities of the donor countries. The donors carry out seldom needs assessments, and therefore the training is not directed at the water sector. The trained individuals are often overqualified and tend to be absorbed by international organisations and donors. Consequently, the capacity gap in the water sector persists, especially in rural areas.

The same situation is occurring in the water sector of Mozambique. The country is implementing a decentralisation process also including the water sector. In this context, the requirements for human capacity and knowledge at decentralised level are growing. Responsibilities and competences are dislocated from the central institutions in Maputo to the districts and provinces. Therefore, the roles of the private sector and the communities are gaining importance. The lack of human capacity at community, district, and province level is a deficiency, which is now affecting the water sector. It will affect it even more as the decentralisation process is going on. This situation is worse in the rural water sector. If no measures are taken for training the actors of the rural water sector, the tasks that the central level dismisses will not be accomplished in the provinces and districts.

Additional to capacity building, knowledge in water and sanitation has to be developed and managed. Research regarding the specific practical problems of the rural water sector has to be encouraged, in order to build a knowledge base for backing the development of the sector.

These suppositions are the starting point for this thesis. A closer look to the rural water sector of the province of Sofala will try to ascertain the situation and locate the main capacity and knowledge gaps. For a sustainable solution to the problem, local institutions
1.2. Problem definition and Justification

In September 2000, the general assembly of the United Nations in New York adopted the Millennium Declaration, which defines the eight Millennium Development Goals (MDGs). The MDGs provide developing countries a framework for development and set time bound targets. One of the targets is to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. In 2000, Mozambique assumed the targets of the MDGs. New challenges emerged for the water sector. To halve the people without access to safe drinking water and sanitation in Mozambique means to achieve, by 2015, coverage of 70% for water supply and 50% for sanitation. In fact, the GoM and the DNA apply these targets in their strategies and plans for the water sector. Different measures for developing the sector are taken. A reform process is taking place, based upon the National Water Policy (POLÍTICA NACIONAL DE ÁGUAS, 1995)) and supported especially by the Water Law (LEI DE ÁGUAS, 1991). The strategies for implementing the water sector reform are the increase of coverage, quality, and sustainability of water supply and sanitation, and the enlargement of technological options. In this context, competences and responsibilities should be decentralised and the dynamism of human resources and institutions increased (PESA-ASR, 2006).

Several donors support this process in Mozambique. Among the donors, the Austrian Development Cooperation is a backer for the development of the water sector. In comparison to other donors, the ADC is a relatively small contributor of bilateral aid. The ADC’s contributions are concentrated in the rural areas of the Province of Sofala, where they rank at the fourth position, behind the agencies of Germany, Denmark, and the EC (KEK-CDC CONSULTANTS, 2006).

Currently, three ADC projects are occurring in Mozambique all concentrated in the rural area of Sofala. They consist of an agricultural project (ProAgri), a support project for Municipalities and a support project for the water sector- the PAARSS project, which this section will describe. The objectives of the development work of the ADC in Mozambique have to coincide with the international goals for development (the MDGs) and the targets set by the GoM. The overall priority aim for Mozambique is to reduce the percentage of poor people from 54% in 2006 to 45% in 2009 (ADA 2006). The ADC concentrates on the achievement of this aim in the rural area, which is particularly weak and which gets less attention than the urban sector (ADA, 2007c). For the development of the rural area, the ADC focuses on the water sector aiming especially to achieve sub target 10 of the MDGs (access to safe water and sanitation) which contributes to poverty reduction. Thereby, sanitation has the same priority as water supply (ADA,
1.2. PROBLEM DEFINITION AND JUSTIFICATION

2007c). However, "The attained provision level (in terms of the MDG-indicators) is not perceived as a detached criterion [...] but as a concrete indicator for the progress of a sustainable development process" (ADA, 2004).

In 1999, the ADC started the PAARSS (Support Program for rural Water and Sanitation in Sofala) in partnership with the provincial government of Sofala. It is a "demand driven integrated sector project for rural water and sanitation" (ADA, 2005). The project covers five districts of the province of Sofala, namely Marromeo, Cheringoma, Dondo, Buzi and Chibabawa and two Municipalities (Dondo and Marromeo). The objectives of PAARSS are the introduction of new water supply and sanitation options, enhancing communication between the communities and the DPOPH/DAS, implementation of new management options for water supply systems and community education (ADA, 2007a). The activities of PAARSS include capacity building for DAS and district staff, parastatal and private organisations, community activists and local masons and constructors. The project comprises a small coordination body with technical expertise, which plans its activities with the DPOPH/DAS and the ADs. PAARSS is now entering its third phase. By the end of the second phase, ADA carried out a mid term review. The results show that the first two phases of the project were successful as it contributed to improve access to water supply and sanitation facilities in Sofala (ADA, 2005).

However, from the mid term review, it emerges that PAARSS was not able to develop sufficient capacity of DAS and the water sector (ADA, 2005). Trained individuals do not suffice for the challenges of the rural water sector of Sofala and tend to switch to better paid jobs (mainly in cities) as soon as they have the chance (JUNG, 2007). This fact shows that there is a labour market with a high demand for skilled personnel in the water sector and a deficit of personnel.

The lack of trained personnel complicates or impedes the establishment of an adequate water service delivery, which is the aim of the GoM and the ADC for the water sector. Until now, the strategy for capacity building was the training of individuals or the strengthening of institutional capacity. It seems that this strategy did not achieve the expected results. If the aims formulated by the MDGs, the GoM and the ADC have to be achieved, training and education have to be given to a wide range of actors. On this way, the high demand for trained personnel can be met. "In the future, the water and sanitation sector in Sofala must become a denser network of different actors who have the capacity to effectively carry out their designated tasks" (KEK-CDC CONSULTANTS, 2006).

The mid term review of PAARSS confirms the urgent need for capacity building in the rural water sector. In the recommendations for the third phase of the project, we can read following assertions:

- PAARSS III needs to focus its efforts to develop the technical and managerial capacities at all levels, focussing on individual and institutional capacity development.
1.3. CONTRIBUTION AND OBJECTIVES OF THE THESIS

- The capacity building should focus on training and development of provincial capacity for responding to the developments within Governmental and Provincial based organisations.
- The initiation of a training centre for water and sanitation in Beira is an exciting opportunity for the water sector of the Northern provinces.
- The focus at community level should be set on hygiene and sanitation education.
- For district/municipalities a training of municipal staff for planning and construction of infrastructure is needed.
- PAARSS should continue as a project for capacity building.

In addition, in recent discussions between ADA and the DNA, it emerged that the DNA is enthusiastic about a capacity building and research program in Sofala and wants it to be started as soon as possible (JUNG, 2007). A discussion took place about the importance of continuing the progress in Sofala and not selecting other areas. The activities of the Austrian Cooperation are concentrated in the province of Sofala; however, it is now the less affected province of Mozambique in terms of poverty (KEK-CDC CONSULTANTS, 2006). The high reputation, mutual trust, good knowledge of the situation should constitute sufficient reasons for the continuance of ADC in Sofala. Initially, the DNA was sceptical about a capacity-building program that would regard only in Sofala, but now it looks forward to the implementation of the program. The program can be seen as a pilot project for capacity building in other provinces.

It can be stated that investing in capacity building and research for the rural water sector of Sofala is essential for the achievement of the aims of the water sector. The ADC could give important support to Mozambique in the achievement of target eight of the MDGs, namely to have by 2015 the population without access to drinking water and sanitation. This thesis wants to assess what the Mozambican rural water sector needs in terms of capacity building and applied research, in order to achieve its objectives. This study concerns the Province of Sofala and should constitute an example for how the human capacity and knowledge problem can be defined and approached at province level.

1.3 Contribution and objectives of the thesis

This thesis will describe and analyse the Mozambican rural water supply and sanitation sector in terms of human capacity and knowledge with focus on the Province of Sofala. In conjunction with human capacity, the institutional capacity of the sector will also be surveyed. On one side, the shortcoming of capacity and knowledge in rural water supply and sanitation will be identified and illustrated.

The deficiency in human and institutional capacity will demonstrate the needs of the
sector for capacity building through education and vocational training. The deficits of knowledge will demonstrate the needs for knowledge enhancement through applied research and knowledge management.

On the other hand, the thesis will analyse the sector seeking for the existing potential, thus the existing human and institutional capacity for training and education and the available knowledge.

The overall goal of the study is to find solutions to improve the human capacity and knowledge in Sofala. Based on the determined potential, four alternatives will be developed. The alternatives will include combinations of existing institutions taking over different parts in the process of capacity building, applied research, and knowledge management.

1.4 Structure and content of the thesis

In the first chapter, the reader should understand why the discussed issues emerged and why they are significant. The main guideline for the changes in the country, the MDGs, provides justification for the realization of this study. A short description of the work of the ADA in Mozambique explains the way human capacity and knowledge became a central matter in the Austrian development cooperation. Out of this, the role of the thesis, its objectives and structure are presented.

The next chapter starts with a general description about the country, focusing on water resources and the water supply and sanitation sector. The same is done on the province of Sofala. The actual situation of water supply and sanitation is reported. This chapter provides the reader background information, which is necessary for understanding the problem the thesis is dealing with. Moreover, state and changes in the Mozambican water sector are delineated, describing the challenges for the DNA and for public administrations at national, provincial and district level due to the process of decentralization. Focusing on human resources, the problems in capacity and knowledge are depicted. A short illustration of existing institutions acting in professional training and research at national level is given. Based on this information, the reader should get an idea about the magnitude and implications of the problem. This is necessary for the reader to be able to follow the core of the study later on.

Chapter 3 describes and explains the methodology used for the collection of data. The method used for analysis of data is a central and a critical item of the study.

Chapter 4 is the apex of the thesis. The results of the research are presented, showing the existing demand and potential for education, vocational training, and research in rural water supply and sanitation in Sofala. A detailed analysis of the existing insti-
tutions, their main activities, and operating modes are depicted. To complete the study, three alternatives for the solution of the problem are developed taking into account the institutional landscape of Sofala.

In chapter five, the thesis is completed with conclusions referring to the targeted objectives. The recommendations in chapter six will give advice for how to develop the sector in terms of education and research and delineate further research, which is required.
Chapter 2

Background of the study

2.1 Mozambique - an overview

Mozambique has to be viewed from a perspective which takes in account its own history and particularities. In the following, the main lineaments of the country will be described. After some general geographical, climatic and demographical information, the history of the country will briefly be discussed. The economic situation of Mozambique in the global community as within the country itself will help the reader to better understand the general conditions and problems the country is struggling with. The reader should consider that the illustration of the cultural and social aspects might contain some generalisation of the facts. However, a precise analysis of the cultural and social landscape of the country would go beyond the scope of this thesis.

2.1.1 Geography, climate, and water resources

Mozambique is situated on the south-east coast of Africa and covers an area of 799,380 km². On the east side, it is bordered by the Indian Ocean on a coastline of roughly 2,500 km. The south-west of the country borders with South Africa and Swaziland, the west with Zimbabwe, Zambia and Malawi while the northern borders are shared with Tanzania. The country is divided into ten provinces, which are subdivided into 128 districts. Municipalities (394), the lowest administrative bodies, compose the districts. By geographical and historical reasons the provinces are distributed upon three regions: the North comprehending Niassa, Cabo Delgado and Nampula, the Centre including Zambezia, Tete, Manica and Sofala and the South with Inhambane, Gaza, Maputo Province, and Maputo City.

Geographically, Mozambique is divided into three areas: The coastal belt, comprising the area south of Save River and lower Zambezia, covering 44 % of the country; the middle plateau at an elevation between 200 and 1,000 meters, covering 29 % of the country and a plateau and highland region at around 1,000 meters, situated in the north
of Zambezi River, covering 27 % of the country. Along the coastline, the climate is humid tropical and dry tropical in the inland. Temperatures vary between 30 °C and 35 °C during the rain season in summer and between 20 °C and 25 °C during the dry season in the winter months from July to September.

The average annual rainfall ranges from 500 to 2,000 mm. The wettest part is the highlands east of Malawi and the central part of the country with precipitations varying between 1,000 and 2,000 mm. The Northeast monsoon (arising in the Indian Ocean between December and April) and the high mountains influence the central region. The precipitations along the coastal region range from 800 to 1,000 mm, increasing between Pemba and Beira to more than 1,200 mm per year. The South is the driest region with an average annual rainfall of 500-1,000 mm.

The main water sources in Mozambique are surface water and groundwater. Water supply for the main cities rely on surface water, while the supply in rural areas and in six smaller cities is groundwater based (SEED, 2002). Most of the rivers have a torrential regime, with 3-4 months of high water and low flow for the rest of the year. There are considerable inter-annual fluctuations, generating an irregular alternation of dry and wet years. This phenomenon often assumes extreme dimensions which results in catastrophic droughts and floods. Furthermore, the water resources are also distributed unequally over the country. The centre and Zambeze are the richest regions in terms of water resources, while the south and the centre-north are the poorest. Table 2.1 shows the annual surface water resources by region.

<table>
<thead>
<tr>
<th>ARA</th>
<th>Area (1000 km²)</th>
<th>Inflow at border</th>
<th>Inflow at border as % of total</th>
<th>Rainfall-runoff (only Moz.)</th>
<th>Rainfall-runoff as % of total</th>
<th>Mean annual runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>192.00</td>
<td>17.0</td>
<td>82%</td>
<td>3.8</td>
<td>18%</td>
<td>108.0</td>
</tr>
<tr>
<td>Centre</td>
<td>84.00</td>
<td>1.20</td>
<td>6%</td>
<td>18.4</td>
<td>94%</td>
<td>233.0</td>
</tr>
<tr>
<td>Zambeze</td>
<td>140.00</td>
<td>88.00</td>
<td>83%</td>
<td>18.0</td>
<td>17%</td>
<td>758.0</td>
</tr>
<tr>
<td>Centre-North</td>
<td>196.00</td>
<td>0.00</td>
<td>0%</td>
<td>35.2</td>
<td>100%</td>
<td>180.0</td>
</tr>
<tr>
<td>North</td>
<td>168.00</td>
<td>10.00</td>
<td>29%</td>
<td>24.9</td>
<td>71%</td>
<td>208.0</td>
</tr>
<tr>
<td>Total</td>
<td>780.00</td>
<td>116.20</td>
<td>54%</td>
<td>100.3</td>
<td>46%</td>
<td>1487.0</td>
</tr>
</tbody>
</table>

Table 2.1: Annual surface water resource availability by region (1.000 million m³). Source: SEED 2002

Mozambique is divided into 18 main river basins. Nine of them are shared with other countries and constitute 75 % of the total land area. Of the 216,000 million m³ of yearly available surface water, 100,000 million m³ is generated by precipitation and
the remaining 160,000 million m\(^3\) come from upstream countries. Mozambique stands in a very vulnerable position regarding the amount and the quality of water flowing into the country from other states. In some cases, their water policy has aggravated the impact of droughts and floods (SEED, 2002). There is a need for regional treaties regarding the transboundary water policy. The country is poorly equipped with dams for flood and drought control. The total useful storage capacity amounts to 21 % of the mean annual flow of the rivers in total. 90 % of this capacity is in Cahora Bassa, the largest dam in Mozambique.

2.1.2 Demography

The population exceeds 19 million and is expected to reach 30 million by 2020 (BRIGGS, 2002). Today, ca. 60 % of the population lives in rural areas, but there is a trend of gravitation to the cities. The population density is one of the lowest in southern and eastern Africa, standing at approximately 23 inhabitants per km\(^2\). The highest populated provinces are Nampula and Zambezia, consisting of 38.2 % of the population. Minority population groups are Indians and Pakistanis, which live particularly around Nampula, and Portuguese living mainly in the cities of Maputo and Beira.

2.1.3 Historical perspective

In 1975, after ten years of struggle, Mozambique gained independence from Portugal. The power was handed over to FRELIMO, a Marxist armed liberation group. The Portuguese dominance in Mozambique left behind a situation, which was not short of disastrous. Before independence, the fragile economy was concentrated in cotton plantations and in the services sector. Mozambique provided the main trade corridors to the sea for the inland countries RSA, Zimbabwe, Zambia and Malawi. After independence, most of the Portuguese community left the country, withdrawing capital or destroying it, due to the nationalisation policy of FRELIMO. As the literacy rate in 1974 was about 5 %, the emigration of the Portuguese resulted in a huge loss of in the skilled labour force. The level of services was reduced, agriculture and industry collapsed. The following decade resulted in economical disaster, which could not be remedied by the interventionalist policies of the government. However, FRELIMO achieved significant successes on the social front. Within five years, primary school attendance doubled and secondary school enrolment increased sevenfold. The government launched an immunisation program praised by the WHO as one of the most successful initiated in Africa, reducing child mortality by 20 %. FRELIMO's efforts for sexual equality showed results in the elections of popular assemblies in 1977, where 28 % of the elected people were woman, a high figure for that time (BRIGGS, 2002).

In the early 1980s South Africa and Zimbabwe initiated RENAMO, a guerrilla organisation with the aim of destabilizing the perceived communist regime. The undertaking ended in a civil war that paralysed the country. About one million people were killed
2.1. MOZAMBIQUE - AN OVERVIEW

and four million displaced. Up to 40% of the infrastructure including 4,000 schools were destroyed or damaged. The damage was estimated at 3.5 $US billion. In 1992, FRELIMO and RENAMO signed a peace agreement. Mozambique's first democratic elections in 1994 with a turnout of 85%, saw FRELIMO as winner but RENAMO gaining majority in the central provinces of Nampula, Zambezia, Sofala, Manica and Tete (NUNLEY, 2004). At present, FRELIMO is constituting the government and the president is with Armando Guebuza.

In February 2000, the worst flooding for 50 years aggravated by a wet and windy cyclone afflicted Mozambique. An other flooding in 2001 followed shortly after this. 700 people died and 500,000 were made homeless. It is estimated that one quarter of the country's agriculture has been damaged. There were too colossal infrastructure losses and land mines laid during the civil war were dislodged. These events affected seriously the developing economy of the country.

2.1.4 Economy

Mozambique has considerable reserves of natural resources. Arable land, water resources, and woodland abound with some spatial inequalities among the country. There are significant amounts of mineral reserves such as gold, copper, marble, coal, natural gas, and gravel. The sea offers plentiful supplies of fish and the coastland, the islands, and the natural reserves constitute a potential attraction for tourists. However, the economic potential has always been poorly developed.

Mozambique is considered to have faced a somehow successful economic development in the time before and after civil war. However, the civil war and the floods in 2000/2001 annihilated the economical achievements. In 1987, the government introduced an Economic and Social Rehabilitation Program (PRES) in succession to the ingress in the IMF. The program aimed to establish financial stability, reactivate the economy, and reduce the absolute poverty. The state gradually reduced its role in the economy encouraging the private sector with a fiscal reform. The tax base was enlarged and duties on equipment reduced. The country experienced an average GDP growth of 6.4% in the years 1994-2002. In this time, the GDP growth exceeded the population growth (AGENDA 2025, 2003). Yet the effects of the growth concerned only parts of the population, mainly living in the cities. After the natural disasters of 2000 and 2001, the per capita income decreased and the absolute poverty level remained high (AGENDA 2025, 2003). Another consequence of the neoliberal macroeconomic policy is the increase of the commercial sectors at the cost of the industrial and agricultural sector. This is because no microeconomic assistance to the productive sector has been implemented (Agenda 2025). Table 2.2 shows the development of the composition of the Mozambican GDP between 1997 and 2000. The country is still one of the poorest of the world with expenditures 50% higher than receipts and 60% of the government budget coming from international aid (SEED, 2002).
Agriculture

Mozambique has 36 millions ha of arable land, with tendencies of erosion and desertification on some areas. Only one fifth of this land is yet cultivated. The amount of irrigated area is insignificant (Agenda 2025). 90% of the population are dependent on agriculture, whereby 79% are self-sustained farmers (ADA, 2005) producing for subsistence. These people are characterized by a low use of technologies and lack of financial capital (SEED, 2002). In addition, the complementary facilities are very weak. Rural markets cannot secure the sale of products and the provision of seeds and equipment. There is a lack of rural infrastructure such as streets, water, and energy installations. The products of the subsistence agriculture are maize, millet, sorghum, cassava, sweet potatoes, groundnuts, beans, and rice. Cash crops are cashew nuts, tea, sisal, and sugarcane. The main exports for Mozambique are shrimps.

Industry

The country's hydroelectric potential and the improving transport infrastructure are able to attract new industrial development to Mozambique. However, the industry is concentrated on a few single sectors and companies. The MOZAL aluminium smelter is responsible together with the food and tobacco industry for 80%, while engineering and technology industry represent just 7% of the industrial product with a decreasing trend. The weight of the ten principal industry products in the total industrial production increased from 50% in 1959 to 80% in 2001. Meanwhile, other important industries disappeared, such as the cashew nut processing industry.
2.1.5 Culture and society

More than 98% of the Mozambicans is of African origins, the rest are Europeans, Indians, East Asian and, people with mixed European-African origin. The ethnical composition is a result of pre-19th-century migrations from the north and west, and the escape of people from the Zulu kingdom in South Africa in the early 19th century (BRIGGS, 2002). Therefore, there is a north-south split with the Zambezi River as border. The northern tribes such as the Makonde, the Makua, and the Lomwe have matrilineal societies and are predominantly agriculturists. In the south societies are patrilineal and mainly cattle rearing. Here the main tribes are the Thonga, the largest ethnic group in Maputo and the Shona in Sofala and Manica, a tribe who grew due to the migrations from Zimbabwe and South Africa. A particular aspect is that Zambezi Valley has been under strong influence of the Portuguese and the Arabs who used the river to access the interior.

Around 60 different languages and dialects are spoken in Mozambique. The official language is Portuguese, which however is spoken only by 25% of the population (BRIGGS, 2002). The indigenous languages belong to the Bantu family, which roots spread out in South and East Africa during the first half of the first millennium AD. For what regards religion, 30% are Christians, 20% Muslims and the other 50% hold indigenous beliefs. In these beliefs, dead ancestors influence daily life (COUTO, 2005) and there are sacred places like mountains, rivers, forests and lakes (CUMBANA, 2006). The rural societies of Mozambique are to a great extend based on hierarchical structured communities. They are led by traditional or neo-traditional authorities ("regulos" or "chefes de bairro"). A strong labour division between men and women result in the women being responsible for child education, hygiene and sanitation and water supply tasks (ADA, 2007, 1).

In the last years, some success has been achieved in education. Now, the illiteracy rate is at 31.4% in urban areas and 68.9% in rural areas. However, there are regional differences. In the southern regions the majority of adults are literate, in the north the majority are illiterate (SEED, 2002).

2.1.6 Poverty and Health

The first goal of the MDGs aims to halve, between 1990 and 2015, the proportion of people living in extreme poverty. Three indicators measure poverty:

- Indicator 1: Poverty headcount ratio (Proportion of population living below the national poverty line)
- Indicator 2: Poverty gap ratio (incidence x depth (severity) of poverty)
- Indicator 3: Share of poorest quintile in national consumption
Concerning the first indicator, the national poverty line is defined by the total value of consumption per capita, which varies from between 5 to 20 thousand meticais (0.2 to 0.8 USD) per day, depending on the region. Table 2.3 shows the poverty indicators for Mozambique.

<table>
<thead>
<tr>
<th>Indicator / Year</th>
<th>1997</th>
<th>2003</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of population living below the poverty line</td>
<td>69.4</td>
<td>54.1</td>
<td>44.0</td>
</tr>
<tr>
<td>Poverty gap ratio</td>
<td>29.3</td>
<td>20.5</td>
<td>n/a</td>
</tr>
<tr>
<td>Share of poorest quintile in national consumption</td>
<td>6.5</td>
<td>6.1</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Table 2.3: Poverty indicators for Mozambique. Source: UNPD 2005

The Absolute Poverty Reduction Support Programme one and two (PARPA I and PARPA II) constitute the basic strategies for all the sector plans for poverty reduction. The PARPA II 2006-2009 (PARPA II, 2006), developed from the experiences of PARPA I, was approved by the council of the ministers in 2006. The PARPA II (2006) defines poverty as a lack of income for minimum consumption and as the inability of individuals in acquiring basic conditions for subsistence. ADA sources criticise the PARPA II (2006) in taking too little consideration into access to services like water, health, and education.

In its report to the MDGs, the UNDP states that inequality among the population increased between 1997 and 2003. The share of consumption of the poorest quintile decreased also from 6.5 to 6.1 percent of total consumption. The richest quintile is holding more than half of the country's total consumption.

The Human Development Index (HDI) in Mozambique is 0.322 (of max. 1) and the country lies at rank 170 (of 173). The GDI (Gender Related Index) is even lower with 0.307, positioning the country at rank 144 of 146 (ADA, 2007, 2).

Poverty is related highly to water supply and sanitation. Water is the key factor for human life as for socioeconomic development and can become the limiting factor for development (ADA, 2007, 3). Especially in the areas of health, food security, and energy, water plays a vital role. It touches all the transversal issues of development assistance - poverty reduction, gender equality, conflict prevention, good governance, environmental protection (ADA, 2007, 3). The lack of safe drinking water generates a poverty cycle. When people get sick (often because of the poor water quality), they can not work, and become a burden for the people looking after them. Medication and care costs money and time, so the cycle of poverty perpetuates. Another point affecting the economy is the distance to water points. As women often have to walk several hours for the provision of water, they loose productive time.

Hence, measures in the water sector contribute on a high degree "to the superior goal of the MDGs - poverty reduction, especially to the dimensions of meeting the basic hu-
man needs and the development of economical abilities” (ADA, 2007, 3).

The health of many people in Mozambique is affected. Malaria, tuberculosis, diarrhoeal disease, and HIV/AIDS are the main diseases, harming the country by affecting its human capital. In rural areas 75% of the diseases are waterborne or water related, including cholera, amoebic dysentery and other types of diarrhoea (SEED, 2002). The HIV prevalence lies at an average of 13% with its peaks in Sofala, Manica, Zambézia and Tete. These regions lie along the Beira commercial corridor, where a large number of immigrants and returned emigrants live. Life expectancy lies at 42 years and is decreasing (OEFSE, 2003), not least because of the high HIV-infection rate. Due to HIV/AIDS, life expectancy will decline by 14 years over the next decade (OEFSE, 2003). The most affected part of the population is the economical active people between 14 and 64 years.

The Portuguese colonial Medicare was concentrated in the urban centres, but after independence, a basic health system was successfully built up (OEFSE, 2003). However, the civil war destroyed it almost totally. After the peace agreement, the state tried to rebuild it. Nevertheless, today more of half the population do not have access to medical care. At the end of the nineties, 54% of the population was undernourished and the average energy consumption reaches only 70% of the recommended value (OEFSE, 2003). The mortality of children under five lies at 200 per 1000. 50% of those deaths are caused by curable diseases.

2.2 Sofala

2.2.1 Geography, climate, and water resources

The Province of Sofala is located in the centre region of Mozambique, bordered to the south by the Save River, to the north by the Zambezi River, to the west by the Province of Manica and to the east by the Indian Ocean. Covering an area of 68,018 km², it makes up 8.51% of the total area of Mozambique. The Province capital is Beira, situated at the mouths of the Pungo and Búzi rivers. 13 Districts, including the city of Beira, constitute the Province of Sofala.

The altitude ranges from under sea level up to 1800 m in the Gorongosa Mountains. Average temperatures lie between 24°C in summer and 32°C in winter. The cyclical climate with a time span of five years varies from extreme drought to extreme floods. On the coastal belt, the climate type is savannah rainy tropical with average annual precipitations around 1,200 mm but reaching peaks of 1,800 mm. The bulk of precipitation is concentrated in the months November to March with local extensions to May. The interior of the province is characterized by a veldt climate with dry winters and wet summers. Average annual precipitations amount to approximately 1,100 mm. Finally, the southern part of the Zambezi valley constitutes the northern part of Sofala. It
2.3. WATER SUPPLY AND SANITATION

is the dryer zone of the Province, having an annual precipitation amount of 500 - 800 mm. The soil is of alluvial origin and has a high agricultural potential. This is why this area has been of high interest for the Arabs and for the Portuguese since their arrival to Mozambique.

The main rivers crossing Sofala are the Zambeze in the north, which is the main river of the country with a total catchment area of 140,000 km², the Pungue, the Buzi and the Revue Rivers crossing the province in the centre and Save River in the south. Along the riverbeds, the groundwater table is high and easy to find. In the semi arid areas, groundwater can be found only at great depths, which reach often more than 100 meters. In such areas, wells are often serving more than 3000 people (ADA, 2007, 2)

2.2.2 Demography

Sofala has 1,564,367 inhabitants. The population density lies on the average of Mozambique, namely 23 per km². However, it varies from 4000 persons per km² in Munhava (Beira) to 2 persons per km² in Cheringoma (ADA, 2007, 2). Population concentrates in small towns, municipalities and along the rivers. About one third of the population lives in Beira, the second largest city of the country. Beira, founded in 1884 is one of the most recent cities of Mozambique. The development of the city accelerated when the railway line to Rhodesia (today Zimbabwe) was completed in 1898. Beira became an important trade centre, serving as port for the Beira corridor, which is one of the major trade routes of Mozambique. Smaller rural centres are Dondo with 90,000 inhabitants, Buzi and Marromeo.

2.2.3 Poverty and Health

Between 1997 and 2003, Sofala was the top performer in poverty reduction, lowering the rate from 87.9 % down to 36.1 %. Nevertheless, the province faces a vast number of problems, especially in the rural areas. The level of child malnutrition is one of the highest in Mozambique (7.6 %), illiteracy reaches 72.2 % for women and 28.7 % for men. In addition, unfortunately, it is one of the Provinces with the highest HIV/AIDS impact. The average prevalence among 15 to 49 year-olds is 26.5 %. Other diseases affecting the population of Sofala, which are especially related to water, are Malaria, Dengue and Schisostomatis.

2.3 Water supply and sanitation

The Mozambican water sector faces two different realities. On one side, there is the urban sector and on the other side the rural water sector which will be closer exami-
nated in this thesis. The two sectors differ in many ways. They achieve different results in coverage, have distinct management models, technical requirements and deal with different problems, especially on social and cultural scale. Hence, the responsibility for water supply is split in two departments of the DNA: the Department for Urban Water (DAU) and the Department for Rural Water Supply (DAR). Urban and rural sanitation are both integrated in the Department of Sanitation (DES). Regarding the distinction between urban and rural areas, there is a divergence between the criteria adopted by DNA and the INE. While the INE uses population models, the DNA uses criteria based on level and size of water supply systems. Hence, different coverage rates result from the surveys of the two authorities. Now, it is not possible to ascertain the reliability of both results. DNA expects the national census in 2007 to clarify this incertitude.

Both the rural and the urban water sectors are characterized by low coverage levels and poor quality. An average of roughly 60 % of the Mozambicans do not have access to safe drinking water (PESA-ASR, 2006), while the average coverage rate for improved sanitation is 38 %. This low coverage rate is influenced by the provinces Zambézia and Nampula, which show a very low level. The average access rate in Sofala Province lies at 47.7 % for water supply and at 28 % for improved sanitation (UNDP, 2005). The bulk of the not served people reside in rural and suburban areas. The urban water sector exhibits a slightly better coverage rate. The deficiency of access to safe drinking water influences greatly on the poverty of rural communities. The GoM wants in alignment with the MDGs to achieve a coverage rate of 70 % in urban and rural water supply and a rate of 50 and 80 % in rural and urban sanitation respectively.

### 2.3.1 Urban water and sanitation in Mozambique

Urban population has been in a growing trend since the last three decades. Despite growth been just 1 % in the decade between 1950 - 1960, it augmented to 10 % after independence and reached 30 % at the census of 1997 (EDR, 2006). According to INE (2004), the urban population amounts currently to almost 40 % of total population. The EDR (2006) states that if the growing rate of rural and urban population persists for the next 15 to 20 years, urban population will exceed rural population. Fig. 2.1 shows the development of the population from 1950 with a projection to 2025.

The development of urban infrastructure, including water supply and sewerage systems, can not keep pace with urban population growth. As they were designed for smaller populations, the current potable water supply and sanitation systems are insufficient. Deteriorating conditions in the urban environment are contributing to the increase of poverty especially in densely populated peri urban areas.

#### Urban water supply

The average coverage for water supply in the 13 biggest urban centres of Mozambique is 40 % (SEED, 2002).
2.3. WATER SUPPLY AND SANITATION

Figure 2.1: Population development in Mozambique between 1950 and 2015. Source: EDR, 2006

In 1998, the first contracts with private water services operators were signed. The National Water Policy (POLÍTICA NACIONAL DE ÁGUAS, 1995) wants the state to withdraw from implementation and envisages the development of new models for autonomous management. Mozambique took measures in order to create the right environment for privatisation. The process was supported by the National Water Development Project, including an urban water reform and management program. It was launched in 1999 and financed by the GoM, the ADB and the Dutch government. An Asset Holding Authority (FIPAG) was created in order to control the private operators, which signed their contracts with it. FIPAG holds ownership and responsibility for development and operation of state water assets. It is authorized to outsource management and operation services to the private sector. Another measure was the establishment of the CRA, created by the GoM as a regulatory body. Its tasks are to give advice on contracts elaboration and performance and to instruct FIPAG and the private operators on tariff policy, the quality of services and customer complaints. Furthermore, the institutional framework for the delegation of services to private operators and the permission of entrance for private investment for public water supplies were given.

23 towns are identified by SEED (2002) and the PESA-ASR (2006). With respect to their management system, they can be divided into three categories:

1. The five largest towns Maputo/Matola, Beira/Dondo, Quelimane, Nampula and
Pemba, where the water services were given to a private operator under a leasing contract for Maputo or under management contracts for the other towns.

2. The other eight larger towns, with water services run by parastatal water companies under the municipalities.

3. 20 smaller towns run by local authorities.

**Beneficiary Assessment**

In 2001, FIPAG commissioned a Beneficiary Assessment in order to acquire information about customers attitudes and practices on the water supply of Maputo and Matola. The water service was provided since one year by “Águas de Moçambique“, an international consortium which had taken over the water supply from “Águas de Maputo“, the former parastatal operator. The assessment that represented about 87 % of the Maputo population revealed that the performance of Águas de Moçambique was underachieving (SEED, 2002). Customers were paying on average 200 % more for water than they had to in 1996. In 2001, 96 % of the consumers paid more than the benchmark 4 % of the minimum salary for their water consumption. In 1997, just 17 % of the consumers paid more than 4 % of the minimum salary. In many cases, the level of services in periurban areas declined and the network supply with social tariffs does not reach most of the poor people (SEED, 2002). Moreover, in some areas, availability of water is given a few hours per day with low volume and low pressure.

In Nampula the assessment team observed similar conditions. Due to the age of the infrastructure, water supply was irregular and characterized by high losses. Billing is based on estimated consumption, with the effect that the customer pays more than he consumes.

The performance of the parastatal companies varies from case to case. The city of Tete is considered to have an adequate accounting system in the company and a good revenue control.

There is a lack of capacity in the urban water sector at provincial and municipal level. This situation has been produced by the centralized government in Mozambique existing up recently. Administration staff is poorly trained and underpaid, consequently the motivation is not high. There is a lack of management capacity and cost recovery for water services is generally low (SEED, 2002). Another problem is the low performance of the Regulatory Council (CRA), because there is little evidence that consumers are aware of its existence (SEED, 2002).

**Urban sanitation**

The main problems of urban sanitation are the lack of human capacity, financial constraints, lack of legislation, no tariffs and consequently no payment from the beneficiaries.
Only the main cities of Mozambique have a conventional public sewerage system. The population served is between 3 and 5% (SEED, 2002). Maputo is the only city with a treatment plant, and one is planned for Beira. Currently all the coastal cities including one part of Maputo discharge their sewerage into the sea, causing heavy environmental damages. A frequently adopted solution for urban areas are septic tanks. The most periurban areas are provided with latrines, reaching an average coverage of 38%. As the coverage is not complete, free defecation is a very common practice in urban and periurban areas. Another factor that contributes to the degradation of the cities and their environment is the lack of drainage systems, especially for storm water. The results are soil erosion and pollution of the environment. Maputo has a drainage system though it does not cover all the city area. This can cause serious damages in the case of heavy rains, which occurred in 2000. Beira has the worst drainage situation in Mozambique. The city lies below the sea level and relies on a drainage system constructed in colonial times. The unprotected open channels and concrete pipes have automatic level gates. These should prevent sea water entering the city at high tide and drain the city's wastewater at low tide. The system is mostly non-operative and can not prevent the high tide to damage the city infrastructure.

Solid waste management

According to Mozambican legislation, environmental sanitation lies under the competence of municipalities. They are responsible for establishing autonomous services. All over the country, the situation regarding solid waste does not conform to the environmental standards. The so called “open dumps”, the most commonly used solid waste disposal method, are filled with unselected waste of industrial, medical and domestic origin. Often solid waste is thrown in the drainage channels, clogging them.

2.3.2 Rural water and sanitation in Mozambique

In a SWOT analysis about rural Mozambique, the Rural Development Strategy (EDR, 2006) outlines the lack of infrastructure as the first weakness of rural areas in Mozambique. In fact, infrastructure facilities are poorly expanded, especially in regards to water supply and sanitation. Much of the existing infrastructures are inoperative due to the lack of maintenance and the low involvement of the community (PESA-ASR, 2006).

Rural water supply

As aforementioned, different coverage, rates were detected for the rural water sector. The INE detected a lower coverage than the DNA. Table 2.4 shows the different rates.

There are more reasons for the different results of both institutions. The first is that the DNA calculates the coverage adopting the national standard of 500 persons
Table 2.4: Water supply coverage estimations by DNA and INE. Source: PESA-ASR (2006)

being served by a well. However, in rural areas with a very low population density it is evident that not every well serves this number of people. The other reason is that the INE does not include small piped systems (SPS) in rural water, since they are considered to serve urban centres. Several stakeholders in Mozambique are looking forward to the results of the census of 2007, which will verify the coverage rates. For the development of its scenarios, the PESA-ASR (2006) utilizes the data from the DNA. Despite the increment in coverage of 1.2% in the last five years, Mozambique lies below the Subsaharian rate, which is 58%. For a detailed coverage rate, province by province see figure 2.2.

Wells When defining the coverage rate for wells, official definition of what constitutes a water point and of the maximum distance the user should cover to reach it are crucial. The GoM set following standard on coverage for rural water supply:

- A well, equipped with a hand pump supplying 500 people (circa 100 families) in a radius of 500 m or a protected fountain supplying 500 persons
- For small towns and bigger agglomerates: A tap for one family or a public well for 500 persons consuming 20 l/day each.

Rural population in Mozambique is distributed horizontally and is very dispersed over the land. Therefore, it is difficult to achieve the government parameter of 500 persons in a radius of 500 m. As the DNA takes this parameter for its calculations, a wrong estimation of coverage can result. In fact, the Demography and Health Inquiry (IDS), carried out by the INE is, uses a different classification of rural population. It uses a coverage standard of 290 persons per well within 500 m (PESA-ASR, 2006). Other sources give lower coverage rates, but they are varying and depending on the region and its demographic structure.
2.3. WATER SUPPLY AND SANITATION

Hand pumps  Mozambique standardised the Afridev hand pump and has to import most of the parts, which increases the cost. Although Afridev is intended to be a “Village Level Operation and Maintenance” hand pump, practice shows that local caretakers are not able to repair it (SEED, 2002). Experiences with new technologies, among others with the rope pump, gave very good results in terms of costs, maintenance adequacy and functioning in depths over 60 m. A problematic issue is the lack of spare parts, especially for the Afridev. As they are slow moving items, shops are unwilling to stock them. Consequently, broken pumps remain inoperative for long times until the parts are available.

Small Piped Systems (SPS)  Some 250 smaller towns rely on SPS managed by district administrations (SEED, 2002). The coverage rate of the SPS lies at an average 4.1 % fluctuating over the years.

Figure 2.2: Population with access to safe water. Source: UNDP, 2005
2.3. WATER SUPPLY AND SANITATION

Rural sanitation

For the current coverage in rural sanitation, no accurate data is available. A study the INE carried out in 2003 displays a coverage of 36 %. However, the INE includes sanitation techniques, which the DNA considers out of standards. The DNA defines the sanitation standard as follows: “The improved traditional rural latrine consists of a fosse, a wooden or concrete floor plate [...] a cavity and a closure head [...] a roofed cabin for ensuring privacy and stability of the fosse.” (PESA-ASR, 2006) The sanitation measures which do not accomplish with the DNA standards are classified as “not improved latrine” (PESA-ASR, 2006). People with access to an “improved traditional latrine” may lie between 2 and 36 % (PESA-ASR, 2006). The water and sanitation sector review of the ADB esteems the rural population without access to sanitation at 80 %, which lies more or less in the average of the INE.

In Sofala, sanitation coverage is estimated to lie at 27.7 % (UNDP, 2005). In the years after independence, the sanitation coverage achieved a rate of 43 %, due to a campaign of the Ministry of Health with the slogan “Every family a latrine”. In the 80's the campaign was weakened by the civil war and rural coverage dropped to rates of 10-20 %.

Health and hygiene education of the population have to go hand in hand with the implementation of sanitation programs. However, no significant education measures have been realized in rural areas so far (SEED, 2002). As the change of behaviour in rural population is necessary for sanitation development, education programs will be needed for achieving better sanitation conditions. For a detailed coverage rate, province by province see figure 2.3.

Social impact

The lack of safe drinking water is a decisive poverty factor for rural population. Besides being the cause of various diseases, it affects the poorest parts of rural society. Studies of the INE show clearly that rural woman, who are the poorest among Mozambican society, suffer most from water related problems. Woman and children spend a lot of time covering disproportionate distances in the provision of water. Consequently, they have less time for carrying out income generating activities, education and general training.

2.3.3 Funding of the water and sanitation sector

The development of the water sector is one of the fundamental areas of the PARPA II (2006). However, the state funding does not reflect the importance given to the sector. In the last years, the government funds for rural water and sanitation increased less than the inflation rate. From 2002 to 2004, they were reduced from 0.5 to 0.3 % of the GDP (PESA-ASR, 2006). Within the water sector, the urban sub sector gets higher
2.3. WATER SUPPLY AND SANITATION

Population with Access to Improved Sanitation (%), 2003

Figure 2.3: Population with access to improved sanitation. Source: UNDP, 2005

investments than the rural. In 2005, the government spent 0.79 USD per capita for rural water and 11.5 USD for the urban water sector (PESA-ASR, 2006). Table 2.5 shows expenditures for education, health and water sector in Mozambique between 2002 and 2004.

In addition to the General Governmental Budget (Orçamento Geral do Estado, OGE), which includes Government budget support (GBS), the Mozambican water sector is funded by donors through two different channels: individual project support and co-ordinated sector budget support (SBS).

At present, only one donor, namely the Netherlands, joins the SBS approach. Hence, funds from this channel are marginal. The SBS is regulated by a very flexible Memorandum of Understanding (MoU) which rules mainly the channels and commitments of delivery. A Water Working Group constituted by donor and government should co-
ordinary the sector. A range of donors are considering joining the SBS, but they see it at an early stage and do not want to give up the individual project support. An argument therefore is that the project approach reaches communities and areas, which are not included in governmental plans (ERNST & YOUNG, 2006). The main donors supporting the water sector are three multilateral donors (the World Bank, the EU the ADB), UN agencies, more than ten bilateral donors (France, India, Ireland, Canada, Italy, Japan, Switzerland, Austria, Sweden, UK, USA) and a range of smaller agencies and NGO's. The DNA estimates the costs for funding rural water and sanitation until 2010 with 139.7 million USD, from which 38.8 million USD are now guaranteed through internal and external funds (PESA-ASR, 2006).

### 2.3.4 Objectives for rural water and sanitation

According to the MDGs, the GoM set coverage targets for rural water and sanitation that should be achieved until 2015. For water supply, coverage should achieve 55 % in 2010 and 70 % in 2015. For sanitation the target is 50 % for 2015.

**Challenges and strategies** In the PESA-ASR (2006), the DNA shows different possible scenarios for how the rural water sector could perform until 2015. For the water supply sub sector, 3 scenarios are presented. Scenario A forecasts 50 % of coverage in 2015, if the sub sector proceeds like the last five years. Scenario B prognoses a coverage of 60 %. It postulates measures for accelerating coverage through encouraging the demand and decentralization. It sets a special focus on the poorer parts of the country. Finally, scenario C envisages the achievement of the target of the MDGs: coverage of 70 %. It postulates the introduction of new technologies, the development of institutional
and management capacity at central and province level and points the focus on all the provinces.
The challenges for reaching scenario C are considerable. First, the sustainability of water supply and sanitation has to be ensured, and coverage increase has to be accelerated for dealing with the rural population growth. Implementation, planning and financing strategies have to be improved within the process of decentralization (PESA-ASR, 2006). Furthermore, new technological options need to be developed, institutions and human resources strengthen and trained. Regarding water quality, the PESA-ASR (2006) includes measures for analysis and control embedded in a national program for quality evaluation. The central factor scenario C requires, (unlike scenarios A and B), is the development of institutional and management capacity at central and provincial level. In a workshop of ADA in Beira, where stakeholders of the rural water sector participated, some actors expressed the feeling that they are not well prepared for facing the challenges the rural water sector is burdened with (JUNG, 2007). This shows that now the institutions of the sector at province level are weak and have to be enforced. Chapter 4 will prove this assertion and analyze how serious the lack of capacity is.

For sanitation two scenarios are developed. Scenario A accomplishes with the objectives of the DNA and the MDGs, namely 50 % until 2015. The construction rate of new latrines should be the same like in the decade before 1997. Scenario B is more ambitious, envisaging coverage of 60 % in 2015. It assumes a coverage increase of 2 % per year, which was the case between 1997 and 2003 (PESA-ASR, 2006). The DNA is working on an Action Plan for Rural Water and Sanitation, which should be the basis for the development of the water sector. The Action Plan does not depend on a specific scenario, because the actions it requires are indispensable at a short term for ensuring the implementation of the strategies it foresees. It contains the following strategic actions:

- Accelerate the coverage
- Sustainability and maintenance of infrastructure
- Introduce innovation, research and realize technical studies
- Improve planning and quality
- Enhance dynamisms of institutions and human resources
- Invest in strategic planning

Every one of these actions provides a detailed set of sub-actions, and every action contains one or more sub actions regarding human and institutional capacity building for the process of decentralization.
2.4 Changes and challenges for rural water

2.4.1 National policy, legal and regulatory framework

In order to control, manage and in first line to reform the water sector, the GoM enacted several pieces of legislation. This subsection introduces shortly the most significant laws, policies and plans.

Agenda 2025

The Agenda 2025 was written in 2003 by the Comité de Conselheiros (Counsellor’s Committee), a group of 14 Mozambicans coming from different sectors of the society. It is the background for the development programs and strategies in Mozambique. It describes a vision for the future of the country and outlines the main strategic objectives to achieve until 2025. The objectives are directed to six key areas, respectively human resources development, health, education, social capital development, economy and development and good governance.

The quinquennial government plan (QGP)

The QGP displays the orientation of government action until 2009. The fundamental target of the program is to defeat absolute poverty. For achieving this, the subordinate objectives are economic growth and development, especially in rural areas, consolidation of national unity, peace, justice and democracy, combat corruption and criminality and reinforcement of sovereignty and international cooperation. Access to safe water and sanitation are highlighted as critical factors for improving the living standards and strengthening the human resources. Hence, the GoM pointed out specific targets to achieve until 2009 (CUMBANA, 2006):

- Increase coverage for rural water supply to 55% for rural water supply serving 8 million of persons.
- Increase coverage for rural sanitation to 50% serving 6 million of persons.
- Reduce mortality related to water born diseases.

PARPA II (2006) - Absolute Poverty Reduction Plan

The PARPA II (2006) is a government document containing the strategies to follow for the achievement of the principal objective of the QGP: reduction of absolute poverty. The macroeconomic, structural and social policies and programs, which have to be adopted in order to enhance the economic growth, are described. The three pillars for poverty reduction are defined as human capital, good governance and economic development. The human capital development is the pillar where the government sets the
improvement of access to drinking water and adequate sanitation as a priority. PARPA II (2006) distinguishes itself from its precursor PARPA I (2001-2005) in giving more importance to basis development at district level and in enhancing stronger economical integration and increase in productivity.

**National Water Policy (POLÍTICA NACIONAL DE ÁGUAS, 1995)**

The National Water Policy was approved in 1995 by the GoM. It is a directive for supporting water supply, sanitation and management of the country's water resources. All the legislation of the water sector is subject to this document. It contains a far reaching reorganisation of the water sector and a set of new principles. These are decentralization, end-user involvement or procurement principle (CUMBANA, 2006), and private sector participation (SEED, 2002). The role of the state is to act as regulator, co-ordinator and facilitator (CUMBANA, 2006). The main objectives of the POLÍTICA NACIONAL DE ÁGUAS (1995) are the following (compiled after SEED (2002) and Cumbana (2006)):

- Satisfaction of the necessities of the most vulnerable population groups
- Provinces with the lowest coverage rate have highest priority
- Latrine construction for rural areas
- Participation of the beneficiaries at all stages of a project (planning, implementation, operation and management), enabling them to make decisions
- Demand driven approach: services should be provided in accordance to the economic capacity of the users
- Considering water as an economic and social good
- Decentralization of Water Resources Management to autonomous catchment agencies (ARAs)
- Expansion of sector capacity through human resources development

The POLÍTICA NACIONAL DE ÁGUAS (1995) defines the minimum service standards (compare chapter two). At present, the paper is in a revision process. Dispositions for sanitation standard definitions and pumping techniques were slightly modified.

**The National Water Law (LEI DE ÁGUAS, 1991)**

The Water Law 16/91 defines the public ownership on water, competences of the state and the general juridical conditions regarding the protection and conservation, inventory, use and supply, control and surveillance of the water resources (CUMBANA, 2006). The Law emphasises the importance of decentralization and provides the legal framework for involving the private sector.
2.4. CHANGES AND CHALLENGES FOR RURAL WATER

Draft to the Strategic Rural Water and Sanitation Plan (PESA-ASR, 2006)

The PESA-ASR draft designs a middle- and long term vision for the development of the rural water and sanitation sector of Mozambique. It sets objectives, priorities and strategies for the sector, and should function as a flexible framework for planning. It is the first of three plans, which together constitute the MDG Roadmap for the water sector (the other two concern Urban Water and Water Resources Management).

The Rural Development Strategy 2006-2026 (EDR, 2006)

The EDR proposes a development strategy for rural Mozambique. It should act as an operational instrument for achieving the objectives appointed in the Agenda 2025. Its principal aims are to ensure that the rural area will not be excluded from the economic development, which is supposed to take place in Mozambique in the next two decades.

Mozambique has an exhaustive regulatory framework for the water sector. However, it is only since 2000 that the policy has started to be implemented at the provincial level for rural water supply and sanitation (SEED, 2002). A point of the POLÍTICA NACIONAL DE ÁGUAS (1995), which has to be considered critically, is the description of water as economic good and the call for privatisation. "To call water an economic good implies that water is to be treated as commodity to be bought and sold. This may be acceptable in developed countries where most people can afford to buy water and where most people enjoy high standard of health supported by affordable and accessible health care services. This is not the case in Mozambique where according to the PARPA II (2006) report 70% of the population are below the official poverty line and live in absolute poverty" (SEED, 2002). For what regards privatisation, it is uncertain if this will be the solution for the problems of the water sector. The water services that were already privatized did not perform as expected.

2.4.2 Institutional framework

The water sector lies under the responsibility of the MOPH. The DNA is the Ministry’s entity responsible for policy making and implementation, overall planning and management of the water resources, provision of water supply and sanitation services. It is subdivided into six Departments:

- The Water Resources Management Department (DGRH), responsible for river basin development, water resources data collection and basic research
- The Department of Urban Water Supply (DAU)
- The Department for Rural Water (DAR)
- The Department for Sanitation (DES)
2.4. CHANGES AND CHALLENGES FOR RURAL WATER

- The Administration and Finance Department (DAF)
- The Department for Human Resources (DRH)

At regional level, the ARAs are responsible for water resources management in their areas of operation. Five ARAs are planned to be installed, charged with the administration and management of the country's 104 river basins. Their work will be coordinated by the DGRH. Besides developing hydrological basin development plans and collecting and analyzing all the data necessary to do this, the ARAs have to maintain and operate hydrological infrastructure and regulate and administer water use. Sofala falls under the responsibility of ARA Centro, covering the river basins in the central region.

At the provincial level, the water sector responsibility lies within the competence of the DPOPH. The DPOPH formulates through DAS policies and strategies and is responsible for water supply and sanitation. Water Resources Management should be given over to the ARAs. The parastatal Provincial Workshops for Rural Water (EPAR) played for many years an important role in implementation of infrastructure and education projects. Now it seems that they are going through a critical phase for the sector reform does not define clearly their future role to transfer more responsibilities to the private sector and the NGO's. Figure 2.4 shows the institutional framework of the water sector.

Figure 2.4: Institutional Framework of the Mozambican water sector. Source: SEED, 2002
2.4.3 The process of decentralisation

In 2005, the process of decentralization of the water sector for rural Mozambique started even if it was outlined already before the peace agreement of 1992. District Administrations (AD) and Municipal Councils in cities and towns will be empowered with the responsibility for water supply and sanitation. Consequently, the task of the DPOPH/DAS, the DAR and the DES will be to assist the districts in their new role.

The strong involvement of the private sector, NGOs and local activists is considered to be fundamental in spreading the activities in water supply and sanitation in rural areas. Private enterprises can be contracted by the DNA, the DPOPH and since 2006 by the ADs for the implementation of projects. NGOs play a double role. On the one side, they implement their own projects and act as “local activists” (DNA, 2006), on the other side they may be contracted as implementators by the DNA or the DPOPH. Local activist are contracted by the private sector or NGOs for education and information of civil society, communities and local public servants, and represent the link between the communities and the institutions of the water sector. As aforementioned, the EPARs face with problems due to the introduction of the free market approach by the POLÍTICA NACIONAL DE ÁGUAS (1995). The main problems are that they miss an institutional definition, have inadequate management models and can not exist without subsidies (PESA-ASR, 2006).

Within the decentralization process, the role of the DNA/DPOPHs is switching from implementation to coordination, supervision and planning, as to mobilisation of funds. Through simplified tender processes, the DPOPH should make possible the participation of the private sector in water supply and sanitation. However, experiences have shown that private enterprises, as far as they exist, are often not willing to participate in the tender process since the contracts generally have a small volume or regard high risk areas. The DNA plays also an important role in finding new technical solutions and developing business packages for the implementation of projects.

Figure 2.5 shows the tasks of the different stakeholders in the rural water sector. Table 2.6 and 2.7 show the change in the function of different institutions due to the process of decentralization.

2.4.4 Human resources

Although serious efforts have been made to train staff for the water sector, there is still a lack of capacity at both National and Province level. As the report of the ADB states, the DNA does not dispose of a sufficient number of middle and upper-level policy analysts, technicians and managers for performing its tasks (SEED, 2002). On one side, a reason for this situation is the incapacity to recruit, retain and motivate trained staff in the water sector. Salaries and incentives for skilled personnel are low and induce them to switch to the private sector or to NGO’s. This factor regards the creation of demand for skilled individuals and stronger institutions in the water sector (SEED, 2002). On
Table 2.6: Change of institutional responsibility for water supply due to the decentralisation process. Source: PESA-ASR (2006)
2.4. CHANGES AND CHALLENGES FOR RURAL WATER

Figure 2.5: Position of the stakeholders and their tasks in the rural water sector. Source: PESA-ASR (2006)

<table>
<thead>
<tr>
<th>Sanitation</th>
<th>current</th>
<th>short term</th>
<th>long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition, coordination and divuluation of policies and strategies at national level</td>
<td>DNA</td>
<td>DNA+DPOPH</td>
<td>DPOPH+Ads+CMs</td>
</tr>
<tr>
<td>Planning of rural sanitation</td>
<td>DNA</td>
<td>DNA+DPOPH</td>
<td>DPOPH+Ads+CMs</td>
</tr>
<tr>
<td>Strategic planning</td>
<td>DNA</td>
<td>DNA+DPOPH</td>
<td>DPOPH+Ads+CMs</td>
</tr>
<tr>
<td>Operational and investment program</td>
<td>DNA</td>
<td>DNA+DPOPH</td>
<td>DPOPH+Ads+CMs</td>
</tr>
<tr>
<td>Fund mobilisation</td>
<td>DNA</td>
<td>DNA+DPOPH</td>
<td>DPOPH+Ads+CMs</td>
</tr>
<tr>
<td>Fund management</td>
<td>DNA+DPOPH</td>
<td>DPOPH+Ads</td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>Families, NOOs, CBOs</td>
<td></td>
<td>private sector, NOOs, CBOs</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Families</td>
<td>Families, private sector</td>
<td></td>
</tr>
<tr>
<td>Education and assistance for users</td>
<td>MiSAU, DANN</td>
<td></td>
<td>NGOs, CBOs</td>
</tr>
<tr>
<td>Implementation support activities</td>
<td>DNA+DPOPH</td>
<td>DNA, DPOPH, NGOs, private sector</td>
<td>Private sector, NGOs</td>
</tr>
<tr>
<td>Capacitation of province, district and municipal authorities</td>
<td>DNA</td>
<td>DNA, DPOPH, NGOs, private sector</td>
<td>Private sector, NGOs</td>
</tr>
<tr>
<td>Research</td>
<td>DNA</td>
<td>DNA, NGOs, NGOs, private sector</td>
<td></td>
</tr>
<tr>
<td>Installation and management of an information system</td>
<td>DNA</td>
<td>DNA+DPOPH</td>
<td>DPOPH+Ads</td>
</tr>
</tbody>
</table>

Table 2.7: Change of institutional responsibility for sanitation due to the decentralisation process. Source: PESA-ASR (2006)
the other side, the low number of academics and upper secondary school graduates, the lack and inefficiency of local training programs and the failure in transferring skills to Mozambicans are constricting the "supply" of requested personnel (SEED, 2002). At Provincial level, the capacity of the DPOPHs has been strengthen by medium level technicians. They are working in collection and planning activities, controlling the application of regulations and managing investment funds. “Nevertheless, there is a shortage of graduates and technicians in the Provincial institutions, mainly those trained in financial and management areas.” (SEED, 2002). There is also a difference of human capacity shortage between the provinces. The fact is that skilled people exist, but most of them are in Maputo and are unwilling to move to the Provinces.

2.4.5 The water sector of Sofala

As water supply and sanitation depend strongly from the climatic and hydro-geological situation, the status of the water sector varies among the province. The sequence of floods and droughts and the temporary and spatial fluctuations of the groundwater table cause a range of organisational and technical problems for the water sector. Water scarcity and water related diseases are very serious problems affecting the population of Sofala. The average coverage of the province is 48.8 for water supply and 28 for improved sanitation, which are, relative high rates.

DPOPH/DAS in Sofala

The DPOPH is responsible for the water sector of Sofala. It encages the DAS with operating in the sector. The DAS plans for the application of funds and negotiates with donors acting at provincial level. Now the ADA, UNICEF and the EU/Zamwat are supporting the water sector in Sofala (ADA, 2007, 2). In the next four years UNICEF, with financial support from Holland, plans to finance a program in 4 districts of Sofala, namely Nhamatanda, Gorongosa, Maringue and Muanza. Each district will get a technician additionally to the technicians, which will be recruited at province level. In another project, UNICEF wants to provide school sanitation for the district of Buzi.

Human capacity in the DAS

The DAS in Sofala "is considered as one of the most organised and capacitated in the country" (ADA, 2005) due to the continuous training and transfer of knowledge provided by the PAARSS team. It has several experiences with carrying out community information campaigns showing good results, especially in the generation and management of community demand (ADA, 2005). The DAS has been involved in sanitation projects initiated by PAARSS and UNICEF and has some capacity in EcoSan. However, the capacity of the DAS is below the one the situation in the province requests. There
2.5. PROBLEM DEFINITION AND OBJECTIVES

are 11 technicians distributed into five sections: communication, SPS and boreholes, database, emergency and sanitation (ADA, 2007, 2). Two of them have an academic degree, two are joining distance study at university and the others have a secondary school degree (ADA, 2007, 2).

Human capacity at district administration

Technical capacity at the district administration is very weak. Even if districts can recruit technicians for the water sector, in Sofala only one water and sanitation technician is working at district level (ADA, 2007, 2).

2.4.6 Institutions for training and applied research for the water sector

The main institutions involved in education for the rural water sector are the DNA, represented in Provinces by the DPOPH and the Technical Training Centre for Water and Sanitation (CFPAS) in Maputo. The last is financed by the SDC and is the only professional training centre specialized in water and sanitation, forming basic and medium level graduates. Research for the rural water sector, apart from sub regional development institutions, is mainly carried out by public bodies like the MOPH, public universities (UEM) and the CFPAS. In Sofala, capacity building was carried out by PAARSS with the main training activities taking place in 2000 during the first phase of the program (ADA, 2005). Staff from CFPAS in Maputo were employed in Sofala training private and parastatal organisations, DAS and district staff and seven “empresas sociais”, local masons and constructors. Community training is given through these actors and other organisations such as the Red Cross. The education and research landscape for the rural water sector will more precisely be analyzed in chapter 4.4, examining the potential for training and applied research.

2.5 Problem definition and objectives

Chapter one and two describe the situation of the Mozambican water sector with focus on Sofala province. Section 1.2 defines the problems emerging from the lack of human capacity in the point of view of the aims to achieve in the water sector. It puts the situation in a logical relation to the objectives and shows that the constraints in human capacity and knowledge are, in fact, a serious problem for the achievement of the primary objectives of the water sector. Chapter two focuses on the problems by describing the rural water sector, trying to depict a more or less precise picture of the situation. Both approaches come to the result that there is a lack of human capacity in the rural water sector.

Two main questions emerge from the described facts. The first one is what the gap in human capacity and further in knowledge really is. In other words, what needs do
emerge for capacity building and knowledge enhancement if the water sector wants to solve the serious problems it faces with.

The second one is which actors are existing in Sofala and overall in Mozambique, which could be able to respond to these needs? What is the potential for capacity building and knowledge generation in the country, especially in Sofala. Are there institutions, which are interested and able to close the capacity and knowledge gap.

Chapter four will answer all of these questions. The methodology for doing this is presented in the next chapter. The results of both the needs assessment and the potential definition will be used for the creation of four solution proposals which will display a capacity building and research "landscape" for Sofala where different actors work together in order to develop capacity for the rural water sector.
Chapter 3

Methodology

3.1 Approach

The methodology of this study is composed by two steps. The first comprehends the methodology applied for data collection and the second the methodology implemented for analysis. The study began with a review of the existing institutional, legislative and regulatory framework. The leading directives and strategies of the Mozambican water sector were sighted. Available literature was collected in order to outline potential stakeholders and their position in the Mozambican water sector. It emerged that the amount of potential stakeholders is great and is ranging from the international down to the “grass-roots level”. Various stakeholders appeared to be potentially essential in terms of education, training and applied research. Hence, the integration of opinions and interests of many stakeholders appears necessary for the formulation of the problem and the development of sustainable solutions for the challenges.

As said before, the theme of this thesis in the discourse between the different stakeholders in Mozambique and the ADA during the second phase of the PAARSS project. The ADA commissioned Hydrophil, a consultancy agency, to carry out a pre-feasibility study. The aim was to find out needs and potential for an education and research program in Sofala. The author of this thesis did the fieldwork together with Ms Suzana Alfama of Hydrophil. As the study was done in the perspective of the possibility of a concrete program, the addressed stakeholders where rather disposed to cooperate. Getting access to important stakeholders was facilitated by the office of the Austrian cooperation in Maputo, and in Sofala by Mr Alberto Cumbana and the PAARSS team.

The topic required in large part qualitative data; thus, the subjects to deal with in education, training and research as the existing potential can only be defined in a qualitative way. The needs for human capacity could be analyzed in a quantitative way; the
exact number of needed skilled persons could be pointed out. However, as the statistical information is mostly fragmentary and the standard to achieve is not yet defined, it makes no sense trying to quantify the lack of human capacity.

Finally, it should be mentioned that the developed solutions and approaches for solving problems were discussed with the concerned stakeholders as with external experts. This allowed ascertaining their disposition for being involved in an eventual program. Furthermore, critical information about the aptitude of institutions for taking over tasks in an eventual program was gathered.

3.2 Tools for the collection of data

Various tools were used for the collection of data. In the following section, they are described one by one. The context when they were adopted is explicated.

3.2.1 Desk study

The first step of the study was a literature review. Documents about methods for research in developing countries were studied. Reports from different organizations gave the first data about the Mozambican water sector. An important part of the document analysis focussed on the main official papers of the ADA regarding Mozambique. These, together with UN - documents about the application and status of the MDGs in Mozambique, which were adopted by the GoM in the main development strategies of the country, display the overall aims to achieve in the water sector. Starting from these aims, ADA and GoM documents give the justification for the taking up of the issue of this thesis.

The legal and regulatory framework such as statistical data regarding the water sector was studied. Finally, the hierarchy of strategies and governmental plans for the development of the water sector were analyzed on their requirements for education, vocational training and applied research. This part of the research procured the data for the definition of the “normative demand”. A problem in this part of the research was the lack of documents dealing especially with the topic of this thesis. The main documents handle the water sector in a general way, touching the education and research issue peripherally.

The main sources of information were ADA, the DNA and other governmental institutions (INE), PAARSS, and Hydrophil. The homepages of organizations like the World Bank, the IRC and different UN organizations furnished useful complementary information.
3.2.2 Interviews

Interviews carried out with stakeholders at province and national level should not only complement the data obtained through the literature review. They are expected to give, together with the group discussions a more personal illustration about the situation. The reason for this requirement will be given in the next section. Two types of interviews were adopted: semi-structured interviews and unstructured interviews.

Semi-structured interviews have predetermined questions, but the interviewer modifies the order according to his perception (ROBSON, 2002). This type of interview was used with all governmental institutions as with the institutions, which could potentially play a role in education and research for the water sector. The semi-structured interviews allows the interviewer to hold a certain control, which was necessary in some cases where the respondents tended to channel the discussion to certain issues.

Unstructured interviews are mostly informal. The conversation develops freely within a defined area (ROBSON, 2002). Unstructured interviews were used in discussions with single experts and partly with water committees in the communities, when they were represented by only one or two persons, such as in Buzi.

In order to get a comprehensive picture of the situation, the research team tried to contact a wide range of experts and representatives of institutions of the rural water sector. The first series of interviews was carried out in Maputo. Following stakeholders were contacted and interviewed:

Academic institutions

In Maputo, four academic institutions were contacted. Three of them were interviewed about the needs of the rural water sector. Mr Raul Sulumine, chief of the Department of Civil Engineering at the UEM was contacted for representing the UEM, the biggest university of Mozambique. Mr Carmo Vaz represented the "Ordem dos Engenheiros", the Mozambican engineers' umbrella organisation, and Mr Luís Felipe Pereira the "Cruzeiro do Sul" (Southern Cross Trust fund), a noted private research institution.

The UEM and the OE were assessed on their aptitude to participate in a program. Furthermore, Mr Carlos Sotomane and Mrs Joana de Carvalho were contacted for assessing the aptitude of ISPU, a private university.

Public institutions

Not all the ministries contacted responded to the request of the research team. It was possible to interview Mrs Ana Vilela Agostinho, researcher at the MCT for assessing the potential given by the MCT. Mr Albertino Clement, director of the National Institute for Professional Training and Employment and Mr Elias Manjate, chief of the Department for Training of the same institute represented the Ministry of Work.

Very important was the meeting with Mr Juliao Alferes, national director of DNA, Mrs
3.2. TOOLS FOR THE COLLECTION OF DATA

Suzana Loforte, manager of DNA and Mrs Carmen dos Santos, responsible for human resources in the DNA.

Private sector

The research team considered important to include in the study the point of view of the private sector about the needs of the water sector. As no official representant of the private sector could be made out, Mr Nelson Matsinhe, civil engineer leading an engineering office in the water sector was interviewed. He was recommended by most of the interviewed stakeholders.

Vocational training institutions

For analysing the situation for capacity building in Maputo, Mrs Francisca Muluana, director of CFPAS and Mr Justino Marrengula, pedagogic director of CFPAS were interviewed. Furthermore, Mr Bruno Duffau, program officer of the SDC contributed with an assessment of the situation in CFPAS, as the SDC was for a long time the principal financer of the centre. A meeting was hold also at the IIM Maputo with Mr Roberto Samuel Macaringue, pedagogic director of the IIM.

In Sofala the following stakeholders were contacted:

Users

In two communities (Buzi and Bairro da Conceição in Dondo), a focus group discussion was conducted with the water committees. They described the situation and the problems they are facing with in the water sector. The focus group discussions allowed to conduct a comprehensive needs assessment, from the point of view of the final beneficiaries of the water sector.

Academic institutions

The interviews with representatives of academic institutions in Sofala should assess the academic potential for capacity building and research for the water sector in Sofala. Furthermore, useful information about the needs of the water sector was gathered. Mrs Luísa Mario Barros André Sumana, substitute of the coordinator of the Department of Geography of the UP Beira, spoke for the UP and Mr Bernard Groosjohan, decan of the Medicine Faculty at the UCM Beira represented the UCM. Mr Jorge Cardoso de Barros, decan of the University Jean Piaget in Dondo introduced the research team to the UJP.
Vocational training institutions

In Beira, it was just possible to contact the CFP as a vocational training institution. The meeting was held with Mrs Elsa Barca, vice president of the CFP Beira.

Experts

Mr Alberto Cumbana, responsible for the PAARSS program assisted the research team during the work in Sofala and gave precious information about the needs of the rural water sector of Mozambique. Furthermore, Mr Helmut Jung, senior expert of ADA contributed with his knowledge about the situation and problems in the rural water sector.

3.2.3 Focus group discussions and workshop

Focus group discussion is an open-ended group discussion, where a researcher acts as a moderator, guiding it (ROBSON, 2002). Focus group discussions were used in the meetings with the water committee in Dondo and during the workshop in Beira. Robson (2002) raises the question if the group should be homogeneous or heterogeneous. In terms of gender, this question arose during the research. In the course of more focus group discussions it appeared that the point of view of men often differed from that of women. In some of these cases, men tried to influence women, breaking them up in the conversation and trying to persuade them with their opinions. On this way, the results of the focus group discussions were homogenous, in other words, the water committee came to one single conclusion instead of letting some questions open to more answers. The workshop in Beira addressed all potential stakeholders for an eventual program at an institutional level. The participants were divided in two groups: one including the stakeholder connected to education or research (university teachers, trainers, etc.) and one including technicians and members of the public administration. In the first part of the workshop a SWOT-Analysis was carried out, in the second part different solutions for the challenges in the sector were developed by the participants.

3.3 Tools for the analysis of the results

3.3.1 Stakeholder analysis

For detecting and assessing the role of the different stakeholders, a short stakeholder analysis was conducted. It should only present the stakeholders at different stages they are acting and the role they are playing in the rural water sector. The information was gathered from different official documents and interviews.
3.3.2 SWOT-Analysis

In order to better understand the situation and the challenges of the water sector in Sofala, a SWOT analysis was carried out. Through a SWOT analysis, the internal situation (strengths, weaknesses) and the position in the surrounding environment (opportunities and threats) of an organization or sector are identified. In this case, the SWOT analysis was carried out for the rural water and sanitation sector in Sofala in reference to education, vocational training and applied research. The "authors" of the SWOT analysis were the participants of the workshop in Beira, which discussed the situation of the rural water sector.

3.3.3 Needs assessment

As the definition of needs is the central part of this work, special attention will be given to the methodology used for this task. First of all, the terms "needs" and "demand" must be defined. Needs emerge from the difference between the real situation and the nominal condition, which is described by the objectives to reach. This difference is a gap or a distance separating the reality from the nominal condition. Needs represent what is "needed" for reaching this nominal condition. Hence, for defining the needs, first the objectives have to be set. This is the reason why chapter one focuses strongly on the objectives of the rural water sector of Mozambique.

Needs become demands now somebody wants to respond to them. The DNA and the DPOPH/DAS want to close the gap in human capacity and knowledge in Mozambique and in Sofala respectively. Hence, the gap in the water sector regarding these issues (needs for capacity building and research) becomes a problem to solve, a challenge, resulting in the demand for the adoption of different measures.

While needs are descriptive, the demand is already addressed to be responded and "cancelled". However, as far as the demand is to respond to all the needs, both contain the same information. Therefore, in this study, needs and demand are used both and have the same meaning. In the perspective of a real program implementation, both should be intended more in the sense of the demand.

Different types of needs: expressed and normative needs

Laws (2003) distinguishes between two types of needs for the development of a country, sector or community. These are "expressed" needs and "normative" needs. Expressed needs are needs "which people themselves put forward" (LAWs, 2003), while normative needs are based on standards and are what "is socially/culturally accepted as necessary for a decent life" (LAWs, 2003).

The expressed needs/demand In this study, expressed needs are those gathered through interviews, focus group discussions and the workshop in Beira. Due to their nature, ex-
pressed needs contain a high degree of subjectivity. They rely partly on the perception of people about the situation and may not always reflect the real facts. The degree of subjectivity may decrease with the formation and the detachment the interviewed person has to the concerned community/society, but it will never disappear completely. How the fieldwork in Sofala showed in some cases, the concerned person may be inclined to judge the situation and the problems toward her own personal problems and not toward the problems regarding the whole community/society. This should not be taken as a negative feature, as the researcher often asks for their perception and not for an objective description of the situation. The point is that all these points generate insecurity in the results of social research. The researcher should evaluate the information and, in our case, decide what corresponds to reality. For facilitating this challenge, this study defines on one side the expressed needs and complements them with the normative needs, which are described in the following paragraph.

The normative needs/demand The normative demand is the demand emerging from "norms". Norms can have an official status (laws, governmental documents) or an informal status (unwritten rules and attitudes, standards the community/society regards as self-evident). For this study, the normative demand derives from official papers. Laws, governmental strategy papers, statistical surveys, journals and studies from established water and sanitation institutions are analysed on the challenges they determine and sight for the rural water sector and the needs for capacity building and research deriving from them. A list of these documents is presented in chapter 2. However, the normative demand does not necessarily describe the real needs of the rural water sector. Official documents like laws and strategies may set objectives, which are unrealistic or irrelevant to the development of the water sector. Therefore, the approach is not to validate the expressed demand with the normative demand, but to validate both with each other. The points where they correspond can be regarded as "real needs", while the points where they differ have to be discussed.

Comparison of the normative and the expressed needs/demand

Both types of demand will be analysed independently form each other on different levels. These are the community level, the district level, the province level and the national level. The result will be an autonomous needs assessment for every type of demand. In the next step, both expressed and normative needs will be compared on differences and similarities. Finally, after the discussion of the similarities and differences, the "real demand" for capacity building and research for the rural water sector of Sofala should be presented. This methodology should give reliable results, as the comparison of the two types of demand should make it possible to discard the wrong estimations mentioned in the last two paragraphs.
3.3.4 Potential assessment

All the institutions, which may influence positively the water sector of Sofala in terms of capacity building and knowledge, build the potential. The potential was detect through interviews with stakeholders and experts. A range of academic and vocational training institutions were interviewed and analysed on their suitability to participate in capacity building or research in the water sector. Strengths and weaknesses of the institutions are depicted.
Chapter 4

Results and discussion

4.1 Stakeholder analysis

For the purpose of this study, the stakeholders of the Mozambican rural water sector acting in Sofala are divided into four main categories. In addition, a fifth category is defined, including international actors (donors and international NGOs) but which is not of high relevance for the thesis. Table 4.1 identifies key stakeholder for capacity building and research in the Mozambican water sector allocated on a continuum. In the first column, the stakeholders, which may benefit from capacity building are presented, while in the second column the stakeholders, which may play an active role in capacity building and research, are depicted. The table shows that some stakeholders are both beneficiary and potential actors for carrying out capacity building or research. They are first trained on a level for being able to train stakeholders at lower levels.

<table>
<thead>
<tr>
<th>Continuum</th>
<th>Level</th>
<th>Beneficiary Stakeholders</th>
<th>Potential actors for capacity building and research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global and international</td>
<td>ADA, UNICEF, WB, other Donors, international NGOs</td>
<td>ADA, SDC and other Donors, international NGOs and research institutions</td>
</tr>
<tr>
<td></td>
<td>National</td>
<td>MOPH/DNA and subordinated public institutions, Min. of Tech., Min.of Work, MINED, MISAU</td>
<td>DNA, CRA, FIPAG, CFPAS, IIM, Universities in Maputo, OE, Cruzeiro do Sul</td>
</tr>
<tr>
<td></td>
<td>Provincial</td>
<td>DPOPH/DAS, private sector, NGOs, EPAR</td>
<td>CFPAS, IIM and CFP Beira, Universities in Maputo and Beira, OE, Cruzeiro do Sul</td>
</tr>
<tr>
<td></td>
<td>District/Municipal</td>
<td>Municipal and district administrations, private sector, local activists</td>
<td>CFPAS, IIM and CFP Beira, NGOs, EPAR, private sector</td>
</tr>
<tr>
<td></td>
<td>Community</td>
<td>Water committee, community, users</td>
<td>Local activists, private sector, NGOs, EPAR</td>
</tr>
</tbody>
</table>

Table 4.1: Stakeholder continuum for capacity building and research

This section will not give an exhaustive description of the different stakeholders,
as most of them are described in the second chapter of the thesis. The most important stakeholders, which constitute a potential for capacity building and research, are described accurately in section 4 of this chapter.

Table 4.2 shows the position of stakeholders in a relevance/interest grid, which shows their relevance and interest in participating to capacity building and research for the rural water sector. The stakeholders were positioned from informations gained during interviews, or from the analysis of different documents. Not all stakeholders are included in this analysis, because it was not possible to gain information about their interest and/or disposition in participating in capacity building or research for the rural water sector.

Table 4.2: Stakeholder analysis for capacity building and research in Sofala

From the stakeholder analysis, following observation has to be made. The stakeholders showing high relevance and interest are ideal partners and can be included in planning for an eventual program. The ones with high relevance and low interest are
4.2  SWOT analysis for rural water in Sofala

Before analysing the demand and the potential for capacity building and applied research in the rural water sector of Sofala, a SWOT analysis is presented. Strengths, weaknesses, opportunities, and threats of the sector relating to human capacity and research were defined by the participants of the workshop held in Beira. Results are interesting as the participants represented almost completely the rural water sector of Sofala, including potential actors in vocational training and applied research. A list of the participants is given in appendix 2. The SWOT analysis is presented in Appendix 3.

4.3  Demand

Section 3.2 explains the methodology for identification the demand for capacity building and applied research. This section will report the normative and the expressed demand. Having done this, both the expressed and the normative demand will be compared and analysed on their consistency with each other. The result is what is supposed to be the “real demand” in Sofala.

4.3.1  Normative demand

Relevant documents

For the definition of the normative demand, the most determinant documents regarding the water sector had to be detected. The normative demand has to arise from documents with official normative or informational status. These are laws, regulatory papers, official government strategies on the one side and official statistical data, studies
and journals on the other side. The following list includes the analyzed documents for the definition of the normative demand:

- National Water Policy (POLÍTICA NACIONAL DE ÁGUAS, 1995)
- Water Law 16/91 (LEI DE ÁGUAS, 1991)
- Second Absolute Poverty Reduction Plan (PARPA II, 2006)
- Draft for the Strategic Rural Water and Sanitation Plan (PESA- ASR)
- Environment Law 20/97 (LEI DE AMBIENTE, 1997)
- Study on Alignment of Sector Aid with Government Planning and Budgeting Cycle
- Statistical Yearbook of Sofala 2003
- Statistical Yearbook of Mozambique 2005
- Different journals and reports of CFPAS

"A plan for the development of human resources should be implemented on short term for the next ten years in order to increase the institutional action capacity for the implementation of the POLÍTICA NACIONAL DE ÁGUAS (1995). The investments will be made on short term; this will make it possible to break with the circle of inadequate solutions. On the same time, a long-term plan will be developed for the coordination of the actions at provincial and national level."

This statement of the POLÍTICA NACIONAL DE ÁGUAS (1995) suggests that there is a lack of human resources in the water sector and declares the disposition of the government to invest in capacity building in order to fill the gap of human capacity which penalizes the water sector.

In the following section, the deficit of human capacity will be pointed out. First, the educational and training deficiency is analyzed and described, at community, district, and provincial level respectively. The second part describes the lack of applied research for each sub-sector of the rural water and sanitation sector.
4.3. DEMAND

Education and vocational training

Education and vocational training represent one of the main gaps in the rural water and sanitation sector. Beginning from the community level up to the central level at the DNA in Maputo, few trained personnel are facing the challenges arising from the reforms in the water sector. In any case, it is not possible to quantify the lack of human capacity in the rural area. The PESA-ASR (2006) states that it is not well known what the capacities for constructing water supply and sanitation infrastructure in the provinces are. Therefore, the following data will only give qualitative information about the lack of human capacity; this means that there is a lack, but we cannot ascertain how big the gap really is.

Community level

Training and education for users Participation of the beneficiaries in rural water supply and sanitation is a central principle of the POLÍTICA NACIONAL DE ÁGUAS (1995). Therefore, education and training for the communities is essential for the implementation of the POLÍTICA NACIONAL DE ÁGUAS (1995). As the PESA-ASR (2006) states, a big part of the water infrastructure constructed since the independency is inoperative due to deficiencies in maintenance, originated by the weak involvement of the community. Furthermore, the same study asserts that every year 5% of the existing wells breaks down and that 50% of the works on wells are rehabilitations. The cause of this situation may be the low quality of the wells. Though as the bulk of the rehabilitation is a consequence of low maintenance, it is more likely that the reason therefore is the community not accomplishing fully with its task in the management of wells.

The users have to be trained in operating and maintaining water infrastructure in order to increase its lifetime, which will be cost-saving for the communities. Of course, not every community member has to possess all the technical skills for maintenance. The task can be assigned to members of the water committees, but their work must be supported by the users.

From the situation described above, another challenge arises: the question of ownership. As the users do not see themselves as the owner of the infrastructure, they are not willing to take care about it. For changing this attitude, the users must be involved in every stage of the project: planning, implementation, management, and operation of the infrastructure. According to the POLÍTICA NACIONAL DE ÁGUAS (1995), in future the communities will also be involved in the allocation of government funds directed to the water sector. For the management of small water infrastructures self-management models will be implemented. The participation of the community according to their financial capacity will also facilitate the return of investments (POLÍTICA NACIONAL DE ÁGUAS, 1995). For all these items, it is necessary to train the community on finance, controlling, management of infrastructure and water quality monitor-
4.3. DEMAND

Article 30 of the Water Law (LEI DE ÁGUAS, 1991) prescribes the users to utilize the water resources in a rational and economic manner and to participate in the community practices for avoiding a deterioration of the water resources. It forbids carrying out actions, which could contaminate the water bodies, like the accumulation of waste. However, at the time, among the population there is a lot of ignorance about the conditions of the local environment and its influence in the projects (LEI DE AMBIENTE, 1997). There is a need for environmental education of the population, enforced by the fact that there is a strong correlation between poverty and environmental deterioration, how the SWAP MoU states.

Environmental education must also include the sanitation issue. According to the POLÍTICA NACIONAL DE ÁGUAS (1995), inadequate use of latrines is the main cause for the pollution of the groundwater resources. This is one of the main problems of the water supply sub sector. The consequence of groundwater pollution through inadequate sanitation is the breaking out of diarrhoeal diseases such as cholera. Change of behaving and construction of latrines, social consciousness in terms of sanitation, hygiene and water related diseases are themes, which the communities have to learn about. However, local traditional know how local culture have to be included in the education programs. Self-management of sanitation systems and a tariff policy, which allows the covering of the costs, should be promoted. Thus too for the sanitation sector the community should be trained in management and financing of sanitation systems.

Education in water and sanitation in primary schools The AGENDA 2025 (2003) states that education should enhance the participation of the community in the development processes. Therefore, the main development issues should be included in the curricula of primary schools. The PARPA II (2006) wants particularly hygiene and sanitary education to be promoted and become a fix subject in schools. The experience with SSHE (School sanitation and hygiene education, promoted by IRC and UNICEF) in different African countries shows that sanitation and hygiene education in schools can affect positively the hygiene behaviour of the children. In the SSHE projects, education programs are always carried out together with the installation of water and sanitary infrastructure in schools, because the development of policies can only be based on experience in real life (DA CONCEIÇÃO JÚNIOR, 2005, 2). On this way, children learn to participate in school hygiene and environmental protection. Moreover, the knowledge about hygiene and sanitation issues alone does not assure a change of behaviour. The measures have to be gender specific for what regards education as for the sanitation facilities (DA CONCEIÇÃO JÚNIOR, 2005, 2). The self-esteem of both boys and girls has to be enhanced (DA CONCEIÇÃO JÚNIOR, 2005, 2). In addition, both girls and boys of different ages have to be involved in the planning, implementation and evaluation processes.

Teachers should be constantly trained on new techniques; therefore they should make
4.3. DEMAND

use of the possibilities for distance learning and training (DA CONCEIÇÃO JÚNIOR, 2005, 2).

District level

Institutional capacity The decentralisation process generates new challenges for the public institutions of the Mozambican water sector. They have to be empowered for leading actively the dislocation of competences and responsibilities from the central to the provincial down to the district level. The analysis of the documents and strategies shows that the capacity of the rural water and sanitation institutions at district level is very weak. Their human resources need to be upgraded if they want to face the institutional reform of decentralisation.

According to PARPA II (2006), following capacities have to be enhanced at district level.

Planning and monitoring systems have to be developed. Local public institutions have to improve their financing management capacity. Municipal councils will play an important role in deciding about the utilisation of funds deriving from sanitation fees, which should be invested in the reorganisation of sanitation services (PARPA II, 2006).

The functionaries of public institutions and local authorities have to be trained for accomplishing with these tasks. They are expected to apply standard national instruments to plan, prepare budgets, manage, and carry out assessments and audits for the development of the rural water sector. District administrations will be charged with the task of directing government funds to different areas of the water sector, especially to demonstration and promotion actions for new sanitation solutions (PARPA II, 2006).

A central theme of the POLÍTICA NACIONAL DE ÁGUA (1995) is the procurement principle. It indicates that communities have to participate actively in the improvement of water supply and sanitation facilities, and not least in the financing. The PESA-ASR (2006) requests the public institutions to develop options for the implementation of the procurement principle. This can be done through demand management and promotion and through the development of models for long term contracts for procurement management. Institutional capacity should also be increased in contracting of the private sector for implementing projects. In this context, measures for improving the low quality of the works of enterprises are to be taken.

The Water Law (LEI DE ÁGUAS, 1991) appoints administration officers for handling of the main problems in the local management of water resources. This too will require an appropriate training.

Professional training The Rural Development Strategy (EDR, 2006) states that Mozambique is one of the countries with the weakest human capacity in international comparison. The low level of human capacity sets the rural water and sanitation sector barriers for the achievement of its aims. The PESA-ASR (2006) estimates the human resources of the Mozambican water sector too weak for accomplishing with its targeted
objectives. Therefore, there is a need for decentralized training of human resources, which will establish a structure of professional careers the sector needs. Local artisans, animators, technicians, and community agents should get an education so that they can act in the water sector.

The POLÍTICA NACIONAL DE ÁGUAS (1995) wants to involve the private sector in the development of rural water and sanitation. The AGENDA 2025 (2003) emphasizes the importance of training the staff of private enterprises and local autonomous agencies. Curricula for the training of local actors have to be reformulated together with the private sector, linking the schools to enterprises. Professional training should be given according to the local demand. During the analysis of the main documents, the following demand for training emerged.

First, there is a need for technical skills for construction, maintenance, and repairing of water supply and sanitation infrastructure. For what concerns water supply, it is important to include in the education programs information about how and where local technicians can get spare parts for pumps (DA CONCEIÇÃO JÚNIOR, 2006). The POLÍTICA NACIONAL DE ÁGUAS (1995) states that the inadequate tariff structure in water and sanitation is one of the main causes for the low service level and coverage in the rural area, which penalizes first the poorest. Therefore, management and administration skills for water supply and sanitation systems are required in order to enhance a more efficient use of available funds (PESA-ASR, 2006). The capacity of contract procurement has to be improved and communitarian financing and controlling agents must be trained in order to increase the sustainability of water and sanitation projects.

The PAARSS project in Sofala province showed that the implementation of new sanitation techniques are often well accepted among the community, but not by local technicians, who were critical about the higher price (DA CONCEIÇÃO JÚNIOR, 2005, 1). Therefore, an accurate training in sanitation is to be given to local actors, enabling them to develop new and cheaper methods for proper sanitation (for instance using local materials).

Technicians and other actors of the rural water sector should get a constant training development, in order to be kept up-to-date. They should be able to respond to the necessities of the market using modern and proper technologies.

Finally yet importantly, there are regional asymmetries among the country for what concerns human capacity in the water sector. This problem has to be solved making education and training available for periphery regions where the human resources are weaker.

Province level Even if at province level the rural water sector in Sofala shows a better scene concerning human capacity than at district level, there is still an institutional and professional deficit. Hence, the DPOPH and the DAS have to enforce their human resources for approaching the decentralisation process.
4.3. DEMAND

The main task of the province administration will be to support and to train the district level and to assist the district administration in the management and monitoring of the water resources. Therefore, the capacity, which is requested at district level, is also requested at province level. In addition to that, province administration has to work out business packages for procurement, contracting and implementing projects (PESA-ASR, 2006). Moreover, it should collect information about the activities of NGOs and private enterprises in the sector (PESA-ASR, 2006). Provincial Sanitation Groups should be instituted with the aim to educate the population in and to research for new solutions for hygiene and sanitation (PESA-ASR, 2006).

As the PESA-ASR (2006) asserts, the capacity of the DAS is weak; the enforcement of municipalities often occurs moving personnel form the DAS to them. This implicates a loss of human resources in the DAS. Hence, at province like at the district level there is a need for mid level technicians that can fill this gap.

As the management of the water resources will be accomplished at basin level by autonomous regional water boards (ARAs) (POLITICA NACIONAL DE ÁGUAS, 1995) and the ARA Centro is based in Beira, there is a need for capacity building in water resources management.

Studies and research, education and assistance in the water sector can be carried out by private enterprises and NGOs. They have to be given access to a training, which enables them to accomplish with this task.

National level  This study concerns the province of Sofala, but there are some aspects at national level, which should be considered. It is clear that the central level has a huge impact on what is going on at province level. The DNA is responsible for carrying out the decentralisation process in the rural water and sanitation sector of Mozambique. The DNA should assist the DPOPH in working out the provincial planning and management of funds in rural water and sanitation (PESA-ASR, 2006). Moreover, it should define a financial policy for rural water and sanitation, monitor and supervise the execution of the plans and their financial efficiency and develop and demonstrate through pilot projects new technologies for the sector.

The POLÍTICA NACIONAL DE ÁGUAS (1995) asserts that the DNA does not have the human resources for accomplishing with these technical and regulatory tasks. Of the 5000 employees of the public water sector of Mozambique, only 1,1 % have an academic degree, 4,4 % are mid level technicians and more than 50 % attended less than 5 years of school (POLÍTICA NACIONAL DE ÁGUAS, 1995). The sector lacks a training and education policy at national and local level. Another problem is that the DNA itself has a centralized structure, as the majority of the high and mid level technicians are in Maputo. This problem can be approached with educating and training of human capacity at all stages of the water sector, including the academic level, in first line for the increase of the consultancy capacity at central level (PESA-ASR, 2006).
4.3. **DEMAND**

**Applied research for water and sanitation**

Technology and innovation are determinant variables for the development of Mozambique. According to the AGENDA 2025 (2003), they must be directed to the actual problems of the population. Besides human capacity building, applied research is a significant pillar for the development of the rural water sector. Public and private research institutions should create and manage new knowledge and turn it into goods and services. Hence, there is a need for knowledge management, performed by a competent institution or nucleus.

**Rural water supply** In its strategy for developing rural water and sanitation, the PESA-ASR (2006) envisages the development of a research agenda for the sector. The available technological options for water supply should be increased. There is a need for new techniques oriented to the different specific groups of the population, which permit to save costs and water resources (PESA-ASR, 2006). Much of the analysed documents indicate the necessity of developing new pumping technologies. The Afridev, which is currently the most used pump in Mozambique, shows problems at a groundwater depth more than 40 meters. New technologies have to be tested in pilot projects and spread out by procurement programs. Moreover, the PESA-ASR (2006) claims for the development of new analysis methods for the quality of water in the communities. For this objective accessible labours have to be created.

A register of all the existing water and sanitation infrastructure should be created, containing information about the condition of the facilities (LEY DE ÁGUAS).

The PESA-ASR (2006) emphasizes the necessity for research about new institutional models, which could be implemented in the water sector. Within the decentralisation process, new financing models for rural water and sanitation projects should be studied and implemented. A balance has to be defined for financing and administrative responsibilities between the different levels (state, province and district). The investments coming from public and private funds have to be coordinated. In particular, there is a need for public expenditure tracking surveys as for investment efficiency studies. A further research matter is the possibilities for cost-recovery by the beneficiaries (PESA-ASR, 2006).

**Rural sanitation and environmental protection** The main environment priorities in Mozambique are, inter alia, sanitation of polluted environment, reduction of the pollution potential for water and soil and natural disaster management and mitigation of its impacts (PARPA II, 2006).

The low level of sanitation in the communities degrades the health and the environmental situation in rural areas. The PESA-ASR (2006) shows that the traditional latrine is the most used sanitation facility among the population. As this is not a proper solution and as it negatively affects health and environment, alternative solutions for
sanitation have to be developed. They should be studied on their compatibility with local housing levels and on the possibility of using adequate local materials for their construction. According to the PESA-ASR (2006), the standard to achieve is at least the improved latrine. In addition, traditional techniques should be inspected on their pollution potential (PESA-ASR, 2006).

Poverty assessment The PARPA II (2006) states that there is a problem in identifying the different strata of the population in communities. When people are asked about their economical situation, the majority claim to be poor in obtaining financial help. According to the evaluation of 2005, communities are divided in three classes: the poor, a medium class and the rich. This distinction is helpful for developing the action plan for projects in communities. Concerning the cause of their poverty, people mentioned more possibilities: poverty is a consequence of not being able to work because of physical or psychological disability, illness, age or civil status. Another cause is that some people have to work too much. This is an important task for the water and sanitation projects. Help has to be directed to the weakest members of the communities, which are often the invisible ones (PARPA II, 2006). Hence, research on methods for identifying and addressing these groups is needed.

Water resources management The POLÍTICA NACIONAL DE ÁGUAS (1995) aims to re-install the net of hydro meteorological stations, which was operating until 1973. Superficial water bodies and groundwater and their use should be inventoried in terms of quantity and quality. On a second step, research for increasing the available amount of water resources will be enhanced by the government. This will facilitate the planning of water supply and sanitation systems (LEI DE ÁGUAS, 1991). Integrated water resources management has to be applied for solving or mitigating the problems of water scarcity, floods and the conflicts with the upstream lying states.

Dissemination of knowledge The participatory capacity of the communities will depend on their access to information and know how. In fact, now, there is a lack of available information about hygiene, sanitation and water-related issues. The PESA-ASR (2006) underlines the importance of spreading existing and new techniques related to water supply, sanitation, disinfection, filtering and boiling of drinking water. It is important that information is made available, but it is equally important to have an institutional framework that enables critical discussion and creative utilisation of such information, so that it can become knowledge.

4.3.2 The expressed demand

For the detection of the expressed demand, the research team interviewed a range of stakeholders and experts of the rural water and sanitation sector. In the following sec-
4.3. DEMAND

tion, the expressed demand for capacity building and applied research will be reported not by interview held with stakeholders, but by the same thematic areas as for the normative demand, which facilitates the analysis.

Education and vocational training

From the interviews, more or less the same results emerged like from the definition of the normative demand. Thus, the priority areas for capacity building in the rural water sector are: implementation and maintenance of water supply facilities, which is still the main problem, assure sustainability of water and sanitation infrastructure, institutional management, introduction of new sanitation techniques, social issues about the communities concerning sanitation, gender issues (VAZ, 2006) and environmental protection.

Community level

Training and education for users  The focus group discussion with the water committees in Dondo and Buzi showed that at community level the responsible for operation and maintenance of water infrastructure are missing the skills they need for doing this. In some cases, the water committees get some training after the completion of the water infrastructure, which “is more an explication than a training” (WATER COMMITTEE BUZI, 2006), and then they are left by themselves as no re-training is given. 

The following list shows the “expressed demand” of the three water committees the research team met in Buzi and Dondo, namely the water committee of Bairro da Conceição (Dondo), and two of Guara-Guara (Buzi). In other words, these are the gaps and needs the operators and owners of rural water infrastructure have relating to education and capacity building.

1. The first problem the water committees of Guara-Guara touched was the ignorance on how to repair pumps and water infrastructure and where to buy spare parts. As a result, wells stay often out of work for months until they are repaired.

2. Preventive maintenance is a central issue, which resulted also from the normative demand. Hence, the committees but also the community have to be trained on how to handle the infrastructure careful and maintain it functioning. This could reduce the repair costs which are very high due to the elevate price of spare sales.

3. Sometimes users do not want or can not afford to pay for the water they consume. Hence, there are water committees, which have financial resources as good as none. In Guara-Guara, the committee expressed the need to learn on how to deal with these problems. They would like to be trained in negotiation and chairmanship with the population in order to avoid and solve conflicts. In this issue, also
the local community chiefs should be involved, as they can rely on their power and form public opinion.

4. In the water committee of Bairro da Conceição, women were concerned with the sanitation, hygiene and waste management “because the conservation of water quality depends on these issues” (WATER COMMITTEE DONDO, 2006). A good training and education in sanitation and hygiene attitudes could resolve many serious health problems. In this context, the lack of material for construction and cleaning of sanitation facilities was mentioned. Training in possible use of local material for sanitation issues would go in line with the objectives of the POLÍTICA NACIONAL DE ÁGUAS (1995).

5. Another problem is the weak financial management capacity of the water committees. All the consulted water committees expressed the need for training in managing financial funds.

6. Management of water resources seems to be a central issue for the water committees, particularly for what concerns the sharing of water rights. As in many zones wells are short, a lot of people draw water from one well, assembled at the same time (e.g. in Bairro da Conceição 8000 people depend on one single well), conflicts arise from this situation. Operators sell water to people coming from other villages without knowing the capacity of the water source. Solution for these problems should be found together with the water committees, which have to be trained on how to act in such situations.

During the meeting with the water committee of Bairro da Conceição, a discussion arose about the priorities in the water sector. Being asked if funds for the water sector should be used either in a training and research program or in construction of infrastructure (wells, pumps), the spontaneous answer of the women was “pumps, of course”. The men, in spite, claimed that education and training is too important and tried to convince the women about that. The difference between the point of view of men and women is given by the different tasks they have in the water issue. Women are the ones who have to procure drinking water for the household. Hence, it is understandable that for them the priority lies at having a water source available at a reasonable distance.

Now, it appears that these results can question the whole purpose of this study. The users, particularly women, seem to set their priority on construction of infrastructure. However, as already the normative part of the results showed, the lack of infrastructure is not only given because fewer infrastructures are constructed, but also because many wells are not functioning. The maintenance problem can be solved through training of the users and technicians (WATER COMMITTEE DONDO, 2006). If the drop out rate of water sources could be reduced, financial resources now used for repair of wells and
4.3. **DEMAND**

pumps could be set free for the construction of new wells. Investing in capacity building can help directly to solve the infrastructure problem.

In addition to the "demand" of the water committees, the contributions of Pereira (2006), the boarder President of the trust fund "Cruzeiro do Sul", are reported. According to Pereira (2006), a very important issue is to create ownership awareness among the community for the whole process of water supply. As he states, often there is a lack of control in the construction and operation phases, because construction enterprises and operators do not feel responsible for the infrastructure and the water resources. Hence, the users have to develop consciousness about their role as owners of the whole process of water supply and sanitation. On this way, they are able to control all the project phases from the planning to the operation phase. For doing this, the users (or in representation the water committees) need to have some basic know how concerning water issues.

Another issue Pereira (2006) sees as priority are the cultural attitudes of the communities relating to sanitation and public health. For instance, Pereira (2006) refers about a belief in rural areas that in the case of cholera, somebody sucks off the blood of the infected person at night. Often the accused persons are the health officers. There is an urgent need for education and sensibilisation about water related diseases in order to prevent the epidemics, which afflict yearly Mozambique (GROOSJOHAN, 2006).

**Education in water and sanitation in primary schools** The members of the water committees of Buzi expressed the need for water education in schools. Children should get training in maintenance and operation of water infrastructure, so that they can participate actively in the water supply process (WATER COMMITTEE BUZI, 2006). In accordance to these statements, Pereira (2006) asserts that education in water and sanitation has to start at primary school, focussing on how to handle the water resources (protection, management). If school graduates get training and education in water issues, further community training could start at a higher level, as this has to align on the education level of the community members (CLEMENT, 2006).

**District level** All the interviewed people agree about the lack of technicians acting in the water sector at district level. As Vaz (2006) asserts, at district level no engineers and academic staff but mid level technicians with a complementary training in social issues are requested. The same demand arises from the discussion with the water committees of Buzi. "Technicians" Mrs Sara Caetano, president of a water committee says, "must have an intermediate formation and be able to repair pumps and wells quickly". From the discussions with experts and stakeholders a more or less clear profile of requirements for water technicians emerges.

Primarily, district staff have to get an overall training including all the issues concerning water (CLEMENT, 2006). Training in fields that do not directly concern the water field (streets, construction) would be useful, because district technicians are often com-
missioned with more charges (MATSINHE, 2006). From the interview with Matsinhe (2006), the following issues for training of personnel acting at district level emerge:

- Maintenance of facilities and management of infrastructure, funds and human resources
- Implementation of water supply and sanitation projects
- Private sector regulation and development
- Ownership
- Public relations
- Social and cultural issues

Management and maintenance refer according to Matsinhe (2006) to "little things that make the difference" like organizing spare parts, fuel supply for generators or vehicles and so on. Human resources management and financial management have to be included in the training. The technicians should be able to control and implement water supply and sanitation projects, getting particularly training in well construction, pump maintenance and equipping sanitation systems. Construction enterprises often do not work on a responsible manner in implementing projects. Therefore, technicians have to learn how to control the private sector. However, this task can not be solved only at district level, since a regulation model for the private sector has to be defined on national scale. The ownership problem was addressed in the previous section. District technicians must be instructed on how to build the sense ownership of the users (MATSINHE, 2006). Another important task for water personnel in the districts is to act as persons to whom the community can turn to if they see problems or things to be improved (MATSINHE, 2006). According to Matsinhe (2006), now there is a lack of communication between the community and district technicians. Hence, the communication skills on both sides, but primarily those of the technicians, have to be improved in order to enhance the participation of the community in the rural water sector. In addition to that, the personnel has to be trained in social issues (MATSINHE, 2006), thus knowing about cultural and social attitudes of the users related to water and sanitation. They have to learn how to intervene for changing disadvantageous attitudes of the population.

Pereira (2006) sees a priority in training the water sector personnel for educating the users in all the above mentioned issues in order to lead them to take part actively in the water supply and sanitation process.

Furthermore, river hydrology, precipitation and the amount of available water should be studied at district level (PEREIRA, 2006). However, according to VAZ (2006) training needs not to be given in Water Resources management because of two facts. Firstly, the rural water sector does not need huge amounts of water, thus it does not influence
wide areas, and secondly, the quality issue is also a local one as it is not influenced by wide areas (VAZ, 2006).

The training of technicians and other actors should take place continuously, offering the possibility of on-job training (VAZ, 2006). The training should be based on short term courses and not be directed to academics (MATSINHE, 2006). According to Matsinhe (2006), similar courses for water and sanitation were given in Beira, but they had a low affluence, because they appeared to be directed to people with high school degree. Motivation has to be created for people attending the courses.

It seems that the districts themselves are not giving priority in investing in capacity building for their water sector, although they would need it (MARRENGULA, 2006). The little financial autonomy they have may not motivate them to spend in training for the water sector (MARRENGULA, 2006). The districts set other priorities due to the absolute poverty level among the country (MARRENGULA, 2006). Moreover, it is the first time that the central Government gave them financial autonomy. In fact, all the training institutions, which were contacted by the team, affirmed that they would be interested in raising a partnership with the districts, but these did not show any signs of interest in contacting the institutions and developing a demand for capacity building. However, as Marrengula (2006) states, the districts are in the way to change this attitude and start slowly to show interest for capacity building in the water sector.

Another problem is that courses are hold mainly in Maputo, which entails high transport costs for students coming from rural areas. On the other side, training institutions face difficulties in contacting the districts as in many cases those do not dispose over means of communication such as telephone, fax or internet access. In this way, the possibilities to create a marketing strategy for enhancing capacity building in rural areas are very few (MARRENGULA, 2006).

From these assertions, it can be conclude that there is a need for creating a communication mechanism between the districts and the training institutions.

**Province level** In Sofala, there is a lack of personnel acting at provincial level (VAZ, 2006). Staff operating at provincial level in the rural water sector should have an academic degree (VAZ, 2006). The lack of engineers in the water sector is a result of the high demand for engineers in the construction sector, which absorbs the bulk of engineers. A high number of water engineers are absorbed by the urban water sector and by public institutions at central level, both offering higher salaries than the rural water sector.

Another problem affecting the water sector at both province and district level is the low living conditions, which induce the personnel to move to where the living standards are higher. In the districts the salary for public employees is about 20 % higher than in cities (MATSINHE, 2006), but this does not compensate the lack of facilities such as education institutions, internet access or others which are offered in urban centres. The consequence is that qualified people move from districts to the main cities and from
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there to Maputo as soon as they get the chance (JUNG, 2007). This problem can be approached in two ways. On one side, incentives for keeping the personnel at district and province level have to be created (VAZ, 2006). These can range from financial incentives to the provision of housing, health and school services etc, hence include a wide range of measures. On the other side, personnel can be kept at decentralized level by giving them just the capacities that are requested at district or province level respectively and not more, avoiding that they can apply for jobs on a higher level (JUNG, 2007).

**National level** At national level, the demand for capacity building is given primarily through the decentralization process the DNA is carrying through. The restructuring of the DNA requests more human capacity in terms of quality and quantity. First, there is a need of experts for the application of the strategic plan, as the DNA does not have the capacity for its application in the process of decentralization (ALFERES, 2006). Furthermore, the DNA needs personnel for the new tasks rising from this process. An important task of the MOPH will be to help creating the demand for capacity building in the rural water sector. Besides the demand which should come from the communities, the private sector and NGO's, the public sector has to formulate its own demand for capacity building (CLEMENT, 2006).

**Applied Research for rural water and sanitation**

The expressed demand for applied research rises only from the interviews with experts of the rural water sector. For what concerns research, no requests were formulated by the water committees or users. The results are the following: Now, there is no national or Province strategy for research (ALFERES, 2006). There are single research programs, “imposed” and financed by donors or decided by the government at central level (ALFERES, 2006). However, the research programs financed by the donors are few, because donors tend to direct their funds on projects where the results can be measured with evident success indicators like constructed boreholes per money (MATSINHE, 2006). According to Vaz (2006), first there is a need for investigating what the reality in rural Mozambique is, in order to obtain a general picture about the situation in the rural water sector. The lack of knowledge about the real situation in the sector was described in chapter 2. This problem could be approached by the realisation of case studies among the rural area (VAZ, 2006). However, the areas for investigation linked to the water sector are many (PEREIRA, 2006). These include the socio-economic, area, land and development, health, economy and the decentralisation issue (PEREIRA, 2006). Specifically for the water sector, topics, which urge at national level are to develop a long term water management strategy, the adoption of measures against water scarcity and floods and negotiations with neighbouring upstream countries for a common water policy (PEREIRA, 2006).
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**Water supply**  According to Matsinhe (2006), the main problem in rural water supply is that the currently adopted technologies are not throughout able to satisfy the drinking water demand. There is a general perception that boreholes are the unique applicable method for rural water supply (MATSINHE, 2006). Hence, the government tends to produce boreholes rather than invest in investigation about new technologies, in order to yield votes. There is a need for the development of new pumping technologies, as the wide spread AFRIDEV pump exhibits problems at delivery heights exceeding 40 meters (MATSINHE, 2006). For water supply, rainwater harvesting is an option, which has to be investigated and implemented (MATSINHE, 2006). This perception is shared by the DNA, which claimed for the introduction of rainwater harvesting. For now the implementation is limited to some single projects (MATSINHE, 2006). Another topic is the waste of energy in water supply. Options for pumping at times where the energy costs are low and storing the water have to be developed and propagated (MATSINHE, 2006). There is a need for developing low cost and simple techniques, which assure the water supply of the communities in terms of quantity and quality as the treatment of wastewater (MATSINHE, 2006).

**Sanitation**  The sanitation problem is affecting heavily the health of rural communities (GROOSJOHAN, 2006). The problem is more a cultural/social than a technological one; there is a strong resistance coming from the rural communities against the adoption of new sanitation techniques (MATSINHE, 2006). Cultural and social differences require different sanitation solutions. For instance, zones with a high Islamic settlement use water to clean themselves after defecation, hence a dry system is incompatible (MATSINHE, 2006). Sanitation methods have to be developed considering the particularities of every zone. A further problem is that often the evaluation of sanitation programs are done with wrong indicators (e.g. clean latrines can signify that the users are cleaning them often or that they do not use them at all) (MATSINHE, 2006).

4.3.3 **Comparison of the demand, results and discussion**

The normative and the expressed demand do not defer from each other. In Appendix 4 they are resumed in a list. For what concerns vocational training and education, normative and expressed results complement each other, forming an exhaustive picture of what is requested by the rural water and sanitation sector.

**Education and vocational training**

**Community level**  For what regards the demand at community level, the expressed demand coincides on a high degree with the normative demand. It demonstrates that on the one side, the authors of the official documents (GoM, experts, DNA) have an idea about what the real situation in the rural communities is. On the other side, it shows
that the experts and most notably the water committees themselves (they defined a big part of the expressed demand at community level) are able to estimate the situation and the needs of the rural water sector. There is a difference in the accentuation of the demand. The expressed demand emphasises more the importance of training the water committees (for instance in negotiation skills), which is clear, as the water committees themselves recognise the need of enhancing their skills. What the normative demand underscores more is the need for including traditional and local knowledge in rural sanitation, which has to be assessed very positively. As practice showed that new sanitation measures are not always likely to be accepted by the population, giving local people the chance participate with their own knowledge in sanitation could facilitate acceptance.

For water and sanitation education in schools, the emphasis of the demands are different. While the interviewed stakeholder, especially the water committees want the children to learn about maintenance and operation of infrastructure, the normative demand emphasises more the importance of hygiene and sanitation education in schools. It seems that the users are more concerned about the participation of the children in helping providing water maintaining the infrastructure. It is clear that the normative part is concerned about the health of the children and accentuates more the sanitation issue, as they are often excluded from using sanitation facilities (CUMBANA, 2006). Both issues are important. Involving the children in water supply can increase their knowledge and environmental awareness. Sanitation and hygiene education at primary school can enhance the change of negative attitudes among the population.

**District level**  
The needs for institutional capacity at district level are exhaustively defined by the normative demand alone. Thereby the focus is set on the development of options for the involvement of the private sector, which participation is demanded more and more by the POLÍTICA NACIONAL DE ÁGUAS (1995). Furthermore, this point is underlined also by the expressed demand, which shows the importance of the issue.

The demand for operators/technicians at district level raised in both parts, the expressed and the normative. The normative part appoints a range of actors, which are needed at district level. A point emerging form the expressed and missed in the normative demand is the assertion that water technicians acting in districts should be involved not only in water and sanitation issues, but also in other areas. Another demand which is only “expressed” is the idea that district technicians could train water committees and users. This is not provided in the official documents but is a good recommendation for taking advantage of available knowledge the technicians have. The technical skills coincide in both demands, while sociological skills are requested more by the expressed demand.

A concordance is given in the need for constant retraining of the actors on issues rising from the local demand of the communities and the private sector. One single issue
where there is a discrepancy within the expressed demand is the question if IWRM should be included or not in the training programs for actors at district level. This question should be answered in a further study, as the author of this thesis can not estimate whether the arguments pro or against are more reliable.

Province level  There is a difference in the specification of the type of actors needed at province level. In addition to mid-level technicians, NGOs and private enterprises, the expressed demand specifies the need for engineers. However, themes for training rise only from the normative demand, emphasising the need for skills for the assistance of the districts in their new tasks emerging from the decentralisation process.

National level  At national level, the demand regards the human capacity within the DNA. The normative part is a little more detailed in the tasks it allots to the DNA staff. It points out the demand for controlling, supporting and consultancy capacity the DNA in Maputo should offer to the provinces and districts. In addition to that, the expressed part wants the DNA to create a training demand by itself, which makes sense, because this facilitates the allocation of funds by the DNA for capacity building.

The results of both demands confirm each other and this represents a validation of the research outcome. There are no contradictions between the expressed and the normative demand, except for the aforementioned IWRM issue at district level. Table 4.3 recapitulates the summarised results for the education and vocational training demand.

Applied research

Concerning applied research, the normative demand seems to incorporate more areas, while the expressed demand focuses more on specific issues. The official documents regarding the rural water sector include an exhaustive quantity of needs for research. Interview results may be somewhat based more on subjective perceptions and hence focus on areas the interviewed persons regard as central, neglecting other issues.

Water supply  Both the normative and the expressed demand contain the need for the development of new adequate low cost technologies for water supply. What the normative demand accentuates more is the need for simple analysis methods for the water quality, which can be adopted in the communities. As in rural Sofala (and Mozambique as well) the settlement structure is much split, it is difficult to take samples of water for analysis to urban centres. Therefore, it makes sense to develop simple methods, which allow on-site water analysis. An issue which is not addressed in the normative demand but which rises in the expressed part is the development of pumping programs, which save energy. In the rural areas, users rely mostly on hand pumps, but in rural townships, this measure can be adopted.
### Training/education about

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<th>Demand</th>
<th>Finance, controlling, management of water infrastructure</th>
<th>Environment education</th>
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<tr>
<td></td>
<td>Chairmanship and negotiation for water committees</td>
<td>Change of behaving in sanitation attitudes</td>
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<td>Water quality monitoring</td>
<td>Community-ownership</td>
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<td>Environmental education</td>
<td>Hygiene and related diseases</td>
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<td>Construction of latrines with local materials</td>
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<td>Social consciousness in terms of sanitation</td>
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<td></td>
<td>Include traditional local knowledge in sanitation solutions</td>
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<td></td>
<td>Planning and monitoring of water and sanitation systems</td>
<td>Maintenance and operation of water and sanitation infrastructure</td>
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<td>Protection and management of natural resources</td>
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<td>Gender specific hygiene and sanitary education</td>
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<td>Constant training of teachers in water and sanitation</td>
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<td>Technical skills for construction, maintenance of infrastructure</td>
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<td>Training in issues not concerning directly water (streets, construction)</td>
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<td>Contract procurement</td>
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<td>Private sector regulation and development</td>
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<td>Public relations</td>
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<td>Procurement of spare parts for pumps</td>
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<td>Enhancing perception of ownership in the communities</td>
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<td>Sanitation (skills for finding new and cheaper methods)</td>
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<td>Social issues and culture</td>
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<td>IWRM?</td>
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<td>Community education in all issues</td>
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<td>Constant retraining</td>
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<td>Formulate curricula for training, together with the private sector</td>
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<td>Training addressed to local demand</td>
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<td>Create communication between districts and training institutions</td>
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<td>Make education and training available for periphery regions</td>
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<td>Water resources management</td>
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<td>Skills for training and assisting the district level</td>
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<td>Business packages for procurement and contracting of projects</td>
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<td>Application of the DNA strategy plan</td>
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<td>Assisting the DPOPH in funds planning and management</td>
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<td>Creation of demand for capacity building</td>
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<td>Skills for supervising the execution of projects</td>
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<td>Consultancy capacity</td>
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Table 4.3: The demand for vocational training and education
4.3. DEMAND

Sanitation  The expressed demand for research in sanitation emphasises the importance of considering social and cultural particularities for the development of sanitation options, while the normative demand is content with mentioning the use of adequate materials and the compatibility of sanitation options with local housing. The requirement resulting from the expressed demand is of high importance, as the main problems in sanitation are social and cultural ones (CUMBANA, 2006) another important need the expressed demand formulates is the development of adequate evaluation tools for studying the impact of sanitation measures among the communities.

Others  For what concerns general research themes, the two parts complement each other. Both agree on the need for the development of long term water management strategies for facing with the water scarcity and flood problems. While the expressed part points out the need for overall case studies for the definition of the real problems of rural communities, the normative part emphasises the importance of know how dissemination among the actors and the communities. This point will be considered in the development of the options (see sec. 4.6)

<table>
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<th>research needs</th>
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<td>development of low cost options and technologies for water supply</td>
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<td>development of low cost water quality analysis methods</td>
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<td>energy saving methods for water supply</td>
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<td>register of all existing water and sanitation infrastructure</td>
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<td>new institutional and financing models</td>
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<td>public expenditure tracking surveys and investment efficiency studies</td>
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<td>development of new solutions for sanitation</td>
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<td>use of adequate local materials for latrine construction</td>
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<td>compatible sanitation methods with local housing and environment protection</td>
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<td>studying social and cultural attitudes regarding sanitation</td>
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<td>development of adequate evaluation tools (such as indicators)</td>
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<td>methods for identifying and addressing poverty groups</td>
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<tr>
<td>overall case studies for defining the problems</td>
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<td>IWRM strategy, measures against water scarcity and floods</td>
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<td>research for increasing the available amount of water resources</td>
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<td>development of a common water policy with upstream countries</td>
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<td>Know how dissemination</td>
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Table 4.4: The demand for applied research
4.4 Potential for capacity building and applied research

In the last years, the DNA tried to enhance its capacity in order to face the challenges emerging from the reorganisation of the water sector. Nevertheless, human capacity in the sector is very weak. As previously mentioned, no more than 2% of the DNA staff has a university degree. At provincial level, this percentage is even lower. The private sector, which is supposed to be one main implementer of projects, also shows a lack of capacity in both water supply and sanitation. The NGO sector features a slightly better picture in terms of personnel but does often act beyond the national strategies and norms.

The DNA/DAR and the DPOPHs are responsible for creating a reliable system of service delivery in order to assure a satisfactory quality level in water sector services. The DNA recognized that for achieving this aim, the human resources of the water sector have to be strengthened (ALFERES, 2006). Training for communities, the private sector and the NGOs has to be promoted in order to create demand and response to the demand for water and sanitation facilities (ALFAMA, 2007).

For capacity building in sanitation, the DES is responsible at national level. It already carried out activities for investigating new sanitation techniques and disseminating them.

The institutional potential was ascertained through semi structured interviews with nearly all the actual and potential stakeholder institutions in education for the water sector. They were asked about the activities and capacities of their institutions and about the role they could play in an eventual program for capacity building and applied research for rural water supply and sanitation. The research showed that Mozambique has some experience on this issue. Almost all the activities on this field are carried out in Maputo by the CFPAS and partly by the DNA. At provincial level, even if there are no training institutions focussing on rural water and sanitation, there are several institutions, which have huge experience in vocational training and education for other sectors (CFP and IIM). These represent a high potential for the water sector. At academic level, the bulk of capacity is located in Maputo. In Beira / Dondo, there are universities, which can be considered potential stakeholders for giving training in the water sector.

Regarding research, little capacity was detected in Sofala. The UCM and the UP Beira are carrying out research but not specific to water supply and sanitation. The stakeholder with the main potential is the UEM, where projects in water supply and sanitation are already occurring. In the following, the different stakeholders will be described one by one. Their current and/or potential contribution to capacity building in the water sector will be analyzed. The sum of all these institutions with their staff, specific structure, orientation, programs and capabilities, build the existing potential for capacity building in rural water supply and sanitation for Mozambique. The focus lies on the...
potential in Sofala, but as this is very weak, it has to be enforced by the potential exist-
ing in Maputo, which is much stronger. In the following description, the author makes
a distinction between the institutions of Maputo and those of Sofala, because they must
be taken in account in a different way for what regards their possible contribution to
capacity building and research in Sofala.

4.4.1 National level - Maputo

The institutions contacted in Maputo and acting at national level were the following:

- The National Water Directorate (DNA)
- Professional Training Centre on Water and Sanitation (CFPAS)
- Industrial Institute of Mozambique (IIM)
- Edoardo Mondlane University (UEM)
- The Superior Polytechnic University Institute (ISPU)
- The engineer’s umbrella organisation “Ordem dos Engenheiros” (OE)
- The research institute “Cruzeiro do Sul”

The National Water Directorate (DNA)

First, the potential for capacity building and applied research rising from the DNA itself
has to be established. As the DNA is responsible for the development and implemen-
tation of the POLÍTICA NACIONAL DE ÁGUAS (1995), its actions will create chances
and/or constraints for capacity building and research in the rural water sector.

Vocational training The DNA has a huge need for training of its staff. Hence, it is
currently investing in training programs for its personnel but also other actors of the
water sector (ALFAMA, 2007). The DNA is finalizing its overall Strategic Plan, includ-
ing also a National Capacity Building Plan. However, as Alferes (2006) states, the DNA
lacks a mechanism on how to carry through the decentralization required in the plan.

Applied research The DNA does not have a plan for research. Research in rural water
is rather imposed on the one side by the donors and on the other side by the central
government, which recommends studies. As Alferes (2006) states, the research issues
do not always correspond to the real needs of the Mozambican water sector. Now no
funds for research are raised by the DNA. However, the Strategic Plan will specify the
issues for research together with universities and public institutions.
4.4. POTENTIAL FOR CAPACITY BUILDING AND APPLIED RESEARCH

Financing The DNA builds the connection between the government, provinces, districts and the donors. It can distribute funds for any kind of activity in the water sector. For what concerns the coordination of donors, the DNA proposes to adopt the SWAP mechanism, in order to have a higher capacity to act.

The DNA potentials for capacity building and applied research The overall Strategic Plan is of huge importance to the rural area. The DNA knows about the lack of human capacity in the provinces and districts. In the interview with Alferes (2006), first it resulted that the DNA is somehow sceptic about carrying out capacity building and applied research in Sofala. It would prefer to be supported on its capacity building activities at district level among all the country, because, as Alferes states (2006), all the provinces have the same problems like Sofala. However, in further discussions, the DNA seems to be more and more interested in a program in Sofala, as it looks forward in having some advantages from the it (JUNG, 2007). At this point a donor intervening in the Mozambican water sector has to be very careful, because the issue contains both potential and threats, depending on how it is approached.

As stated in chapter 1, the ADC wants to keep its focus in Sofala. For doing that, without getting in conflict with the DNA in Maputo, the ADC has to explain the reasons of that choice and to act in a way that the DNA and the DPOPHs in other provinces benefit thereof.

The potentials can be found first in the Strategic Plan and in the National Capacity Building Plan. If the actions taken in one Province (in this case Sofala) coincide totally with the plan and do not get in the way of actions taken on national scale by the DNA, the donor can influence positively the Mozambican water sector.

One weak point of the National Capacity Building Plan is the fact that the DNA does not know how to implement it in the process of decentralization. This represents a potential, because the donor can carry out a project in that way that it acts as example for the implementation of the National Capacity Building Plan at Province level. The DNA could benefit from such a program, regarding it as a pilot program for the implementation of the National Capacity Building Plan. Regarding responsibility and financing of a possible program in Sofala, it will be difficult to finance it in a SWAP approach through the DNA at national level. It has to be financed through the DPOPH, for not creating parallel competence and flow of funds. The donor should coordinate also with the main donors of the DNA for capacity building, namely the SDC, the Netherlands and the WB.

According to Alferes (2006), the DNA would prefer that already existing institutions are involved in capacity building and applied research for rural water and sanitation, instead of creating new institutions.
Professional Training Centre on Water and Sanitation (CFPAS)

The CFPAS in Maputo is the only institution with a long-time experience in vocational training and partly in applied research for the water and sanitation sector. It was created in 1980 with the aim to respond to the personnel and knowledge necessities of the water sector. Until four years ago, the CFPAS was integrated in the MOPH, now it is an autonomous institution. The Centre employs around 40 people. It disposes of different class rooms, laboratories (hydraulic, chemical), a library, a workshop where water equipment is build and tested and a dormitory and other facilities for students.

Vocational training  The centre has trained 1,500 students since it was created (MARRENGULA, 2006). Until 1995, CFPAS offered only long-term courses lasting at least one year; now also short term courses are given (from one to three weeks). With these courses, CFPAS wants to address the private sector and the public administration, offering further professional training and on-the-job training to their staff. According to Marrengula (2006), now the main clients are the private sector and the NGOs. Currently the offered are following:

- One course during one and a half years giving the diploma holder a degree corresponding to the 12th school year.
- A three year basic course with the first year conforming with the seventh school year and giving the diploma holder a ninth school year degree.
- Different short term courses, given on request.

The demand for the courses is coming from the DNA and from several actors of the water sector. For instance, UNICEF or the GTZ already made use of the services given by CFPAS. The procedure for designing courses starts with a program proposal sent to the potential stakeholders. They are requested to take a position and suggest changes. Finally, the program is compiled by CFPAS (MARRENGULA, 2006).

The costs of the courses amount to around 30 USD per month and per person.

Applied research  CFPAS disposes of some research facilities, but only single research projects were carried out. These projects concerned more the social area, dealing with sanitation and the impact of latrines. The technical research is limited to the construction and testing of different pumping technologies.

According to Marrengula (2006), the cause for the weakness of CFPAS regarding research is that there is no specific internal budget for research. Consequently, the marketing strategy for research activities is very weak.

International linkage  The centre is somehow linked to international water institutions or programs as the staff participates at meetings and abroad training courses. CFPAS benefits from those courses insofar as the persons who participated impart their
acquired knowledge to the other members of CFPAS. The main partners are NETWAS, IWSD, ITN.

**Financing** The infrastructure of the centre was found since 1980 by DANIDA. After 1983, the SDC become the main financer of CFPAS, contributing on the budget on a quote of 70% (DUFFAU, 2006). Since CFPAS was separated from the MOPH, the Government bears mainly the salaries for the staff and contributes only to a small extent with basic grants, but in reality, only part of the Government budget arrives to the centre (DUFFAU, 2006). SDC decided to reduce the finances for CFPAS and stop funding in 2008. The centre needs now to find other financiers. The main client is the GTZ, asking for a training program for the private sector, NGOs, provincial directions and municipal councils (MARRENGULA, 2006). As Muluana (2006) states, the district administrations constitute a huge potential for the creation of training and research demand, as they dispose of an own budget since the process of decentralization started. However, they seem to be not motivated to spend their budget in capacity building programs for water related issues, as they are dealing with multiple other problems. A short SWOT analysis of CFPAS shows the following results:

**Strengths** New tools for financial audit were implemented for controlling the management staff, due to corruption cases during the last years. Every six months an external audit takes place. After the last one left because of corruption, a new account manager was engaged.

There is demand for training coming from the DNA, different donors (GTZ, DANIDA, SDC), NGOs and the private sector. Strength of CFPAS is the documentation centre, which edits every quarter a journal about the activities in the Mozambican water sector.

**Weaknesses** The centre deals still with management problems. As the Ministry financing CFPAS appears to be not willing to punish or expulse staff involved in corruption affairs, less can be done again for improving the financial management (DUFFAU, 2006).

There is a lack of quality management and the centre has no entrepreneurial vision in their activities. According to Muluane (2006), this situation is inter alia a consequence of the lack of human capacity the centre is facing with.

Another point is that there is no system for knowledge management, which connects the centre with other institutions working in research and capacity building in the water sector. In this manner, there is no database collecting informations for instance about different water supply and sanitation technologies and their use and appliance in different parts of the country.

The network activities with international partners (IRC, IWSD, ITN, and Stream Knowledge organisation) are decreasing.
Opportunities  The interest of different donors for the water sector constitute a chance for CFPAS as it is at the moment the only institution acting in capacity building for the water sector in Mozambique. The fact that the SDC will stop its grants for CFPAS can represent an opportunity, as it is a threat. The centre will have to find new donors, and therefore it will have to revise its programs and strategies and to assure transparency. The EU commission, the Netherlands, France, the World Bank, the ADB, the MCC and the MCA will increase their funds for the rural water sector in the next 10 years, so there is really a favourable environment for CFPAS.

Threats  Many problems of the CFPAS are generated by the inadequate environment of the water sector. First, as Duffau (2006) states, the DNA itself has no integrated vision for which could be a training or capacity building plan. Even if CFPAS is autonomous, it is still linked to the public water sector, led by the DNA through policy making and financing actions. In the public sector, there is also a low absorption rate for graduates. As previously mentioned, the demand is yet not coming from the districts, as they are not willing to spend huge parts of their budget in the water sector. A serious deficiency is that neither the MINED nor the Ministry of Work recognise yet the certificates of CFPAS, resulting in low motivation by students and trainers. Now that the SDC is giving up its role as financier, the CFPAS will face with serious funding problems, if it does not find an alternative donor.

The CFPAS potentials for capacity building and applied research

Vocational Training  As the CFPAS is the only training institution for low and mid level technicians in the water sector, it constitutes a potential, which has to be take in consideration for capacity building. Even if some stakeholders state that the contents of the courses and the program of CFPAS are not up to date, its experience and knowledge about the environment in capacity building are not negligible.

Applied Research  During an on-site visit to CFPAS, the research team could ascertain that the research, which is performed, gives positive results, particularly in pumping technology. Even if there is very few coordinated research, the team could assert that there is in fact potential for development of a research unit within CFPAS.

Yet the existing infrastructure including laboratories, workshops, documentation centre, constitutes a potential for capacity building and applied research. CFPAS can furnish experienced teaching staff, if its human capacity will be increased. What CFPAS definitely has to do is to direct its attention to the district and province level, getting in line with the process of decentralization. This why donors are concentrating their funds always more to districts and provinces, like the SDC, which wants
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...to enter in the decentralization process through the water sector. Muluana (2006) stated that a partnership with a program or an institution in Sofala could benefit the centre. Thus, the directorate of CFPAS is interested in being involved in the capacity building process even at province or district level (MARREN-GULA, 2006).

The problem of CFPAS seems to be generated more by weak management capacities than by other factors. Hence, enhancing its management capacity and re-defining its management strategies, program, marketing and pr-practices could create a dynamic institution able to play a key role in research and capacity building for the Mozambican water sector.

The Industrial Institute of Mozambique of Maputo (IIM)

... During the field work in Sofala, it was not possible to get a meeting with the Industrial Institute in Beira. According to the opinion of the bulk of the participants at the workshop held in Beira, the IIM Beira would represent a huge potential in vocational training for the water sector. Hence, the IIM Maputo was contacted.

The IIM lies under the responsibility of the Ministry of Education and Culture. There are IIM institutes in Beira, Nampula and Maputo. The curriculum is organized by the Ministry, the IIM itself has less autonomy (MACARINGUE, 2006).

Vocational training The IIM offers mid level courses on different technical and practical professions. Students start after the 12th school year and get the bachelor degree. Short term courses at province level are organized by demand together with the MOPH. Only in Maputo the IIM offers constantly a course on a water related issue (hydraulics).

Labour market According to Macaringue (2006), almost all the IIM graduates get absorbed by the labour market. The number of students joining every year the IIM is 400. With a drop-out rate of 50 %, the 200 finishing their studies have no problems to get a job if some of them are poised to move to the provinces (MACARINGUE, 2006).

Applied Research The IIM does not have a research strategy. Research is carried out just by single persons, but uncoordinatedly and always on the same topic: poverty reduction. The IIM Maputo owns laboratories where this research is carried out, but which are not optimally used (MACARINGUE, 2006).

Financing Funds are given by the Ministry of Education. The students have to contribute with a fee of 60 USD for three years. This money is given in a fund for students with weak financial capacity. The IIM is sustained by the WB, partially by SDC and ASDIS. Inter alia, the SDC finances internships for IIM students in enterprises. These programs have a high reputation within the private sector in Mozambique (MACARINGUE,
An analysis of the IIM features the following weaknesses and strengths for the IIM as a potential stakeholder in water capacity building:

**Strengths** The Ministry of education is starting in 2007 a reform on technical education, which apparently will give more autonomy to the IIM (MACARINGUE, 2006). This could make it possible for the IIM to decide on the range of courses they offer, leading to a more demand-driven approach. The IIM owns good infrastructure (labs, class rooms, workshops) even in Beira.

**Weaknesses** The teaching staff of the IIM is mainly staff of the MOPH. Consequently, even if they are well prepared on the topics they teach, they do not have much time for teaching. Furthermore, there is no link between the faculty of civil engineering at the UEM and the IIM. That fact is an obstacle for the communication between the two institutions, which results in graduates from the IIM not being able to pass the admission test at the UEM (MACARINGUE, 2006).

The IIM's potentials for capacity building and applied research

**Vocational training** The IIM is a public institution with an excellent reputation, what emerged from the workshop in Beira. Its long time experience with vocational training could represent a potential for the water sector. The IIM is one of the most adequate institutions for giving long term courses on water related issues. Its degrees are officially recognized and the good reputation could elevate the attractiveness of the graduates in the labour market. How Macaringue (2006) stated, now it is not possible to organise short term parallel courses because of the little autonomy the IIM has. In a recent future, after the reform on technical education, the IIM could be able to decide at least partly on its program.

**Applied research** The IIM has not a wide experience in research, but it owns infrastructure where research could be done. The laboratory of the IIM Maputo is under-utilized; using it for further projects, like for research in rural water, could make the infrastructure more rentable.

The advantage of the IIM is firstly the fact that it is a public institution with a long time experience in vocational training and a high reputation. It gets constant basic grants from the government and is well linked to the labour market. The IIM Beira, supported by the IIM Maputo, has to be considered as a potential implementer of vocational training (and research) for the rural water and sanitation sector.
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The Edoardo Mondlane University (UEM)

The UEM, founded in 1962, is the oldest university in Mozambique. It is a public university, owned by the state and is the biggest of Mozambican universities in terms of teaching capacity.

Vocational training and higher education The civil engineer career is composed by nine units of six months each. In the first year, students have to absorb one course in general hydraulics, and just in the last unit they can choose an orientation (hydraulics or construction), but there is no particular specialization on water supply and sanitation. In the 8th year, four month internships are organised with enterprises and public institutions. For the water sector, internships took place mainly within the DNA and the FIPAG. The faculty is giving on-job courses, which are usually attended by many workers of the private sector. The certificates of these courses is recognized by the "Ordem dos Engenheiros".

Applied research The research team paid a visit to the hydraulic laboratories of the UEM. The university employs owns the appropriate equipment for research in water related issues. At the time of the visit, a project was carried out about cheap technologies for drinking water treatment.

Financing Besides the government funds, the UEM gets support from different donors and is involved in more projects. PhD courses are planned in collaboration with SAREC, while the SDC finances laboratory equipment and bibliographic material for hydraulic courses and supports internships for students in the water sector (SULUMINE, 2006).

Strengths The UEM has a huge capacity and expertise for acting as capacity builder in the water sector. In addition to that, the department of civil engineering plans to introduce new courses in hydraulics and IWRM and in water and sanitation (SULUMINE, 2006). Through the internships, the faculty of engineering has a good connection to the labour market. At the time no demand for internships is coming from the municipalities or the districts, but the current policy of the UEM is to give more attention to the needs of them aligning with the requirements of the decentralisation process (SULUMINE, 2006).

Weaknesses A weak point of the faculty of engineering in relation to the water sector is that the civil engineering courses focus too little on water and sanitation. The lack of courses results in a disinterest for the water sector by the students and consequently in ignorance about the possibilities the water sector could offer. This estimation is confirmed by the most of the interviewed persons. In fact, the majority of the graduates
join the construction sector because there the demand and the salaries are higher (SULUMINE, 2006).

Regarding research, the UEM is struggling with a staff problem. As the university staff are involved in more profitable projects (the salary of a professor is around 400 USD per month), they miss the time for doing research at the university (VAZ, 2006). Another problem is that research at universities is directed to education. The research has to be inline with the international standards. In this way, research is often not directed to the real problems of the country, but to high level technology, which hardly can be implemented in rural Mozambique.

The UEM's potentials for capacity building and applied research

Vocational training and higher education The faculty of engineering of the UEM features a very high potential in higher education and in vocational training, which it has already experiences with. It disposes of high quality teaching staff linked to the labour market and to other important institutions. If the department of civil engineering decides to put a focal point on the water sector, the UEM could become a central player in capacity building for the water sector.

Applied research The potential for applied research in water supply and sanitation exist, but as mentioned before, there is a lack of interests on the part of the academic staff. In the 1980's the level of research at the UEM was much higher than now, but the increased cost of living induced university staff to switch to the private sector as academic research does not give regular and big amounts of money (VAZ, 2006), (MATSINHE, 2006). Hence, making investigation at university more attractive, e.g. with financial incentives, is a premise for revitalising academic research. As Vaz (2006) states, many funds would be available for research at university, coming from the state or from donors and a huge demand for academic research exists. Therefore, it is only a question of enhancing the scientists interest for research.

The UEM has a huge potential for capacity building and applied research in the water sector. Being the first National University its reputation is very high among the country. The water institutions could really benefit from the UEM being involved in the water and sanitation sector.

The Superior Polytechnic University Institute (ISPU)
The ISPU was the first private university of Mozambique. It was founded in 1995 and offers higher (University) and mid-level (superior) education.
4.4. POTENTIAL FOR CAPACITY BUILDING AND APPLIED RESEARCH

Vocational training and higher education  The range of teaching reaches from different technology areas, finance and medicine to social and pedagogic studies and development sciences. Postgraduate in marketing and law are offered. Courses are also organized by demand. The profile and duration of the courses are discussed and developed with the interested party. When courses are given at province and district level, local people are employed, as far as possible. Local infrastructure is detected and used. The teaching staff are mainly employed in public institutions and jump between more employments (the so-called turbo teachers) (SOTOMANE, 2006). The advantage of employing these teachers is that they are aware about the demand of the labour market, the disadvantage is that they have less time for the university. The ISPU is in partnership with Brazil for post-graduate courses in human resources management and a thesis in enterprise management.

Applied research  The ISPU is financed privately to 100 %. The students pay fees of 250 USD per month. DANIDA finances a bachelor program and other donors like the Spanish cooperation and the Caritas finance single projects. Financial support was asked from the Belgian government for a technical training project in order to support the governmental decentralisation process.

The ISPU's potentials for capacity building and applied research

Vocational training and higher education  The teaching staff of ISPU is connected to the labour market and to the reality in Mozambique, hence, the ISPU can be considered as an eventual actor for capacity building in the water sector, especially for what concerns single courses where instructors have to be contracted.

Applied research  For what concerns research the ISPU exhibits very few potential as now it has neither the experience nor the facilities and human capacities for applied research in the water sector.

The engineers umbrella organisation "Ordem dos Engenheiros"

An important institution for capacity building and research in engineering sciences in Mozambique is the engineers umbrella organisation Ordem dos Engenheiros (OE). The OE is more and more concerned about the problems of the water sector (VAZ, 2006). Actions taken in this field were e.g. cooperation in the publication of the journal of CFPAS, organisation of conferences and courses together with the UEM.

Vocational training  The OE does not give training, but it stimulates the universities (UEM) to organize courses for mid level technicians. The OE acts somehow as a lobby-
ing organisation for different technical sectors. Courses on urban and periurban water supply and drainage were given in cooperation with the SDC.

**Applied research** The OE does not carry out research by itself, but it enhances the research landscape of Mozambique connecting the different stakeholders through symposiums and conferences.

**The OE's potentials for capacity building and applied research** The OE, assembling numerous engineers working at academic and practical level, has a high potential for taking over an advisory activity for the rural water sector. Some members have good cognitions about the rural water sector and institutions involved in it. They are able to estimate the aptitude of different institutions for being involved in capacity building and applied research for the rural water sector. As the OE is linked with organisations in Brazil, South Africa and Portugal, it has access to international databases and to experiences of other countries in this field. Vaz (2006) assured that the OE would be interested in taking part into capacity building and research for the rural water sector. Its role could be to organize symposiums, support research and training. For the last, the OE is suited more for training engineers, as it has no experiences with mid-level technicians.

**The Southern Cross Trust fund “Cruzeiro do Sul”**

Almost casually the research team hit on the autonomous research institution “Cruzeiro do Sul”. Established in 1997 as a trust, the “Cruzeiro do Sul” seeks to enrich the Mozambican development through applied research. The team is made up of prominent academics, researchers, practitioners and influential civil leaders. It supports the government, the private sector, civil society actors, NGO’s and international donors performing in the development of local communities. The staff includes economists, statisticians, historians, sociologists, anthropologists, agronomists, medics and lawyers, forming a multi-skilled team for complete research projects. It is funded by different donors, primarily by the Dutch government.

**Research** The Trust Fund was created with the aim to study the Northern region of Mozambique in order to develop a strategy for defeating poverty. Thereby, the central question of the research was how the poor, including single people and families, react to the adopted policies for the struggle against poverty. The first programs took place in Nampula, and the focus points were set on water and sanitation, environment, agriculture, infrastructure and health (PEREIRA, 2006). The analytical model is composed by the following factors/indicators:

1. Economy
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2. Good governance
3. Institutional texture
4. Decision makers (at family and community level)

The methodology used for the studies includes the following steps:

1. District study (on development and growth)
2. Field study (different communities are chosen and analysed on development differences)

This methodology gives results at community level which usually are not noticed by the communities themselves, as they are not aware about the differences between communities (PEREIRA, 2006).

Now the “Cruzeiro do Sul” has widened its investigation area to other provinces. In Manica, for instance, a study is carried out on how the family sector can be involved in the private sector. In Sofala, the trust fund is conducting an investigation about communities living in natural reserves including political issues (PEREIRA, 2006).

Demand for research Pereira (2006) declares that the demand for research comes from the provinces. They say which their interests for development are; usually the key areas are socioeconomy, economy, land and development, health and decentralization.

The potentials of the “Cruzeiro do Sul” for capacity building and applied research

The interview with Pereira (2006) showed that the “Cruzeiro do Sul” has a good knowledge about the reality of Mozambique. As it includes some of the most qualified academic staff and has a long experience with development research, it represents a huge potential also for the rural water sector. However, the trust fund may be more qualified to carry out overall research in the water sector than specific applied research in e.g. water supply methods or sanitation methods. It could conduct impact assessments, evaluations or act as consultant. On the other side, the question is if the “Cruzeiro do Sul” would accept to do a single investigation project in Sofala for the water sector, as it sets the focus on the North of Mozambique and usually conducts overall studies including all the indicators listed above.

4.4.2 Province level - Sofala

In Sofala, on-site potential for capacity building and research exists on different levels. On one side, there are the different professional training centres and on the other side, several universities are situated in Beira/Dondo.

The institutions contacted in Beira/Dondo were the following:
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- Provincial Directorate of Public Works and Housing (DPOPH), representing the DNA through the DAS
- Professional Training Centre (CFP)
- Pedagogic University of Beira, Department of geography (UP)
- Catholic University of Mozambique, Beira, Department of Medicine (UCM)
- University Jean Piaget in Dondo (UJP)

There were two institutions, which the team was not able to contact but which could be potential stakeholder for capacity building and applied research in the rural water sector:

- Professional Training Centre on Water and Sanitation (CFPAS) in Beira
- Industrial Institute of Mozambique (IIM) in Beira

The Provincial Directorate for Public Works and Housing (DPOPH)

The DPOPH represents the DNA at province level, and is responsible for the implementation of the plan for institutional capacity building of its own staff. It is also supposed to support the training program for the district authorities. The main task of the DPOPH is to ensure that the financial packages for supporting the training programs reach the districts and are transferred to the local authorities (ALFAMA, 2007).

The Professional Training Centre (CFP)

The CFP is an institution of the Ministry of Work and is one of the two public institutions for professional training (besides the IIM). In the Province of Sofala, the CFP is situated in Beira since 1995, but holds courses also in other towns if requested.

Vocational training Every single CFP unit (they are disseminated all over the country) is enabled to define its own curriculum. The Ministry of Labour only controls the programs, extracts statistic data and sometimes influences them (CLEMENT, 2006). In Beira, the CFP offers courses in civil construction, electro-techniques and mechanics, which have duration of 3 months. These courses are for basic school degree holder. Another type of courses requires the ninth year of school, e.g. secretary courses. The CFP in Beira does not have specific training courses for the water field.

For defining the demand for vocational training, the CFP Beira is conducting a study concerning the training requirements of the private sector. The results should come out in 2007 (BARCA, 2006). A memorandum with the provincial administration exists, whereby the administration asks for courses according to its needs and gives the CFP subsides and accommodation.
The centre offers also on-job training for enterprises, which is worked out together with them.

**Labour market** The centre sends students for internship to enterprises, where usually 30% is accepted and 5-8% are assumed on long term. This low assumption rate is a consequence of the weak industrial sector of Sofala (BARCA, 2006). The courses at district level show better results in terms of integration into the labour market. That is why they are only requested for specific areas, where the district knows that there is a need for trained workers.

The CFP has no marketing strategy because it was organized for responding to a concrete demand from the government.

The certificates of the CFP are not recognized equally at national level. However, the Ministry of Labour is working in collaboration with the Ministry of Education, on a program for a national wide certification system. This program is discussed in the next chapter.

**Financing** The CFP is financed to 25% by the students, the rest are state grants. The centre performed courses financed by the ADC, different NGO's and several state institutions enhancing vocational training.

**Strengths** The advantages of the CFP Beira are that it has huge experience and capacity in training mid-level technicians through short term courses and on-job training, what is mainly requested by the rural water sector of Sofala. The centre is able to transfer its staff to the districts for teaching local actors without them travelling to Beira, which would take them precious time and money.

**Weakness** The CFP has no experiences in giving long-term courses.

**The CFP's potentials for capacity building and applied research** It results that the CFP has no capacity for research. In exchange, it is an ideal institution for giving short term courses and on-job training for enterprises and district technicians. Compared to the IIM, where the curricula are developed by the Ministry of Education, the CFP seems to have a considerable autonomy in the development of the curricula. Hence, it is able to respond to the demand coming from the districts, NGO's, donors and the private sector. This means that involving the CFP in capacity building for the rural water sector would not be bureaucratically complicated, as the programs can be developed at Provincial level.
The Pedagogic University of Beira (UP)

The UP is a public university with the primary mission of forming teachers for the Mozambican schools. The research team had a meeting with the Departments of Geography of the UP in Beira. The centre of the UP and the most human resources are in Maputo. There the global curriculum is prepared containing specific thematic units. The UPs in the Provinces split the thematic units in study units, which form the detailed local program. An intern scientific council decides about the programs and the analytic plans, trying to include the voice of civil society.

Higher education The curriculum of the university includes, besides psycho-pedagogic courses, the programs for secondary school, and some technical courses containing practical components. UP graduates not only work as teachers, but some join also the private sector. Hence, the UP is partly adapting the courses according to the labour market demand. The departments of Geography at central and provincial level offer single water-related courses, like hydrology or water resources management. For 2007, a course on environment management and community development including water and sanitation issues are planned. The centre sends students for internship to enterprises, where usually 30% is accepted and 5-8% are assumed. This low assumption rate is a consequence of the weak industrial sector of Sofala (BARROS, 2006). The idea for such a course rose from a thesis written in this field. For this course, the Department expects students from the rural environment and personnel from the agricultural sector joining the courses. Priority is given to people having already work experience in that field. The UP is in constant contact with the districts, as the students have to absolve an internship teaching in schools. On the other side, the UP offers distance on-job training for the teachers at the districts.

In Beira, the UP employs nine teachers with fix term contract and one financed by the airport of Beira for the Meteorological Department.

Research At the UP, research is conducted only in relation to the courses. For the water area, some research was done concerning water resources management, hydrology, hydrobiology. In Sofala, specific research projects were e.g. a hydrological data collection project on behalf of ARA Centro and an investigation about the Pungue river on water rights regulation. However Barros (2006) states that there is no continuous specific demand for research coming from the public or private sector.

Partnerships The UP has partnerships with a Brazilian university and has agreements for sending PhD students abroad to Brazil, Australia and Spain. A partnership is planned with the UCN (University for Natural Sciences) and the UCM.
4.4. POTENTIAL FOR CAPACITY BUILDING AND APPLIED RESEARCH

Analyzing the UP on strengths and weaknesses, we can draw following conclusions:

**Strengths** The UP as public university assures an institutional and temporal continuity. It already offers courses in water related issues and has decided to switch the focus largely on the water field for both education and research.

**Weakness** The UP has no experience in vocational training. Although the university deals with water issues, no focus is set on water supply and sanitation.

The UP's potentials for capacity building and applied research

**Vocational training and higher education** The UP has capacity building potential for the water sector in terms of higher education. In terms of vocational training, other actors seem to be more adequate. The fact that the university forms teachers, which are sent to the districts, represents a potential, especially regarding water education in schools.

**Research** For what concerns research, the UP is one of the few institutions situated in Beira with potential for applied research. Owning infrastructure and skilled personnel, it could play a role as researcher for the rural water sector. Through the linkage with universities abroad, the UP has access to information concerning the water sector from other developing and donor countries.

What remains to ascertain is whether the UP can handle the rural water supply and sanitation issue. One advantage is surely the sociological and pedagogical skills the UP features and which constitute an important part of the rural water sector, how chapter 4.3 showed. On the other side, it is questionable if the UP could also handle with technical basic issues like repairing of pumps, development of sanitation solutions et cetera.

**The Catholic University of Mozambique, Beira (UCM)**

The UCM was founded in 1995 and is situated in the cities of Beira, Chimoio, Cuamba, Nampula and Pemba. As the name says, it is a catholic university, financed by private funds. The courses offered in Beira range from a seven year medicine degree to different management, financing, economy studies and one in rural planning giving the diploma holder a bachelor’s or masters degree.
Higher education The UCM plans to open an engineer faculty in Tete with some focus on the water field. In Beira, the Faculty of Medicine concentrates intensively on the HIV/AIDS topic and on public health. For education, the so called "Problem Based Learning Approach" is adopted. It consists in the students themselves identifying a problem to solve in the real world and an objective to achieve. The students have to research and learn by themselves. A well equipped library is provided. In line with this approach, the students carry out different programs. For example in one program, every student attends three families of the suburbs of Beira with the aim to change their hygiene attitudes and sensitise them to use latrines. Another program is done in partnership with the Municipality of Beira and regards the conception and promoting of a management and maintenance plan for the waste collecting system. This applied methodology seems to work good and is adopted by different Mozambican Universities like the UP and the police academy (GROOSJOHAN, 2006). The UCM owns a clinic where students can do their practical training. A high demand for graduates in medicine and public health is coming from the public health sector due to the enormous health problems Mozambique is facing with. The Ministry of Health and the Provincial Department of Health are asking for health management courses for their Institutions.

Research Besides the applied research carried out by the students within their programs in the Problem Based Learning Approach, the UCM is conducting research about HIV/AIDS and sexual behaviour in the district of Buzi (Sofala), Malaria prevalence and hygiene. The UCM disposes of a centre for medical research.

Partnerships The UCM is carrying out exchange programs for students and teachers and has strategic partnerships with different European and South African universities. through the PBLA, research is done automatically. This approach could be applied to the water sector in rural areas.

Financing The fees for students amount to 1,000-1,500 USD per year. 70 % of the students obtain a scholarship, the others are paying themselves. As the university works as non-profit organisation, all the fees flow in a fund for the facilities of the university (library, clinic, biochemical laboratory). A good financing management makes the UCM independent from public funds (GROOSJOHAN, 2006).

Strengths The UCM is competent in the health sector, especially in regards to public health. The constant contact with the real world prepares the students for their professional life and enriches the university with precious information about what the real problems of the country are. Furthermore, a master for public health for Beira is planned (GROOSJOHAN, 2006). According to the assertions of Groosjohan (2006), the
UCM has good management and financing skills. It has to be added that the UCM has a good reputation, how various stakeholders affirmed.

Weakness Related to the water sector, the UCM Beira is capable to cover only the hygiene and the managerial/financing field. For technical issues no skills are available within the university.

The UCM's potentials for capacity building and applied research

Vocational training and higher education The UCM appears to present a high potential for capacity building for the rural water sector, for what concerns hygiene and sanitation attitudes. As this is a central point of the rural water sector, it would make no sense to not include the Faculty of Medicine of the UCM in capacity building for the water sector. Even if the UCM is primarily a university and consequently more adapted for offering higher education, the author would not exclude that it would have the capability for giving courses on a lower level. The comprehension of very practical aspects in the programs of the UCM can be a prerequisite for being able to give short term courses on hygiene to community activists or to communities themselves. According to Groosjohan (2006), the students breaking up the medicine studies could represent a potential for changing to sanitation or public health courses, which are planned to be given at the UCM Beira.

Furthermore, a potential could be to expand the "Problem Based Learning Approach"-programs to the rural area. Now they are carried out in Beria and surroundings, but exporting them to the rural area could widen the knowledge of the university about the hygiene problems in rural areas. On the other hand, the results of the programs could be implemented in the areas for solving the problems. Including the rural area in the program of the UCM could arouse the interest of the ongoing degree holders for rural Mozambique, while now most show interest for the main cities.

Applied research Through the Problem Based Learning Approach, applied research is done automatically. It complements the research carried out by university staff with information about real life in the country.

The University Jean Piaget, Beira (UJP)

The University Jean Piaget in Beira belongs to the Institute Jean Piaget, a Portuguese private founded institution for higher education founded in 1979. In Beira, the university was founded in 2004 and it is the only Jean Piaget institution in Mozambique. As the UJP is a private institution, it is financed by the fees students are paying or are paid by donors for them.
4.4. POTENTIAL FOR CAPACITY BUILDING AND APPLIED RESEARCH

Higher education The courses given are civil engineering, law, economy, sociology, ICT, public administration, but no course directly related to the water field. The UJP expected huge demand from state and provincial administration, but "nothing came from their part to the UJP" (CARDOSO DE BARROS, 2006). As the university is very young it plans to amplify the courses it offers. A partnership for PhD programs exists with the University of Santiago de Compostela.

Applied research Now no research is carried out, but the UJP has some plans concerning research. A research fund should be created and for specific research and different donors should be involved. The Portuguese Cooperation is planning to finance a laboratory for agricultural sciences.

The UJP's potentials for capacity building and applied research

Vocational training and higher education The UJP has no experiences in capacity building for the water sector. However, it could organise courses as it has teachers and facilities.

Applied research As the university does not research, it is difficult to say if it could have potential for applied research for rural water and sanitation.

The UJP is the youngest university in Beira and as yet has no graduate students. Therefore, it is difficult to evaluate its position in the education and research landscape. In a bidding system for research, it could be able to apply for projects, depending on how it develops its research capacity. What has also to be taken in consideration is that if there are communication problems with the public institutions, as Cardoso de Barros (2006) states, it is not sure that enough demand for education arises and if the university will continue. These are things that should be assessed in a further study.

CFPAS Beira

No meeting was held with CFPAS Beira. However, some information could be gained during the workshop. CFPAS Beira exists now, but it counts only one employee. No information was obtained about actions it takes. According to the assertions of several stakeholders, including the staff of CFPAS Maputo, it seems to be a very weak institution.

IIM Beira

The participants of the workshop in Beira agreed on the high potential of the IIM Beira for vocational training. Hence, the IIM Beira should be taken into account for capacity
building in Sofala.

4.4.3 Other institutions/actors representing a potential

The donor's community There is a general concordance among the donors about the lack of human capacity in the Mozambican rural water sector. To analyze the single points of view of the donors and the actions taken by them in the water field would go beyond the scope of this thesis. Hence, the assertions of Duffau (2006) and other interviewed stakeholders are adopted without further investigation. In other words, it can be assumed that all the donors agree about the lack of human capacity in the water sector which the existing institutions are not able to resolve. This concordance is important, as it is a central point in the Paris Declaration. The Paris Declaration commits the signatory countries to put more effort into increasing the effectiveness of aid delivered to and managed in recipient countries. It promotes better coordination between all stakeholders in the field of development work (MAIR, 2006). The donors have to “align” and “harmonise” their actions. According to Alferes (2006), the SDC and the World Bank are planning to provide funds for capacity building in the DNA. As they will act at national level, a program at Provincial level in Sofala will not generate double structures. On the contrary, if the program is aligned with the actions taken by other donors in other regions and at national level, it will support capacity building for the complete Mozambican water sector.

The Ministry of Work The ministry of work is currently working on a reform program for professional training (PIREP). As previously mentioned, the Professional Training Centres (CFP’s) among the country do not dispose of an uniform qualification system (CLEMENT, 2006). The PIREP will develop a national training qualification system (SNQF) for the standardisation of the CFP degrees. In the course of this process, new training courses are going to be developed, but there is none for the water sector. The standardisation of the SNQF represents a potential for the water sector. Including the CFP in capacity building would signify that courses in water supply and sanitation hold at this institution would be recognised at national level.

The Ministry of Technology (MCT) The main challenge of the MINED is the dissemination of new technologies among the country for the development of the communities. Therefore it carries out applied research at district level. The researchers are partly ministerial staff, and partly scientists contracted by tender. The ministry disposes of a fund for investigation, which is mainly financed by the GoM. A research council decides about the utilisation of the financial resources and defines the best proposal. According to VILELA (2006), these funds could also be made available for students doing their master thesis in a field of interest of the MCT. An involvement of the MCT in capacity building and applied research for the water sector is an opportunity for the sustainabil-
4.5. VISIONS AND CHALLENGES SEEN BY THE STAKEHOLDERS

ity of the program. As many problems of the water sector are of technological nature, the MCT could be a potential supporter, carrying out investigation by itself or financing research when the donor's support stops.

The Ministry of Education (MINED) Unfortunately, the research team could not arrange a meeting with the MINED. As important as its cooperation would be, it showed no interest for the issue. However, in the case of the implementation of a program, it should be one of the next steps to contact the MINED and to check its opinion about the issue.

4.5 Visions and challenges seen by the stakeholders

The research team could collect suggestions and recommendations on how to answer to the rising demand for capacity building and applied research. During the workshop in Beira, the participants elaborated a range of suggestions on how to resolve the human capacity and knowledge problems of the rural water sector. Thereby the focus was set on which institutions come in question for capacity building and applied research. These information are complemented with advice of Matsinhe (2006).

According to the opinion of the local stakeholders, a possible program for training and research should primarily incorporate the existing institutions. It should include education and training institutions at both the academic and the vocational level in order to integrate professional training, high education and applied research. The results of the workshop in Beira, are depicted in Appendix E. The participants had to define the demand for education, training and research and to seek for solution options, which respond to the demand.

During the discussion with Matsinhe (2006), the following issues regarding actions to take in future were outlined.

If the demand for capacity building is vocational training, the courses should be given at institutions like the IIM, the CFPAS or the CFP, as they are more adapted for this type of training. Universities should restrict their work on filling the gap of academic education in the rural water sector, and could undertake the task of managing the program. Another institution that could coordinate the program is the MCT, which operates a knowledge database and has therefore some potential. It would make sense to include also the FIPAG in the program, as far as it is disposed to act in the rural water sector. According to Matsinhe (2006), the new created scientific council for water (CNA) is also a potential for supporting capacity building and knowledge enhancement for the rural water sector.

The courses should be by the majority of a short term. An important issue will be to plan measures for creating motivation among the stakeholders attend the courses. The SDC financed training courses for the water sector in Beira, but the attendance was very low (MATSINHE, 2006). A manner for enhancing the interest for courses could be
the creation of an integrative curriculum composed by single short term courses with different levels. It is necessary that the degrees are officially recognised by a ministry. Another very important issue is the active involvement of the districts in the capacity building and research process. As they dispose on funds (even if not large amounts), they could participate in the creation of demand.

### 4.6. Solution proposals

#### 4.6.1. General requirements

On base of the collected information it should now be possible to develop a conceptual model for a capacity building and applied research program. The demand defines the areas to be touched and the actors to be trained, while the potential outlines who could perform those tasks. However, before designing solution alternatives for the gap of knowledge and human capacity, some conditions and considerations have to be taken into account.

**Switch from individual training to program approach** As stated in chapter 1, the experience of ADA in Mozambique and in other developing countries showed that capacity building has to move from training of individuals to creating a continuous training program for the rural water sector. For doing this, isolated training or institutional capacity building programs are not enough. The support measures for the rural water sector have to be directed to develop a “capacity building landscape” by strengthening the existing capacity building institutions and by supporting them with complementary institutions. The same must be done for applied research. This approach should lead to a shift from responding to basic needs to an advanced sector development.

**Involving existing institutions** The potential assessment shows that a considerably high potential for capacity building and applied research is available in Sofala and in Maputo. Hence, according to the recommendations of the main stakeholders, these institutions should be considered for implementation before inventing new ones.

**Decentralisation** In any case, a capacity building and research program has to support the process of decentralisation. Human capacity and knowledge have to be created and enforced at the levels they are needed, thus community, district and province level. Concerning research, the facts outlined in this chapter show funds, institutions and demand for research already exist. The main challenge seems to be to motivate the researchers to initiate research projects.

**Demand driven approach** Another important issue is the demand for capacity building and research. All the measures have to be demand driven. Now, in this study the
4.6. SOLUTION PROPOSALS

demand was assessed. However, it must be considered that the resulting demand is
only a snapshot of the rural water sector of Sofala, as it can change over the time. The
demand assessed in this study can be used as starting point for the planning of a pro-
gram, but it surely has to be re-defined as the process of capacity building and applied
research is going on. This task should be fulfilled by a component of the program and
will be described more accurately in the next section.

4.6.2 Tasks assessment

Different tasks arise in prospect of a program. They are discussed in this section and
brought in conjunction with the stakeholders/institutions qualified to accomplish with
them. The conceptual model used for the development of the alternatives is presented
in fig.4.1.

Figure 4.1: Conceptual model
4.6. SOLUTION PROPOSALS

Donor  For the first phase, the program founder will be an international donor. The tasks it fulfils are to initiate, to fund and to monitor the program. Funding can and should also be given by the public hand. The DNA, different ministries and the DPOPH/DAS can finance the program through basic grants or for single projects.

National partner - coordinator  The national partner - coordinator manages the funds and channels them to capacity building and research actions on base of the demand. It acts as an intermediate stage between the donor and the implementing institutions. It is responsible for the program and is the contact institution for the donors and financers. The coordinator plans the process of capacity building and applied research, developing detailed implementation plans. It defines the demand for actions to take, which has to be detected together with the stakeholders of the water sector. Therefore, this institution must be in contact with the district administrations, the water committees, the implementators and all the actors of the rural water sector, which potentially can have needs for capacity building or research and conduct a continuous dialogue with them. The body acts as the voice of all the stakeholders. In order to meet the real needs of the rural water sector, this institution must be obliged to the stakeholders. They should have the possibility of controlling it. The interaction with the stakeholders of the water sector can be assured through the creation of a steering committee, which is described in the next paragraph.

Another task the coordinator could accomplish if it has the capacity, is to create a system for knowledge management. A database for the results of research done would be an enrichment for the program and for the water sector of Mozambique. It is important that the coordinator, which creates the demand, does not carry out training and applied research by himself. This could lead to the creation of a wrong demand. As the implementer profits by giving courses or carrying out research, it could take actions that are not needed for the water sector. The division between coordinator and implementer assures the control about the utilisation of funds.

For this function in first line the DPOPH/DAS itself is eligible, where democratic control is given indirectly through the provincial elections. The universities in Sofala or the “Ordem de Enjenheiros” can also assume the coordinator function. This could give the program a high level of competence. However, they may have less contacts at district level and the possibility of being controlled democratically is weaker.

Steering Committee  The steering committee fulfils two functions. First, it develops overall capacity building and research programs and second it controls the coordinator in the realisation of these programs. It approves the plans made by the coordinator. While the coordinator manages and organises the capacity building and research program, the steering committee is responsible for furnishing the contents and creating the overall directives. This body acts as the voice of all the stakeholders. It composed by elected representatives of every level of the water sector. The author would suggest
that the DPOPH/DAS is represented by the President of DPOPH or DAS in the council and one additional competent person. The districts could be represented by one or two district presidents, and the water committees by two elected representatives. For the scientific part, a member of the OE and one or two from universities should join the council. The involvement of representatives of academic institutions ensures a high level of competence in the committee. It will be important to include the implementers of water and sanitation projects. Therefore the private sector, the EPARs, the NGOs and the local activists should be represented by one or two persons each. Figure 4.1 shows the connection between the capacity building and applied research process and the demand creation process. The beneficiaries of training and research are the stakeholders represented in the steering committee. This ensures, that the demand arises directly in the water sector and the program responds to the real needs of the stakeholders. For ensuring the political independence of the committee, the DPOPH/DAS should not take a higher position than the other stakeholders in the committee. It is important to create a mechanism that ensures that the actions taken by the coordinator can be controlled by the steering committee. The coordinator must be obliged to plan the actions to take according to the program developed by the committee. Once or twice a year, the committee should control and evaluate the work of the coordinator.

Implementer As implementer for short or long term courses and applied research all the Universities and professional training institutions are eligible, as far as they are willing to focus on issues of rural water supply and sanitation and have the expected know how. Further, possible implementers can be private enterprises or NGOs, especially for community training. They can be contracted for long term or just for short term actions. Implementers can be the UP and the UCM for issues regarding sociological issues, hygiene and public health. The vocational training institutions in Beira can give technical training in water supply and sanitation. Private enterprises and NGOs may be more suited for community education and training of water committees. The implementers can be simply contacted by the coordinator and commissioned with courses or research or contracted by tender.

In Beira, three vocational training institutions exist. The IIM and the CFP are giving courses in different professional areas, while the CFPAS Beira has at the moment only one employee and is not operative. Two main points may influence the decision about choosing the coordinator. The first one is that to strengthen CFPAS Beira means to build up an institution, which now nearly does not exist and has no capacity. However, the interviews showed that neither the CFP Beira nor the IIM Beira gave courses in water related issues. Consequently, they have no facilities (labours), but they show a good institutional capacity. It would be much more expensive to capacitate CFPAS for giving professional training than the IIM or the CFP. The second point is that CFPAS Beira would be a training centre giving only water
related courses and must be funded through basic grants. This implies high constant basic costs. The IIM and the CFP give vocational training courses in many areas. They are getting constant basic grants from the public hand and from different donors. It would therefore be possible for them to give punctual courses when they are needed to employ special staff for single projects. This would lower considerably the program costs.

Between the CFP Beira and the IIM, the author does not express any preference, because further discussions and institutional analysis have to be carried out with both institutions in order to assess their suitability for coordinating the program. Some advantages the CFP shows are of organisational nature. The CFP has more autonomy for what regards the education programs. An inclusion of water related issues in its program would imply less bureaucratic problems. Further, the reform program for professional training carried out by the Ministry of Work will create a uniform qualification system for all CFPs. Including the program in this process would surely be an advantage for it. Research has to be carried out by institutions of academic level. The universities in Beira (UP, UCM and UJP) are potential partners, but also institutions in Maputo can be contracted for single research programs. These are the UEM and the "Cruzeiro do Sul".

National institutions  It is important to involve in the program national public institutions. The DNA should participate actively in the process of capacity building and knowledge enhancement for the rural water sector. The program in Sofala must be incorporated as soon as possible in the National Capacity Building Plan of the DNA. It is necessary for the sustainability of the program itself, and benefits the national water sector. The DNA can participate in the creation of demand with direct enquiries for courses or research. Furthermore, it can finance single projects, as it disposes of funds for capacity building.

In addition, some ministries may profit of the program in Sofala. As the results showed, the demand for training and applied research rising in the water sector touches several areas, which lie in the competence of different ministries. Sanitation and hygiene regard the health sector, education in schools the education sector and needs for research the technology sector. Hence, the MINED, MISAU and the MCT are potential partners for the program. As the needs for capacity building regard professional training, the Ministry of Work should play an active role in the process.

The CNA, as a scientific council for the ministries, can participate with its expertise supporting the steering committee.
4.6. PROPOSALS FOR A CAPACITY BUILDING AND APPLIED RESEARCH PROGRAM FOR THE RURAL WATER SECTOR OF SOFALA

On base of the described conceptual model, four alternatives for program implementation will now be designed and discussed.

Alternative 1 a

In the first proposal, the national partner is the DPOPH/DAS, while the coordinator is an external office. The coordination office is a body specially established for the program and employs full time staff. It develops the program plans within the framework of the capacity building and research programs of the steering committee. The DPOPH channels the funds of the donors to the office and controls their utilisation. The coordination office is submitted to the steering committee regarding the contents of the program and to the DPOPH/DAS regarding the finances. Implementers are contracted by tender or commissioned for long or short term courses. Academic institutions in Maputo with high competences in the water sector can give professional support to the program. These are first the UEM, the OE and the "Cruzeiro do Sul".

The advantages of an external office acting as coordinator is that it can work more autonomously than if it would be incorporated in the DPOPH. The task repartition between the coordinator, the national partner and the steering committee is clear and impedes interferences. Both, the DPOPH/DAS and the steering committee have the same influence in the program, however on different areas. A disadvantage may be that creating an external body for coordination is connected to high costs. Furthermore, the control of the coordination office results more difficult in this case than in alternative 1b.

Alternative 1 b

The DPOPH/DAS is at the same time national partner and program coordinator. Internal staff of the DAS coordinate the activities for capacity building and applied research. If necessary, an own office within the DAS can be created for fulfilling this task. The DPOPH/DAS is controlled by the steering committee concerning the contents of the program. The rest of the program components are the same as in alternative 1 a.

The advantage of alternative 1 b is that no new body has to be created, since an existing institution with a high potential coordinates the program. The DPOPH/DAS being responsible for the program means also a stronger involvement of the DNA, as the DAS is the provincial agency of the DNA. The disadvantage is that two tasks are concentrated in one institution, which may result in the DPOPH/DAS having too much influence in the program.
Figure 4.2: Alternative 1a
Figure 4.3: Alternative 1 b
4.6. SOLUTION PROPOSALS

Alternative 2a

Alternative 2a shows the UP Beira fulfilling the role of national partner and coordinator. The advantage of a university coordinating the program is the high institutional capacity it has in terms of personnel, knowledge and infrastructure. A further positive point is the ability to create a knowledge management system with a database situated in the university. This is fed by research done for the program, and knowledge the university already has or knowledge gained by international partnerships with universities abroad. Another advantage is that the DPOPH not being involved directly assures the political independence of the program.

Taking into account the universities in Beira, the UP and the UCM seem to be suitable for fulfilling this role. As the UCM Beira has at the moment no courses regarding the rural water sector, apart from the public health and hygiene courses at the medicine faculty (but more directed to urban sanitation), the department of Geography of the UP seems to be more suited for coordinating the program. Despite it has had no experience with water supply and sanitation, the department is dealing with water related issues (hydrology, hydrography) and covers a wider thematic field than the UCM. However, before starting the program, personnel of the university should be specifically trained. An important point is that if the UP Beira coordinates the program, it can not participate as implementer. All capacity building and research activities must be sourced out to other institutions.

The advantage of a university acting as coordinator is the political independence of the program. The DPOPH/DAS is represented in the steering committee and has the same voice as the other stakeholders. The university has the capacity for managing a knowledge system for rural water, which would constitute a high potential also for the national water sector. A disadvantage of alternative 2a in comparison to the antecedent alternatives may be the weak involvement of the DPOPH/DAS, which may disconnect the capacity building and research program from the water sector. It is important that the program stays in conjunction with the water sector.

Alternative 2b

The last proposal shows a different combination of the program components. The steering committee is an internal body of the UP Beira. It is composed predominantly by academic staff of the UP. Representatives are still elected by the different stakeholder groups of the water sector but their weight is smaller than in the other alternatives. This gives the UP stronger autonomy. The steering committee has more academic lineaments, but it is questionable if the UP staff have the capacity for fulfilling this task. Furthermore, the control function of the steering committee over the coordinator is restricted.
Figure 4.4: Alternative 2a
4.6. SOLUTION PROPOSALS

Figure 4.5: Alternative 2b
4.6. SOLUTION PROPOSALS

4.6.4 Further requirements

Contact with the districts An important point, which was mentioned in section 4.3, is the continuous creation of demand what has to be done for meeting the real needs of the rural water sector. The national partner and coordinator have to stay in contact with the districts and the communities. This is difficult because of the big distances separating Beira with the districts. A mechanism has to be created in order to ensure the flow of information between central and district level. This may be partially ensured by giving courses in the districts. Furthermore, the representation of the districts and communities in the steering committee is important for the process of the assessment of the real demand.

For ensuring the decentralisation process, courses have to be given where the demand rises. This means that education and training activities have to take place to a great extend at district or community level. For instance, courses for local activists, water committees, district technicians or private enterprises could be organised in a district. This would ensure the flow of knowledge from Beira down to the district level. New research results have to be transferred to the stakeholders in the communities and districts.

Important institutions to involve There are some institutions with a very high potential and competence in some areas that should be included in the program. These are in first line the UEM, the OE and the "Cruzeiro do Sul". As they are in Maputo, some tasks like the program coordination are out of question. However, they should apply for research projects and their staff be contracted giving single courses or just give scientific support to the coordinator in Beira.

Another institution the author estimates worth being involved in the program is the UCM. Its experiences in sanitation, hygiene and public health are considerable and could benefit the program. The problem based learning approach, described in section 4.4 seems to work well in the UCM and should be tested in rural water and sanitation. The CFPAS Maputo could play a role in the program if its capacity allows it to apply for tender processes in Sofala. The author would not recommend to capacitate CFPAS Maputo or CFPAS in Beira for the program, as there are other institutions with a higher potential available. All these institutions, especially the UEM and the "Cruzeiro do Sul" have to be contacted and asked on their interest in participating in the program, as during the interviews it was not possible to ascertain this point exactly.

Pilot program The program should be a kind of a pilot program for the implementation of the National Capacity Building Plan. It is therefore important to involve strongly the DNA. This is the reason why every alternative shows the DNA and Ministries creating demand and financing the program. The DNA should have the possibility to play an active role, as it is the overall "owner" and customer of the program. The DNA can
4.7. CONCLUDING REMARKS AND DISCUSSION

learn how to carry out capacity building and research in other provinces.

Degree recognition A very important point, which arises in the demand, is the recognition of the degrees resulting from the courses. For this problem the MINED could be sought for advice, but as it seems that its interest for the program is limited, it may make more sense to contact the Ministry of Work. As aforementioned, the Ministry of Work is already working on a uniform qualification system, which is an opportunity for the program. In this sense, the CFP, which underlies the Ministry of Work, is the actor, which has to be addressed for training courses.

4.7 Concluding remarks and discussion

The water sector reform did not consider sufficiently capacity building and research, especially for what concerns the rural water sector. The programs carried out by the DNA and different donors were not able to create an adequate category of competent personnel and an available knowledge database for facing the challenges rising due to the water sector reform. The focus was directed too much to the urban water sector. As urban population is growing, it seems to make sense to put the attention to the urban centres. However, the rural sector has to be made attractive for holding up the migration tendency towards the cities. An adequate water supply and sanitation will help to increase this attractiveness.

It is understandable that the government has not enough funds to direct specifically to capacity building and research to the rural water sector. The support of donors is needed. However, donor funding will stop at a certain point, while the demand for vocational training and applied research will continue to rise. Planning should be made about how to go further with financing capacity building and research for the rural water sector.
Chapter 5

Conclusions

The main objective of the Mozambican water sector is to achieve by 2015 a coverage rate of 70% for water supply and 50% for sanitation. The GoM and the DNA develop different measures and strategies for reaching this aim. A reform process is taking place, based upon the National Water Policy (POLÍTICA NACIONAL DE ÁGUAS, 1995) and supported especially by the Water Law (LEI DE ÁGUAS, 1991). The strategies for implementing the water sector reform are the increase of coverage, quality, and sustainability of water supply and sanitation, and the enlargement of technological options. In this context, competences and responsibilities should be decentralised and the dynamism of human resources and institutions increased.

However, the constraints in human capacity and knowledge are a serious problem for the achievement of the aimed objectives. Section 1.2 and Chapter 2 of this thesis show that there is a serious lack of human capacity in the rural water sector of Mozambique, comparing the situation with its formal objectives.

Two main questions emerge from these facts. The first one is what the gap in human capacity and further in knowledge really is. In other words, what needs for capacity building and knowledge enhancement do emerge if the water sector wants to solve the serious problems it faces?

The second one is which actors exist in Sofala and overall in Mozambique, which could be able to respond to these needs? What is the potential for capacity building and knowledge generation in the country, especially in Sofala? Are there institutions, which are interested and able to close the capacity and knowledge gap?

The objective of this thesis is to answer these questions and it was achieved on the whole. The three weeks of field work in Mozambique allowed assessing the potential in a manner that allows a general estimation of the situation. However, further research is needed for assessing more exactly the suitability and willingness of the mentioned institutions in participating in a program. A question this thesis can not answer is how much reinforcement and training these institutions need for being able to carry out the
program. This should be assessed in a further study.
The methodology used for data collection allows gaining the necessary information for fulfilling the task of this study. The semi-structured and unstructured interviews induced the interviewed stakeholders to express their personal point of view freely and to open new questions they consider important during the discussions. Very good results were given by the workshop in Beira resulting in dynamic, interactive discussions. The only weak points of the data collection are the focus group discussions with the water committees. The ones carried out gave good results, but the author holds that some points would be worth to be assessed with more water committees, as they are the final beneficiaries of the capacity building and research process. However, the results gained during these meetings can be regarded as credible, as they confirm the results of the interviews, desk study, and workshop.
The tools used for the analysis of the data are very useful for this study. Special attention has to be given to the needs assessment, which methodology allows analysing the results on their reliability. The distinction between expressed and normative needs allows comparing two different points of view, namely the "normative", formal one and the more subjective one, "expressed" by various stakeholders of the sector. The concordance between the two shows that the sources were reliable and that the stakeholders know what is going on in the rural water sector of Mozambique. An objection could be the fact that much of the interviewed persons for the collection of the expressed needs are the ones, which took part in the elaboration of the documents expressing the normative needs. Consequently, the expressed demand is naturally the same as the normative. This may be right in some cases, but the results coming from discussions of stakeholders acting "at the grassroots level" (water committees, district technicians, municipal president) or outside the water sector (Universities), which surely did not participate in the development of the "normative" documents can be regarded as the real expressed demand with no influence in the normative demand. On base of these arguments, the author considers that the methodology achieves its aim.
On this way, the demand and the potential were defined in a way that allows to develop different scenarios for the implementation of a vocational training and applied research program and to discuss them critically.
The thesis describes and analyses the deficiency of human capacity and knowledge between the Mozambican rural water supply and sanitation sector focussing on the Province of Sofala. In conjunction with human capacity, the institutional capacity of the sector is surveyed.
The deficiency in human and institutional capacity demonstrates the needs of the sector for capacity building through education and vocational training. The deficit of knowledge demonstrates the needs for knowledge enhancement through applied research and knowledge management.
On the other hand, the thesis detects the existing potential, thus the existing human and institutional capacity for training and education and the available knowledge with
focus on Sofala province. Based on the determined potential, four alternative program proposals for improving human capacity and knowledge in Sofala are developed. The alternatives include combinations of existing institutions taking over different parts in the process of capacity building, applied research, and knowledge management. They are no program proposals, as these should be developed after a further study where the institutions have to be analysed more accurately.
Chapter 6

Recommendations

Finally, some recommendations are given for the stakeholders of the rural water sector of Mozambique and their donors. The recommendations are not listed in any order of priority. These recommendations are meant to be an advice for the capacity building process in the rural water sector of Mozambique.

- Capacity building and knowledge enhancement for the water sector should be promoted in Mozambique, as they contribute to the achievement of target 10 of the MDGs. Enhancing the knowledge and widening the range of trained persons in water and sanitation issues is not essential for the sustainability of infrastructure programs.

- The DNA should assist the capacity building and knowledge enhancement project in Sofala, in order to profit from that experience for the implementation of the National Capacity Building Plan in other provinces of the country.

- The ADA should go ahead with supporting capacity building in Sofala, as it is a real need for the rural water sector. A good collaboration and synergy with other projects for capacity building in Mozambique (CFPAS), also regarding the urban water sector can beneficiate the project as it can help to use together and save human, institutional and financial resources.

- As for funding this project no SWAP approach is recommended, the ADA should coordinate the actions with all the donors supporting the water sector. All donors active in capacity building and research for the Mozambican water sector should keep a constant dialogue with each other in order to develop, together with the DNA, a uniform strategy until funds can be channelled in a SWAP approach.

- It is very important to perceive the needs for vocational training and applied research defined during the fieldwork in Mozambique not as a static property of the rural water sector, but as a dynamic variable of the reform process in the Mozambican rural water sector. This variable influences and is influenced by the process
which wants to change the water sector. Therefore, the needs should constantly be re-defined through the "demand creation" process which can be found in the afore described alternatives.

- In addition to the "demand creation" by stakeholders in dialogue with the steering committee and the national partner, further studies could be done for re-defining the demand. These can consist in short interviews with stakeholders of the water sector. The author suggests involving more the users, water committees and implementers, thus private enterprises, NGOs, local activists and EPARs than it was done in this study. This will help defining the demand more specifically for every actor of the water sector.

- For further studies, the author suggests to include in first line local institutions. The study showed that particularly in Maputo very competent research and education institutions exist, with long time experience and good cognition about the situation in Mozambique. Such institutions are in first line the University Edoardo Mondlane, the "Ordem dos Engenheiros" and the "Cruzeiro do Sul".

- Finally Yet Importantly, the author wants to address a question he estimates of central importance. This is the financial sustainability of capacity building and knowledge enhancement in Sofala and in Mozambique. The central question is how the project will be financed after ADA cuts the funds. The owners, actors and beneficiaries of the project should think now about possibilities of financing the project in future.
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WATER COMMITTEE BUZI. (2006). Focus group discussion.

Figure A.1: Source: UN, Department of Peacekeeping Operations, 2004
Appendix B

Workshop in Beira: represented institutions

- ADA Beira
- ComuSanas
- DPOPH/DAS
- DPS - CHAEM
- EPAR Sofala
- Hidrofuros
- PAARSS
- PROMEC
- UCM Beira
- UP Beira
- UTAAS
Appendix C

SWOT analysis for capacity building and knowledge
### SWOT Analysis

**Key factors for the conceptualisation of a strategy for training and applied research in rural water supply and sanitation**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existence of technicians of the DPOPH in every district</td>
<td>Low level of training in CFPAS; lack of funds for CFPAS; lack of permanent teachers (water expert and leadership)</td>
</tr>
<tr>
<td>Existence of water committees, participation of civil society and involvement of the women in the water sector.</td>
<td>Lack of know how in financial management, hygiene and sanitation issues in the communities</td>
</tr>
<tr>
<td>Existence of infrastructure</td>
<td>Lack of systematisation and circulation of information about the allocation of water resources at all levels</td>
</tr>
<tr>
<td>Existing experience with low cost sanitation techniques</td>
<td>Lack of promotion prospects for the water technician career (generates low motivation of the personnel)</td>
</tr>
<tr>
<td>Diffusion of the National Water policy at all level</td>
<td>Education institutions don't promote training of personnel working in the water sector.</td>
</tr>
<tr>
<td>Existence of motivation</td>
<td>Lack of coordination between the water and education sectors.</td>
</tr>
<tr>
<td>Existence of private enterprises</td>
<td>Coordination deficit between implementing teams (private enterprises, public companies)</td>
</tr>
<tr>
<td>In construction, the Centre of research in water and sanitation in the municipality of Dondo</td>
<td>Lack of administrative and financial management in the water services,</td>
</tr>
<tr>
<td>Existence of AEA centre in all district (alfabetização e educação de adultos)</td>
<td>Unreliability of the private sector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process of decentralisation</td>
<td>Negative influence of traditional customs and behaviours on water supply and sanitation.</td>
</tr>
<tr>
<td>Existence of a lot of partners and donors acting in the water and sanitation sector.</td>
<td>Fluctuation of personnel</td>
</tr>
<tr>
<td>Existence of private sector</td>
<td>Week sensitivity to the sanitation problem at the community level</td>
</tr>
<tr>
<td>Possibility of delegate management of water services</td>
<td>Week capacity for implementation of infrastructure projects</td>
</tr>
<tr>
<td>Existence of several high education institutions with a water/sanitation component.</td>
<td>Overburden the water technicians at the district</td>
</tr>
<tr>
<td>Existence of several professional and vocational training centres in Maputo, Beira and Dondo.</td>
<td>Constant disintegration of water committees, absence of members at meetings.</td>
</tr>
<tr>
<td>Existence of women groups &quot;Círculos de interesse das mulheres&quot; in all districts,</td>
<td>Lack of capacity at district institutions in contract negotiations with the private sector</td>
</tr>
</tbody>
</table>

| Table C.1: SWOT analysis of the rural water sector of Sofala |
Appendix D

Normative and expressed demand: detailed results

<table>
<thead>
<tr>
<th>sector</th>
<th>research needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>water supply</td>
<td>technological options for water supply</td>
</tr>
<tr>
<td></td>
<td>analysis methods for the quality of water</td>
</tr>
<tr>
<td></td>
<td>register of all the existing water infrastructure</td>
</tr>
<tr>
<td></td>
<td>new institutional models which new financing models</td>
</tr>
<tr>
<td></td>
<td>public expenditure tracking surveys as for investment efficiency studies</td>
</tr>
<tr>
<td>sanitation and environment</td>
<td>alternative solutions for sanitation</td>
</tr>
<tr>
<td></td>
<td>compatibility with local housing and environmental levels</td>
</tr>
<tr>
<td></td>
<td>using local adequate materials for their construction</td>
</tr>
<tr>
<td>others</td>
<td>methods for identifying and addressing poverty groups is needed.</td>
</tr>
<tr>
<td></td>
<td>research for increasing the available amount of water resources</td>
</tr>
<tr>
<td></td>
<td>problems of water scarcity, floods and the conflicts with the upstream lying states.</td>
</tr>
<tr>
<td></td>
<td>Know how dissemination</td>
</tr>
</tbody>
</table>

Table D.1: Normative demand for research
<table>
<thead>
<tr>
<th>Level/Stakeholder</th>
<th>Demand</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>training/education in:</td>
<td>operating and maintaining of water infrastructure</td>
</tr>
<tr>
<td>Community/Consumer</td>
<td></td>
<td>finance, controlling, management of w&amp;d's infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>water quality monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>environmental education</td>
</tr>
<tr>
<td></td>
<td></td>
<td>change of behaving in sanitation attitudes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>hygiene and related diseases, construction of latrines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>social consciousness in terms of sanitation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>including local know how and culture</td>
</tr>
<tr>
<td>Community/Primary Schools</td>
<td>education in:</td>
<td>gender specific hygiene and sanitary education</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teachers should be constantly trained on new techniques</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in addition</td>
</tr>
<tr>
<td>District/Institutional Capacity</td>
<td>training/education in:</td>
<td>Planning and monitoring w&amp;d's systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>finance management capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adoption of national planning instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>skills for promotion actions for new sanitation solutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>options for implementation of the procurement principle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>management and promotion of the community demand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>contract models for the private sector implementing projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>local management of water resources</td>
</tr>
<tr>
<td>District/Mechanical Technicians</td>
<td>training for:</td>
<td>Local artisans, animators, community and controlling agents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>private enterprises and local autonomous agencies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>technical skills for construction, maintenance of infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>procurement of spare parts for pumps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>management and administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sanitation (skills for finding new and cheaper methods)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>contract procurement</td>
</tr>
<tr>
<td>Other needs</td>
<td>constant retraining</td>
<td></td>
</tr>
<tr>
<td></td>
<td>formulate curricula for training together with the private sector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>training addressed to local demand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>make education and training available for periphery regions</td>
<td></td>
</tr>
<tr>
<td>Province</td>
<td>training for:</td>
<td>mid level technicians, provincial sanitation groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>private enterprises and NGO's</td>
</tr>
<tr>
<td></td>
<td>training/education in:</td>
<td>like at district level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>water resources management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>skills for training and assisting the district level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>business packages for procurement and contracting of projects</td>
</tr>
<tr>
<td>Central/Constitutional Level</td>
<td>training for:</td>
<td>assisting the DPOPH in funds planning and management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>skills for supervising the execution of projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>consultancy capacity</td>
</tr>
</tbody>
</table>

Table D.2: Normative demand for education
### Table D.3: Expressed demand for education

<table>
<thead>
<tr>
<th>Level/Stakeholder</th>
<th>Demand</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community/Primary school</td>
<td>education in:</td>
<td>operation and maintenance of water infrastructure</td>
</tr>
<tr>
<td></td>
<td>training/education in:</td>
<td>finance, controlling, management of water &amp; sanitation infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>chairmanship and negotiation for water committees</td>
</tr>
<tr>
<td></td>
<td></td>
<td>environmental education</td>
</tr>
<tr>
<td></td>
<td></td>
<td>change of behavior in sanitation attitudes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>community-ownership</td>
</tr>
<tr>
<td></td>
<td></td>
<td>hygiene and water related diseases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>construction of latrines with local materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>social consciousness in terms of sanitation</td>
</tr>
<tr>
<td>District/institutional capacity</td>
<td>education in:</td>
<td>maintenance and operation of water and sanitation infrastructure</td>
</tr>
<tr>
<td></td>
<td>training/education in:</td>
<td>protection and management of natural resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>management of infrastructure, funds and human resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>maintenance of infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>implementation of projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>training in issues not concerning directly water (streets, construction)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>private sector regulation and development</td>
</tr>
<tr>
<td></td>
<td></td>
<td>public relations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>social issues and culture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>community education in all issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>enhancing perception of ownership in the communities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IWRM?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>create communication between districts and training institutions</td>
</tr>
<tr>
<td>Province</td>
<td>training for:</td>
<td>engineers</td>
</tr>
<tr>
<td>General level</td>
<td>training/education in:</td>
<td>actors at all stages (academic, mid- and low level technicians)</td>
</tr>
<tr>
<td></td>
<td>experts for DAN for application of plan strategy</td>
<td>creation of demand for capacity building</td>
</tr>
</tbody>
</table>

### Table D.4: Expressed demand for research

<table>
<thead>
<tr>
<th>Sector</th>
<th>research needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Supply</td>
<td>development of new technological options for water supply (pumping, rainwater harvesting)</td>
</tr>
<tr>
<td></td>
<td>energy saving methods for water supply (pumping)</td>
</tr>
<tr>
<td></td>
<td>development of low cost options assuring water supply in terms of quality and quantity</td>
</tr>
<tr>
<td></td>
<td>new institutional models and new financing models for water and sanitation</td>
</tr>
<tr>
<td></td>
<td>public expenditure tracking surveys as investment efficiency studies</td>
</tr>
<tr>
<td>Environment</td>
<td>development of new cheap sanitation methods considering social and cultural particularities</td>
</tr>
<tr>
<td></td>
<td>development of adequate evaluation tools (such as indicators)</td>
</tr>
<tr>
<td>Others</td>
<td>overall case studies for defining the real problems</td>
</tr>
<tr>
<td></td>
<td>IWRM long term water management strategy, measures against water scarcity and floods</td>
</tr>
<tr>
<td></td>
<td>development of a common water policy with upstream countries</td>
</tr>
</tbody>
</table>
### APPENDIX E. SUGGESTIONS OF THE STAKEHOLDERS

<table>
<thead>
<tr>
<th>Strategic area/ thematic demand</th>
<th>Key-demands for the conceptualisation of a strategy for training and applied research in rural water supply and sanitation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Which area?</strong></td>
<td><strong>How?</strong></td>
</tr>
<tr>
<td>Enhance the capacities of</td>
<td>Through training institutions, NGOs</td>
</tr>
<tr>
<td>water committee and of</td>
<td></td>
</tr>
<tr>
<td>communities facilitators</td>
<td></td>
</tr>
<tr>
<td>Introduction of water and</td>
<td>With public training institutions as CFPAS, UP and DPEC</td>
</tr>
<tr>
<td>public health modules in</td>
<td></td>
</tr>
<tr>
<td>community alphabetisation courses</td>
<td></td>
</tr>
<tr>
<td>Training of local leaders in</td>
<td>Short training courses</td>
</tr>
<tr>
<td>management, maintenance, hygiene,</td>
<td></td>
</tr>
<tr>
<td>gender issues, etc.</td>
<td></td>
</tr>
<tr>
<td>Training personnel in</td>
<td>Through the IIM or/and the faculty of engineering of the UEM</td>
</tr>
<tr>
<td>hydraulic project conception</td>
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<tr>
<td>Training in contract management</td>
<td>With Universities and private sector</td>
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<td>(conception of tender procedures,</td>
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<td>monitoring etc.)</td>
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<tr>
<td>Training of personnel and</td>
<td>Design of a specific model for training in public health in partnership with training institutions, UCM and UP</td>
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<td>community activists in</td>
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<td>sanitation, hygiene and</td>
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<td>public health issues</td>
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<td>Allocation and retention of</td>
<td>Create attractiveness at district level</td>
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<td>technicians in the districts</td>
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<tr>
<td>Development and introduction of</td>
<td>With support of international donors (UNICEF, EC etc.)</td>
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<tr>
<td>methods for water analysis at</td>
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<tr>
<td>district level</td>
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<tr>
<td>Provide new and adequate</td>
<td>CFPAS, CFP (partnership with UP, UCM, INEFP, DPECS)</td>
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<td>equipment to the training centres</td>
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<tr>
<td>Creation of a discussion forum</td>
<td>Involvement of all stakeholders, promotion by the DPOPH</td>
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<td>between the water sector and the</td>
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<td>training/education and research</td>
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<td>institutions</td>
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<tr>
<td>Creation of a knowledge database</td>
<td>Involvement of several actors (public administration, private sector, research and training institutions)</td>
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<td>and information system</td>
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Table E.1: Suggestions of the stakeholders in Beira
Appendix F

Interviews and focus group discussions

F.1 Guideline for semi-structured interviews

F.1.1 Interviews for representatives of capacity building and research institutions

1. How is your institution organized? Do you have autonomy or are you directly subordinated to an other institution (Ministry, Department)?

2. What are the activities you carry out?

3. How is your institution financed?

4. Who are your main partners?

5. How does the demand for your activities raise? Do you have some marketing strategy?

6. Do you have contact with the districts/rural communities?

7. Do you have experiences working in the rural water sector?

8. What are in your opinion the main problems of the rural water sector?

9. Would you be interested in taking part in the capacity building and research process for the rural water sector?

10. How should such a process be organized and who should participate?
F.1. GUIDELINE FOR SEMI-STRUCTURED INTERVIEWS

F.1.2 Interviews with experts

1. What are the main problems of the Mozambican rural water sector?
2. Is there a need for capacity building and research in the rural water sector?
3. Which is, in your opinion, the demand for vocational training/research for the rural water sector? Who should be trained and in which fields?
4. In which way can the decentralisation process be enforced through capacity building and research in the water sector?
5. Who could carry out capacity building and research actions for meeting the demand?
6. How could such a process be initiated in Sofala?

F.1.3 Interviews with public institutions

1. Which are your tasks and responsibilities in the water sector?
2. Which activities do you carry out?
3. How is your institution financed?
4. Who are your main partners?
5. How do you implement the process of decentralisation?
6. What are in your opinion the main problems of the rural water sector?
7. Is there a need for capacity building and research in the rural water sector?
8. Which is, in your opinion, the demand for vocational training/research for the rural water sector? Who should be trained and in which fields?
9. In which way can the decentralisation process be enforced through capacity building and research in the water sector?
10. Who could carry out capacity building and research actions for meeting the demand?
11. How could such a process be initiated in Sofala in a way that it can benefit the Mozambican water sector?
F.2 Focus group discussions with water committees

1. What is the function of the water committee?
2. What are the main problems for you concerning water and sanitation?
3. Does the committee get a training? Which kind of training do you need?
4. Which kind of training do you need for technicians/actors at district level?
5. Which are in your opinion the priorities for investing available money in the water sector?

F.3 Results of the interviews

Data on CD