

« Sustainable management of urban waste and waste water » research program, French Foreign office (Paris)

The improvement of the sanitation services in Moshi (Tanzania)

Demand Analysis And Sector Regulation

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Following an invitation to tender of the French Foreign Office on research on management of urban waste-water in developing countries, a consortium of institutions from France and Tanzania has been created in 2000. The proposition of the consortium has been accepted; it included a research project on the improvement of the sanitation services in Moshi (Tanzania).

1 Invitation to tender of the French Foreign Office (1999, extracts)

« From 1995 to 1998 the French Cooperation has funded a program consisting of research and pilot projects entitled “Drinking water in suburban areas and small towns in sub-Saharan Africa”. In view of the very encouraging results it was decided to repeat this kind of program with a wider geographical scope, this time on the more complex matters of sustainable management of solid waste and waste water and excreta sanitation in urban areas.

During the last decade, there have been many innovative experiences and approaches on this topic. The current challenges are the following:

- technical, socio-economic, environmental, and management assessment of the efficiency and coherence of existing systems;
- Identification of problems faced by decision-makers, field workers and donors and research on possible solution.

Therefore, the final objectives of the new program called “Sustainable management of solid waste and urban waste water” are:

- drawing up of improved intervention methodologies for the implementation of solutions which are sustainable from different points of view: socio-cultural, technical, economic, environmental, sanitary, institutional and legal;
- to stimulate the sharing of knowledge on these methodologies;
- to promote these methodologies among the sector’s stakeholders.

The program consists of the implementation of two types of projects: research projects and pilot projects.

A multi-partner program

The program is under the responsibility of the DCT/ILO of the French Foreign Office. A steering committee has been created which is made up of representatives of the French Foreign Office, the French Development Agency, the “Programme de Développement Municipal” (Local Development Program, based in Benin) and the Programme Solidarité Eau (Water Solidarity Program) as well as the chair of the scientific committee. This steering committee is responsible for the management of the program, the monitoring of the projects and the progressive promotion of the results.

A scientific committee has also been created, made up of experts from Africa, Asia and Europe which are known for their work on sanitation or waste in developing countries and on more global approaches to urban management. This committee is in charge of the selection of project proposals and of their scientific orientation.

An invitation to tender structured around four approaches

The invitation to tender has been structured around four approaches which are common to both management of solid waste and waste water and excreta sanitation.

- technico-economic, environmental and sanitary,
- sociological, anthropological, cultural and geographical,
- micro- and macro-economical and financial,
- institutional et legal. »

2 Research team and objectives of the “Moshi” research project

2.1 The team of the « Moshi » research project

Pre-existing ties enabled to build a consortium of institutions from Tanzania and France specialised in several disciplines. Researchers and institutions involved in this project are:

- ◆ Centre de Recherche Eau Ville Environnement (Research Centre on Water, Cities and Environment), Ecole Nationale des Ponts et Chaussées, Marne la Vallée :
 - Alain Morel à l’huissier - Engineer, Doctor in Environmental Sciences and Techniques
- ◆ Department of Political Sciences, University of Dar es Salaam :
 - Amos Mhina – Doctor in Political Sciences
- ◆ Department of Geography, University of Dar es Salaam :
 - Elisabeth Palela – Doctor in Geography
- ◆ Centre de Recherche et d’Etudes sur les Pays de l’Afrique Orientale (Research Centre on East African Countries, Université de Pau et des Pays de l’Adour, France) :
 - Bernard Contamin – Doctor in Economics
 - Julien Milanese – Phd student in Economics

The proposition of the team, accepted with about twenty others projects focused on different sub-Saharan countries, was divided into two axes :

- Axis 1 : « *The improvement of the sanitation services in Moshi (Tanzania) - Demand analysis and sector regulation*»
- Axis 2: « *Domestic management of waste water and excreta: study of practices and behaviours, demand functions, their measurement in contingent situation and their field application* » *Comparative analysis of six demand surveys made in sub-Saharan cities (Moshi included).*

Field investigations, data analysis and writing of the reports have been done during the years 2002 and 2003.

The organisation of a workshop for the presentation of results to the local authorities in Moshi was planned in our proposition for this research project. We will organise this workshop the 5th and the 6th of November 2003.

2.2 Working hypotheses and objectives of the axis 1:

The research was divided into two parts: the first one was the analysis of the households’ demand; the second one was about the sector regulation. The hypothesis and the objectives of the research were the following:

2.2.1 “Demand analysis

We are starting from the hypothesis that household demand for sanitation service is determined by household characteristics and social and physical environment.

The first objective is therefore to identify the different segments of the demand and their specific determinants: ranking of sanitation problems within global housing and environmental concerns, sanitation practices and behaviours, type of existing services and facilities, costs, satisfaction, type of complaints about existing facilities and wishes of improvements, willingness to pay for improved facilities.

This demand segmentation should allow to identify homogenous customer groups. It should also enable us to understand better the process of household decision-making, notably seen from the angle of coordination between landlords and tenants. It has indeed become apparent in the preliminary research that coordination problems between these two groups may hinder investments - and therefore improvements- in rented plots.

The second objective is to test some improvements on field use of the contingent valuation method (time to think for the households, measurement of a willingness to work of the households for improved facilities).

2.2.2 Regulation analysis

The segmentation of the demand of sanitation services involves a diversification of the supply. This diversification together with a lack of public funding has led to the development of a decentralised regulation so as to promote the carrying out of initiatives and the sharing of the financial burden.

Our hypothesis is that this decentralisation/liberalization can lead to a great lack of coherence and therefore is in need of coordination and regulation. Our objective is to identify and understand different types of coordination which underlie different kinds of regulation.

From an institutional point of view, we assume that this decentralisation is of a technocratic nature. Due to its high degree of autonomy the water and sewerage authority (MUWSA) seems to favour a supply driven policy. The analysis of his functioning and its relationships with the other stakeholders (Municipality, ward committees) must be assessed in the light of urban development and decentralisation policies in Tanzania. One of the issues is to find out if this autonomy can and must be reinforced, and if so what should be the role of the Municipality and the ward committees.

From a financial point of view, our hypothesis is that the autonomy of the water and sewerage authority (MUWSA) enables it to balance its running costs but doesn't seem to be able to cover all of its equipment costs. The objective is to proceed to a financial assessment of the MUWSA and to compare this with the costs of alternatives solutions – on-plot sanitation, condominium-

From an environmental point of view, the hypothesis is that there is not enough information about the impact of waste water disposal on environment to define appropriate policies. The objective was to draw up an appraisal of environmental data on water quality and risks linked to water pollution. More specifically the objective is to identify the institutions in charge of these issues, to make an appraisal of the measurements that they have carried out and to assess their compliance with a minimum set of indicators. Our ambition is to lay the foundations for an environmental information system on the different aspects of waste water management.”

3 Context of the survey: Moshi

Located in Chagga land, Moshi has been created in 1911 by the German occupant on the foot of the Kilimanjaro Mountain, in the North-west of Tanzania. Administrative capital of the Kilimanjaro region Moshi is mainly populated by Chagga (60% of our sample), Pare (11%) and Sambia (5,3%). Economic centre of one of the richest region of Tanzania Moshi is getting its resources from the crops growing on the slopes of the mountain and from the tourism activity.

3.1 A surface of 56 km² with a strong declivity

The surface of Moshi has increased from 28,6 km² in 1978 to 56 km² in 1979, that is an increase of 96%. Four *kata* mainly made of rural areas have been added: Kiboroloni, Karanga, Msaranga and Longuo. This extension must be taken into account when looking at the evolution of the total population.

Located on the south slopes of the Kilimanjaro Mountain, Moshi reaches an altitude of 985 meters on its North-eastern part and the lowest point on the south of the town is 750 meters high. As underlined by the Master Plan 1974-1994 (Ministry of Lands, 1974, p. 6) this declivity of more than 200 meters allows to set up water and sewage networks functioning with gravitativity.

The city is divided in four unequal parts by two rivers (Karanga and Rau) and a stream (Moïro). This other factor of division of the town has led to give priority to a north-south configuration of the networks.

3.2 A population of 144 336 people in 2002

The data from the different census show that the population of Moshi was increasing by 6 to 7 % per year from 1948 to 1988 and is now growing at a trend of 2,9% per year:

	1948	1957	1967	1978	1988	2002
Moshi Municipality (number of people)	8 048	13 762	26 969	52 223	96 838	144 336
Annual growth rate between census	+6,1%	+7,0%	+6,2%	+6,4%	+2,9%	

Table 1 Moshi Population (census)

The 2002 census has been conducted after the survey; data are now available at a *kata* level:

Kata	Total household	Total population by sex		
		Male	Female	Total

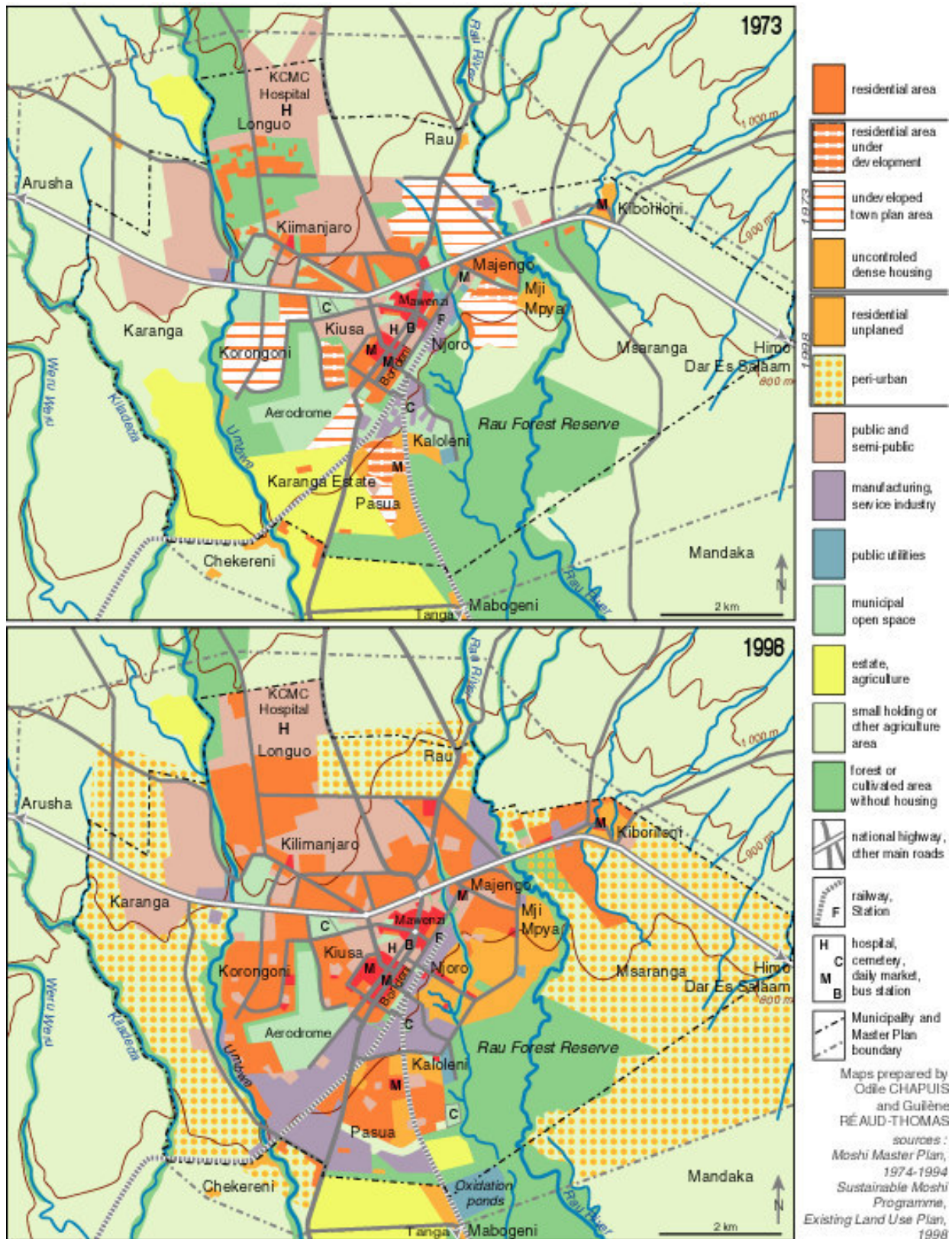
Kilimanjaro	962	2 678	2 620	5 298
Njoro	2 957	5 335	5 140	10 475
Mji Mpya	3 063	5 693	6 081	11 774
Majengo	5 433	9 379	10 192	19 571
Mawenzi	363	1 009	1 167	2 176
Rau	2 496	5 527	6 002	11 529
Korongoni	4 379	7 794	8 690	16 484
Kiusa	1 506	2 683	2 703	5 386
Bondeni	1 214	2 291	2 355	4 646
Pasua	5 205	9 678	10 147	19 825
Kaloleni	1 509	2 843	2 715	5 558
Kiboriloni	1 830	3 324	3 704	7 028
Msaranga	2 167	4 317	4 750	9 067
Karanga	1 711	5 684	3 847	9 531
Longuo	1 315	2 805	3 183	5 988
Total	36 110	71 040	73 296	144 336

Table 2 Data of census 2002¹

3.3 Moshi land uses

To complete this short overview of Moshi we can have a look on the land uses changes between 1973 and 1998 on the following Map 1.

¹ Source: Municipal Council



Map 1 Moshi town changes, 1973-1998

PART 1

THE IMPROVEMENT OF THE SANITATION SERVICES IN MOSHI (TANZANIA)

INSTITUTIONAL, FINANCIAL AND ENVIRONMENTAL REGULATION

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1 Institutional Regulation - *Dr. Amos Mhina*

1.1 Introduction

Our study which includes a willingness to pay survey with its subsequent demand analysis, as well as that of financial and environmental regulation required an examination of the institutional framework to go with the reforms in the water and sanitation sectors. As our study was based on demand driven logic, it became imperative to examine whether there are institutional reforms, which would make the implementation of such logic not only possible but also sustainable.

Many actors in Tanzania are increasingly recognizing the importance of confronting sanitation problems. These actors include the government at central and local levels, donors and investors as well as habitants of urban areas who have become more aware of the deadly diseases, which can spread because of poor sanitation. Until mid 1990s non-governmental initiatives were not encouraged in the domain of public sanitation. Initiatives had to come from the government and from the ruling party in an ad hoc manner. As it happened urban governance in general and urban sanitation in particular were not high in the agenda. Consequently urban planning went down the drain. The planned parts of the City of Dar Es Salaam and the other big towns remained static; while in settlements growing to become towns they were non-existent.

As there are now concerted efforts to reforms leading to new initiatives, it becomes important to examine whether the institutional framework is facilitating such efforts. As Wright points out, the goal of institutional framework in strategic sanitation is to create incentives that are compatible with the goals of investment and operational efficiencies. Incentives are needed for the participation of users at all stages, for transparency and accountability, for management at the lowest appropriate level, for the use of step by step approach and for competition and private sector participation (Wright 1997 p.29).

In the case of Moshi in Tanzania we need to examine whether the institutional framework for sanitation matches with the logic of reform which is occurring in the sector. Whether it recognizes and makes way for intelligent and useful initiatives on sanitation from different actors. We believe that for the institutional framework to be useful to the people of Tanzania in general and Moshi in particular, it must be based on the reality and real needs on the ground. International experiences and new techniques in sanitation need to be taken in, but these have to be translated to the Tanzanian situation. It is only in that context that reforms can be sustainable in the long run.

1.2 Objectives and hypotheses on institutional regulation.

The aim of introducing the question of regulation in our analysis is to bring into the fore the need for good governance and the pursuit of coordination between public and private actors so as to ensure coherence in the implementation of sanitation policies.

We developed a number of research questions which we believed would facilitate the analysis of institutional regulation. In the first we ask as to what are the positions and logic of different institutions involved in the direction of sanitation. These institutions include the Ministry of Water, the Urban Water and Sanitation Authorities (UWSAs), the Municipality and Ward committees.

Another research question sought to establish the fields of competence, the procedures of planning and control as well as legal and financial means available to official institutions dealing with sanitation. The third research question concerned the forms and conditions of developing coordination between different actors including the civil society.

The axis of regulation of the sector was guided by the principal hypothesis that the regulation of local public service cannot be reduced to just organizations and the measures they make. It is rather a complex process of coordinating different actors whose logic of action is influenced by economic, political, social and cultural aspects.

Without pretending to be exhaustive the study then proposed to look at a number of issues of coordination in the areas of finance, institutional framework and environment. In the domain of institutional regulation the main hypothesis was that the decentralization, which has created Urban Water and Sanitation Authorities (UWSAs), seem to be technocratic and based on the logic of supply rather than that of demand which is the logic of current reforms. We proposed to look at the authority in relation to its area of jurisdiction, its procedures of planning and control, its legal and financial means and its relations with other actors, namely the Municipality, Ward committees and the private sector. The logic and actions of MUWSA was to be examined in the context of urban development policies with its legacies and a new logic.

The objectives were two. The first was to establish the strengths and weakness of the institutional set up of Moshi Urban Water and Sanitation Authority (MUWSA) to deal with sewerage system in Moshi. The second was to look at the MUWSA and the Municipality set up in relation to dealing with the sanitation question in the whole of Moshi.

1.3 Methodology

Since in institutional regulation we were seeking to establish the ability of the current institution framework to facilitate strategic sanitation, it became important to see whether previous barriers have been removed. In other words whether there is a

qualitative break with the past. Legacies and other negative behavior have a tendency to be resilient in Tanzania even as reforms are being made.

It became important through literature to examine the logic of the reforms and how they differed from past both at the level of policy and in practice.

After that there were two sets of interviews, at the Ministerial and MUWSA levels and Municipality and sub-municipality levels. The purpose was to establish formal and informal relationships existing from the Ministry to the Municipality. It became important also to establish the type of and extent of initiatives being undertaken in relation to the magnitude of the sanitation problem in Moshi. The sanitation task in Moshi can not be reduced to the area covered by the sewage network operated by MUWSA. The areas not covered by the network, including some unplanned areas pose the most serious sanitation challenges in Moshi today.

1.4 The Logic of the Institutional Framework which established MUWSA

Examining the logic of establishing UWSAS necessarily includes a critical look at the system, which it is attempting to replace. A system which for long and unsuccessful years tried to deal with sanitation problems in the urban areas of Tanzania.

1.4.1 The Legacy

With the establishment of UWSAs the supply of portable water and part of sewerage disposal have been put together. In a legacy set up since colonialism the supply of water has been the responsibility of the Department of water in the Ministry responsible for water. Sanitation for its part has been the responsibility of town councils or Municipalities in the local government system.

The system established by colonialism survived the first decade of independence from 1961 to 1971 but would suffer from the decision by the Central Government to abolish the local government system in 1971. The local governments which included town councils for urban areas and District Councils for rural areas, were replaced by a 'decentralized' system which in reality was a deconcentration of the central government to the Regional and District levels instead of devolution of power to those areas. Central government cadres were sent to the levels as managers and they operated without elected councils of local people. Dar Es Salaam City became a region while major Regional towns became districts. The sanitation unit in the Municipalities became part of the new administration. Although still in the Department of health, the emphasis on preventive measures including cleansing was diminished. Sanitation had to get the attention of Regional and District Directors whose priorities were more with implementing policy directives from above than with the local sanitation.

The consequences were a serious deterioration of urban services and infrastructures. According to Kironde decentralization made a bad situation worse (Kironde, 1999 p.110). The situation had reached crisis level in the capital Dar Es Salaam for everybody to see. By 1976 the government had set up a committee to study the situation and give recommendations. The logical solution was to recommend the re-

establishment of local governments. Local government authorities were restored starting with Dar Es Salaam whose sanitation situation was seen as explosive. Indeed for the first time the country had seen the entry of cholera in 1976. It started in Dar Es Salaam and spread elsewhere in the country. The restoration of Dar Es Salaam city was done under an interim legislation in 1978 because of the urgency of the situation.

Permanent legislation restored the rest of the local government councils in 1982. The specific legislations were the local Government (Urban Authorities Act of 1982 and the Local Government (District Authorities) Act of 1982. Urban Authorities in the form of towns, municipalities and city councils, are charged with most day to day duties and responsibilities concerning sanitation. The 1982 Urban Councils Act give them mandate for both solid and liquid waste. This involves actual collection and disposal of solid waste but also to provide for the disposal of all sewage from all premises and houses. The urban councils can also make by-laws to ensure that residents participate in sanitation activities.

The institutional framework which guides MUWSA today which is based on autonomy and taking up a sewerage component came from trends which were emerging concerning the provision of portable water and sanitation services since mid 1980s but especially in the 1990s. The first trend was the recognition of the limitations of providing urban water through a central government department. In 1984 the National Urban Water Authority (NUWA) was established to deal with the supply of urban water. The legislation that established NUWA expected it to be responsible for the supply of water in all urban areas of Tanzania. In practice it ended up as an organization supplying water in the city of Dar Es Salaam. That fact was recognized and NUWA was transformed into Dar Es Salaam Water and Sanitation Authority in 1997, again a precursor to the Authorities to come. When NUWA was established other urban areas continued to receive water from the office of the Regional Water Engineer. The task of completing establishing Authorities was achieved when 18 UWSAs were established in 1998 to replace the Regional Water Engineers in the supply of Urban Water, leaving them with the responsibility of rural water supply.

The second trend was the renewed attention given to urban sewerage networks in the 1990s. This was partly donor driven in the context of increased global attention to urban sanitation problems and the need for strategic sanitation. In 1992 a Sustainable Dar Es Salaam Project (SDP) was established. It oversaw the formulation of policies related to waste management in Dar Es Salaam (Kironde, 1999, p.130).

In liquid waste management, the Dar Es Salaam Sewerage Sanitation Department (DSSD) was established with the assistance of the World Bank. The Department was first located in the Ministry of Lands, Housing and Urban Development, since it was part of a wider Sustainable Urban Program. It was later transferred to the Ministry of Water before it became a semi autonomous department under the Dar Es Salaam City Council. These were the first step to link water supply and sanitation. The situation remained ambivalent as to whether it should be linked to the City or Municipality. We are going to argue that the ambivalence persists because despite a part of sewerage has been put under MUWSA the task of sanitation is wide and it falls under the Municipality.

The third trend is new form of decentralization. The trend towards autonomous organizations as opposed to departments of Central or Local Government. Such decentralization however allows for an increased rate of privatization as well the involvement of civil society organizations.

The establishment of UWSAs therefore followed logic of reform, which has been occurring in water supply and sanitation. The concern is efficiency in the supply of those services. It falls within the reform logic, which is the challenge for developing an institutional framework for the sanitation sector. The question is how one can achieve investment and operational efficiency with low transactions costs (Wright, 1997, p.32).

In the case of Moshi and 17 other towns the government of Tanzania decided on semi autonomous bodies in the form of UWSAs. In the case of Dar Es Salaam the problems of water supply and sanitation were deemed to be of such high magnitude that the solution would be sought in the form of privatization to involve a large international corporation with experience in the domain. As it happened a British Company Biwater in collaboration with a German company HP Gauff won the tender after two French Corporation SAUR and Vivendi withdrew in the last minutes. If agreement is going to be signed the companies will run the activities of DAWASA for 10 years. Meanwhile there will be a program which will cost approximately USD 140 million to be financed by the World Bank, Africa Development Bank, French Development Agency, European Development Bank and DAWASA itself (Mtanzania, Newspaper, 5th October 2002).

1.4.2 MUWSA and the Ministry of Water

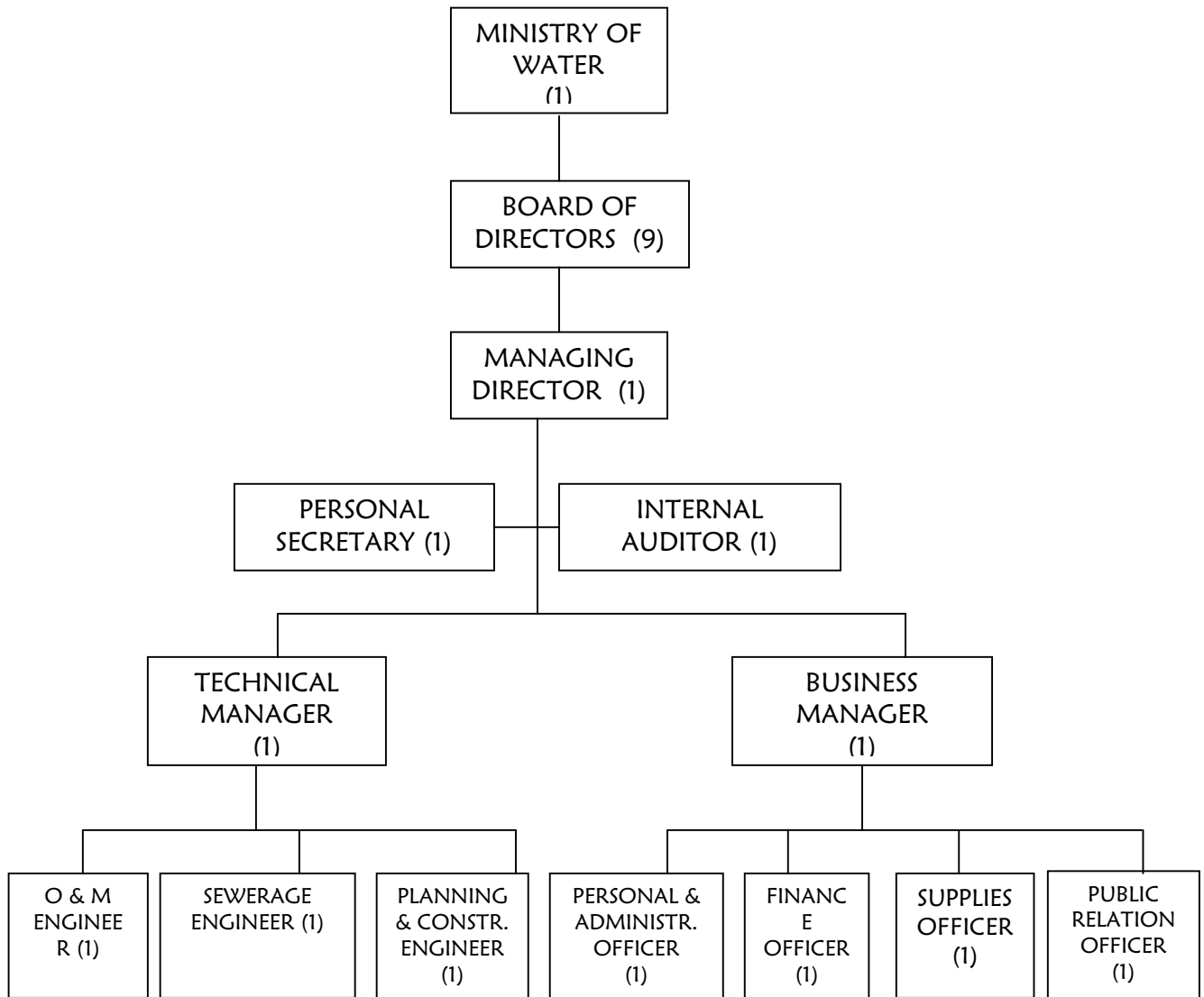
As indicated above the task of sanitation in Moshi is the responsibility of two institutions MUWSA and Municipality. The establishment of MUWSA in 1998 falls in the process of reform, which is going on not only in Tanzania but also else where in developing countries concerning the sanitation sector. This has occurred through recognition of the great importance of the improving sanitation in the urban areas. It is recognized that there are 3 strategies to ensure investment and operational efficiency in the sanitation. These are first applying commercial principles. Secondly, broadening competition and thirdly involving non-formal institutions. In achieving the required results in public sanitation utilities, a number organizational tactics are proposed and one can choose the variant be used. One could use performance agreements, using such criteria as service quality, productivity and administrative and financial efficiency. Another mechanism however could be corporatization or giving the enterprise the same independent legal status as a private firm. Corporatization is supposed to insulate utilities from government constraints and pressures while allowing the government to continue to set out base goals (Wright, 1997, p.32).

MUWSA is an example of corporatization. It has been given a good degree of autonomy when some people, including workers of MUWSA believe that MUWSA is autonomous in relation to the Ministry of Water the status of MUWSA send it was completely and that the Ministry of Water had no jurisdiction over it.

The Director of MUWSA recognizes that the Ministry of Water is responsible for policy including selecting the organizational form of UWSA's. The 1997 Ordinance provided for different bodies from which one could chose one for providing water and sanitation services. The final choice was for autonomous bodies, but it could have been a public company, a private company or a water association (United Republic Tanzania-1997).

The MUWSA organizational charts shows the Ministry is at the top.

MOSHI URBAN WATER SUPPLY AND SEWERAGE AUTHORITY ORGANIZATION CHART



The Director therefore recognizes this in that the Ministry could decide to privatize the activities. That would however come if the authorities performed poorly. Recently, the Minister for Water reiterated that the authorities are likely to continue for sometime. Another area where the autonomy of MUWSA is limited concern capital investment. UWSAs are not permitted to take loans to make capital investment without the permission of the Ministry of Finance (Kasonta, June 2002).

The necessity to consult the Ministry of Finance arises because the government is trying to avoid entering into liabilities, which it is, not aware of. It becomes even more important if the investment involves private actors. Agreements are important concerning the ownership of capital investments. The current trend is for the government to be the eventual owner and private investors to be given the right to use the infrastructure for a specific period. It is the case in Dar Es Salaam where loans from

Will be used to rehabilitate the Dar Es Salaam infrastructure while private companies will operate for an agreed period.

MUWSA therefore has enough autonomy to avoid day to day government interventions and pressures. In this, a Memorandum of Understanding guides MUWSA between the Board of Directors of MUWSA and the Minister of Water. The Board of Directors has much say in most matters concerning the running of MUWSA. It appoints all personnel except the Managing Director who is appointed by the Minister. The Board however makes the initial selection and interviews of candidates and then forwards 3 names to the Minister with their comments on each name. The Minister therefore is influenced by the board on the choice of the Managing Director.

The Board of Directors therefore has much say in the running of MUWSA. This signifies a considerable degree of autonomy. The memorandum of Understanding mentioned above prevents government interference in the day to day running of MUWSA. One typical interference what had plagued public utility companies in the past had been government intervention in the provision and payment for services. Usually some government departments and institutions such as the army were insulated from paying for the services. The Board of Directors at present set the tariffs for services their own and government departments which are not paying up are disconnected from the services.

The idea of water boards started in 1994 as a measure of decentralization of water services, especially are regards setting tariff for water services. The Department of Water would propose members chosen from among “stakeholders” in the regions who would make up the Water Board. These stakeholders included big consumers of water (Corporations and Public Institutions) and small consumers mostly domestic.

One general criticism of the Water Boards is that it is the representatives of the “stakeholders” are appointed rather than selected democratically. The water Department and the Minister of Water have a lot of say in the selection. The criteria might be well intended but the selection of the actual people is not transparent. From the beginning the idea of reforms was not popular participation, rather it was “technical competence” This logic has been questioned but the spirit of establishing the Boards seem to have been to protect and pursue the interests of water authorities and

not to oversee them. According to the MUWSA Director one control mechanism is to ensure that members are competent because if board members a weak the authority will perform poorly, which would imply insecurity for the Managing Director who is judged on the basis of performance.

In the Board of MUWSA three people out of 10 enter by virtue of their positions. These are the Municipal Director, the Mayor and the Regional Administrative Secretary. The first two represent the Municipality. Although the link between MUWSA and Municipality does not seem to be hierarchical in the eyes of the MUWSA Director, the presence of the two top municipal leaders in the MUWSA board means that the Municipality would always be aware of what is happening in the Authority. The Regional Administrative Secretary represents the Regional Commissioner who is the head of the central government in the Region.

Although appointment of Chairpersons has political overtones, political control in Tanzania had been linked to ruling parties' appointees. At present appointments might have political influence but those appointed are expected to perform competently. In the Municipality politics are being played in the Municipal Council when councilors come from different parties. At the Departmental level appointments are usually based on technical competence and merit.

Institutionally therefore there is a hierarchical link between the Ministry of Water and MUWSA and apparently not with the Municipality which is under the Ministry of Regional Administration and Local Government. The concept of autonomy however as it exists is strengthened by the relative financial independence of the authority. As shown in the discussion of Financial Regulation the Ministry closely monitors the performance of UWSAs. They have to write weekly flash reports and monthly reports and each year there is a report evaluating the Authorities under different categories and then in terms of overall performance.

In the 1999/2000 financial year for example each authority was supposed to submit 52 weekly flash reports and 12 monthly reports. Although many reports were submitted later than the agreed time all 52 weekly reports and 12 monthly reports were nevertheless received at Coordinating Unit in the Ministry (Ministry of Water and Livestock Development, 2001, p.6).

One can say that the monitoring is quite excessive yet it is important in light of earlier experiences concerning sanitation services, which was unsatisfactory. The Ministry has to see how the authorities are performing every year otherwise they are likely to slide backwards. Up to now there might have been improvements but the performance is still fragile.

In the case of Moshi it was observed that although they provided adequate water to 65% of the population for at least 12 hours per day still 48% of the water could not accounted for. It had 8,745 customers out of which 5,252 customers were active. Concerning the sewerage connections it had 843 connections. From these connections the authority collected Tshs. 16.3 million which was 25.9% of the total value of bills prepared of Tshs. 63 million. The authority faired better in collection of water bills.

The bills were worth Tshs. 646.6 million and it collected Tshs. 477.8 million, which was 79% of the targets. The overall grading of MUWSA after evaluation of 34 performance indicators put the Moshi authority at 52% which is quite average.

MUWSA was advised to ensure that water quality should conform to WHO standards and to reduce water lost by replacing old pipes. It was also advised should reduce other charges which make 55% to increase operation and maintenance costs (MWLD, 2001, pp.19-20).

While some UWSAs scored highly the general observation of the report was that no remarkable achievements had been achieved by UWSAs. It was recommended to them that they should introduce extensive metering to reduce unaccountable for water, they should also expand the customer base and improve the quality of water to WHO standards. Although MUWSA is one of the authorities which are self sufficient on own funds, close monitoring is required because as the discussion of Financial regulation has shown that the situation is still precarious.

In the area of sanitation performance is inadequate. There is also indication that the Ministry of Water is not very concerned with sanitation. The reports give much more attention to water than to sanitation. One result of the performance evaluation and precariousness is the tendency to avoid risks. Certainly it is more so in the sanitation area. MUWSA is content to operate in the areas sewage network. Even here it does not have an aggressive strategy to ensure more and more connect to the system. Such a strategy to succeed it needs to reduce costs. The head of the sanitation unit strongly believed a proposed technology proposed to efficient but also reduce the costs paid to that time.

MUWSA is happy to leave autonomous sanitation to the Municipality, even the potentially profitable cesspit emptying. The challenge which lies ahead is whether the performance of MUWSA would be adequate to stave of her forms of operation, including privatization, as will seen be the case in Dar Es Salaam city, whose problems are considered too complicated to be operated by DAWASA as an Authority.

The inadequacy of the activities of MUWSA in sanitation can also be looked in terms of the fact that there are considerable parts of Moshi, which are not covered adequately by both MUWSA and the Municipality. There are critical areas whose inadequate sanitation services lead to serious health problems including such diseases as typhoid. It is important therefore to examine the mandate of MUWSA vis-à-vis the municipality in the area of sanitation including autonomous sanitation. It is also important to look at institutional arrangements, which can facilitate sanitation in the autonomous sanitation areas.

1.5 Institutional Relationship between MUWSA and the Municipality in the Area of Sanitation

The legal framework, which created MUWSA, gives it, clear protection especially as regards water production and supply. The sewerage component is now part of

UWSA but it does not get much attention. At the same time the Act does not nullify the overall responsibility of the municipality concerning sanitation.

The 1982 Local Government (Urban Authorities Act) which has not been amended, gives the municipality mandate for both solid and liquid waste. It is responsible for collection and disposal of solid waste and all sewage from all premises and houses.

There have been numerous amendments to the Local Government Act of 1982, the most extensive can be found in the Local Government Laws (Miscellaneous Amendments) Act of 1999. These amendments however, deal with the democratic aspects of the Municipality as well as the relationship between Local government and the Central government. The sanitation aspect remains intact.

The Municipality therefore has the overall responsibility of over sanitation activities including sewerage because it is in charge concerning the process of disposal of waste. The municipality is also responsible for making the people of Moshi to participate in the disposal activities as well adhering to correct sanitation. One human observes that the Municipality is readily accepting that sewerage be transferred to MUWSA. For its part MUWSA seems content with the sewerage network and going beyond it to other sanitation activities is not their priority. Essentially the Municipality is expected to monitor the activities of everyone, including MUWSA concerning sanitation practice.

In the Municipality there are three departments which have responsibility for solid and liquid waste management. These are urban planning, engineering and health. The planning department is supposed to play an important part in terms of showing the direction to be pursued in order to improve sanitation. The Planning Officer of the Municipality however recognizes that planning is lagging behind development (Moshi Municipal Planning Officer, Feb. 2002).

Indeed the fact that urban planning is lagging behind is easily seen because of the mushrooming of unplanned urban areas. Cities have Master Plans funds for specific surveys are lacking but there is enormous pressure by people to have the land before land is made available properly. In Moshi this is compounded by the fact that the town is surrounded by farmland of a people who are highly conscious of the importance of land and holds steadfast to it. As a result the Municipality has limited land at its disposal. This is in spite of expansion of its area from 23-sq. km. to 585-sq. km. in 1973. The Municipality has been forced to negotiate with the neighboring District of Hai to get a site for building a solid dump to be financed by the World Bank.

In the municipality houses takes 50.2% of which 35.1% are located in planned areas. Areas for recreation makeup 20.6% while public buildings make up 15.2%. Industrial area covers 6.6% while commercial and transport takes 6.9% of the land (Cooperative College, DANIDA, 2001). The planning Department is constrained because adhering to plans would lead to breaking unplanned areas which would have serious consequences to people.

The other department responsible for sanitation is engineering. This department is responsible construction works and maintenance of sanitation trucks. Since sewerage has been transferred to MUWSA it does not have much construction works related to sewage. It has however construction responsibilities related to solid waste dumps including maintenance of roads to the dumps.

The Health department is central to sanitation in the municipality, which falls under its jurisdiction. The Department has three sub-departments namely, Curative, Preventive and Social Welfare. The Sanitation unit is tucked in the Preventive sub-department. The logic of sanitation in the Health Department is that of cleansing. That is cleaning to ensure that no communicable disease epidemics do occur. The question of recycling of waste does not come into the picture.

The institutional weaknesses manifest themselves when heavy investments have to be made. In such situations the capacity of the sub-department has been found inadequate and investors and the government have tended either to move the Ministerial level or to create new organizations such as UWSAs.

The Urban Sector Rehabilitation Project (Water and Sewerage Component) finally leaned towards the Water Department. Although the project rehabilitated water and sewerage systems in seven municipalities, in the final analysis the responsibility for the services were given to the authorities under the Ministry of Water. The US\$ 40 million project raised capacity building and institutional strengthening of UWSAs (Ministry of Water 1999).

The Municipality is expecting to come into the picture through the building of a solid waste dump because solid waste management is still within its jurisdiction. In the sanitation sub-department there is no indication of animosity between them and MUWSA. Indeed members of the unit inform MUWSA when there is leakage in the sewerage network. It would seem therefore that the unit is happy with the sewage network being transferred to MUWSA in light of the limited capacity of the unit (Head, Sanitation Unit, July 2002).

In terms of sanitation regulation however the responsibility lies with the Municipality. The waterworks regulations act of 1997 does not take the overall responsibility of sewage from the Municipality in the sense that it is silent about it. The main focus in water and sewage comes only as an appendage. It comes only in the UWSA's Operation Guidelines. One gets the impression that sewage was put into the Act as an afterthought.

Related to the question of responsibility there could later raise the question of ownership. The Director of the Municipality acknowledges the good relationship between MUWSA and the Municipality, especially since the Director and the Mayor are members of the MUWSA Board. While the Director of MUWSA did not recognize the existence of formal relationship between the two, the Director of the Municipality believes that in the final analysis MUWSA is owned by the Municipality and certainly the oxidation plant at Mabogini. It is however paying MUWSA for having their trucks

to discharge at Mabogini. MUWSA argues that the revenue is needed because after a number of years the plant will need a major cleaning of silt at the bottom.

The question of ownership still comes up. In other words even if UWSA is at present autonomous, if it comes down to privatization of the installation the Municipality would claim ownership because although built with World Bank loans, they are located on Municipal land. The tug of war would most likely be between the Municipality and the Ministry of Water and in such a situation the central government would be the one to decide. The fact remains however "autonomous" MUWSA it is still owned by the government the only shareholder. Such a situation is yet to come. What is becoming evident as a problem however is dealing adequately with the magnitude of the sanitation problem.

Both solid waste management and liquid waste management are considered inadequate. Concerning solid waste it is estimated that 120 tons are generated daily within the central business district and Municipal retail markets. On average the Council collects only 70 tones which are crudely dumped at Kaloleni dumping site. The remaining 50 are uncollected and one can add into that other waste uncollected especially from the unplanned areas (Cooperative College/DANIDA 2001).

Concerning liquid waste management the study on Moshi municipality states that of 7,000 cubic meters discharged daily only 33% is disposed through the central sewerage system at Mabogini Oxidation ponds the rest is out of its orbit. It is observed that most residents in the peri urban wards use pit latrines whereas those the urban wards use septic tanks. The management of these is not always correct although Municipal trucks are used to transfer some of this liquid waste to the oxidation ponds.

The makeshift pit latrines are considered offensive, environmentally dangerous and a breeding ground for flies, mosquitoes and other vermin that are vectors for the spread of diseases such as dysentery and malaria (Cooperative College/DANIDA 2001).

What it means that there is considerable liquid waste problems not covered by MUWSA and which the Municipality are not prone to deal with adequately. The head of the sanitation unit described the situation as not very bad but not adequate. The situation is worse in squatter areas where even accessibility is a problem. The trucks find it hard to reach places such as Njoro, Kaloleni and Mji Mpya. However, since 1997 Moshi has been spared of serious epidemic diseases (Kombe, July 2002).

The Municipality therefore is responsible for autonomous sanitation. This includes cesspit emptying and the whole sector of different types of latrines. Trucks do cesspit emptying. While these are doing a seemingly adequate job the activity is not financially viable as the section on financial regulation shows. In reality it is likely that not all revenue paid for the services find their way to the coffers of Municipality. Such practice was widely observed in Dar Es Salaam before the entry of competition from private operators.

The function of cesspit emptying which covers mostly the accessible areas could be taken by MUWSA, which can have trucks which they could better monitor the trucks which is not done adequately by the Municipality. It is likely to meet opposition from those responsible for operating the trucks because they are likely to be benefiting from that activity. At the same time MUWSA is not very eager to capture such activity being contented with operating the sewage network.

The institutional set up of MUWSA has allowed increased efficiency in the running the sewage network, but MUWSA is not for a profit maximization organization and therefore expansion is not a critical issue to them, especially expanding to areas where profitably is not clearly assured. Second MUWSA is not bound to expand into more areas of Moshi. Certainly expanding into the latrine areas is even less likely.

These are prevalent in the unplanned residential areas of Moshi. The latrines pose environmental hazards including the danger of ground water pollution. The latrine areas raise a number of institutional issues. First, it is important that there should be clear responsibilities and mandate to improve sanitation in those areas. In the present framework the municipality is responsible for those areas but their approach is not frontal. They have construction models to advise people who wish to build latrine and other sanitation structures. Most areas involved are however considered to be squatters, and typically in planners mentality sanitation campaigns in these areas would be construed as justifying the existence of the unplanned areas. There are also no concerted efforts to sanction people responsible for dangerous sanitation practices. There are by laws against such practices but implementation in the unplanned areas is limited.

Secondly there is need to think of widening technological options and the organizational forms which can go with it. One such technological option, which can be tried, is the condominal system. In the unplanned areas of Moshi where residents have to face daily sanitation inconveniences, such as sewage flowing in the streets or on neighbors' plots, it might be an alternative solution. There have been efforts to raise the status of some unplanned areas, through people contributing land to allow for such infrastructure as roads and power lines to be contacted. One such example occurred in Longuo Moshi where residents were working to raise the status of their squatter area. They paid for a survey to draw an upgraded plan, they however met resistance from the Municipality Planning Department (Lerise, 2000).

In the case of sanitation some people with a bit more land than others could offer space for condominal systems. According to the Head of the Sanitation unit, what would be crucial there to the adoption of the condominal system will be the sensitization of the technology but also having lower costs compared to other alternatives. She argued that people in the town were very cost-conscious. It explains also why very same people in the MUWSA network areas are not connecting they compare the connecting costs to that of trucks (Kombe, July 2002).

The introduction of a condominal system would also depend on the appropriate non-formal institutions to go with it. It is recognized that non-formal institutions can fill gaps in service in urban areas, especially in areas where formal institutions do not

reach (Wright, 1997, p.34). There is a possibility of emerging small neighborhood companies, which can take condominal installations. These could be assisted by NGOs or by donors interested in improving sanitation in these areas.

The third institutional issue concerns the relationship between the Municipality and Community Based Organizations (CBOs) at the ward and street levels. At present the Municipality is encouraging the emergence of such organizations. The increase of sanitation committees and organizations at ward and street level require attention because the offer important opportunities for improved sanitation is the problem areas.

1.6 Organizing Sanitation at the Ward Level

The study at this level used purposive sampling in pilot studies in a number of cases. The visits allowed for discussions with Ward Executive Officers, members of Ward Development Committees and members of Community Based Organizations involved in improved sanitation. The area of study included Njoro, Longuo, Majengo, Kiboriloni and Kaloleni.

To understand the administrative structure at the municipal and sub-municipal levels it is important to understand that there are central government and local government structures. Moshi town is both a District and a Municipality. The central government structure is the District under a District Commissioner, who is mostly responsible for law and order issues and the coordination between the central government and the local government in that geographical areas.

Below the District we find the Division which is the lowest central government unit. Moshi town has two divisions, Moshi East and Moshi West each under a Division Secretary with a similar law and order mandate as the District Commissioner. Below the division one finds wards. The Wards are however Municipal administrative units, although many people do not make a distinction between the central and local government institutions at the sub-District level. Six wards are located in Moshi West Division. These are Kiusa, Kilimanjaro, Korogoni, Karanga, Longuo and Rau. Moshi East has 9 wards, namely, Bondeni, Mawezi, Njoro, Msaranga, Majengo, Mji Mpya, Kiborloni, Pasua and Kaloleni.

The Wards are under a Ward secretary and has an elected ward committee. The Land Committee is therefore an important participatory institution of the Municipality. Below the ward there are street administrations responsible for dealing with different problems facing people in the areas. There is the street elected Chairman and its committee.

It was observed by respondents that individual sewage disposal systems receive little attention from local authorities. At the same time owners often do not conduct adequate maintenance once the units have been constructed. The systems have tended to create health hazards through contamination with water supplies or through exposure of excreta to rodents and insects. It is observed that the pits are generally

utilized for reception of both sludge and excreta reducing expectation life of the pits. The process also can lead to the overflow of the effluent when local resident's fails to afford emptying the contents. These aspects were observed in an earlier survey of Milanesi. In his sample 65% of the residents used traditional pit latrines while 16% used ventilated latrines and 19% used water closets. Most of the VIP latrines were decayed. Those with more than 15 years made up 60%. It was also observed that 63% of latrine owners used the pits to dispose of wastewater (Milanesi, 2000, pp. 8-9).

The disadvantages of pit latrines are most evident in commercial-cum-residential areas of the town. Pits have repeatedly been dug until there is little space for fresh pits. This is observed in Majengo and Njoro areas. Contaminated water often flows along the roads and in open spaces.

The ward leadership recognize the existence of the problems but there is little in the form of strategic sanitation improvements. This is required for both solid waste and liquid waste. The four refuse vehicles for emptying dustbins are considered inadequate. There is also the problem of uncontrolled disposal of solid waste which encourage fly and rat breeding. Dustbins in low and medium areas are usually emptied only twice a week instead of daily basis. Many respondents reported that the emptying of septic tanks is problematic. Sometimes it can take up to a two months for septic tanks to be emptied since the problem has been first reported to the people responsible for the Municipal trucks.

Regulation by ward leaders becomes problematic because there are no clear by-laws which focuses on the sanitation behavior. Every household has to have at least a latrine. However, when the latrine is full the owner usually gets away with only verbal warning instead of harsher sanctions.

Some respondents stated that while by-laws for sanitation existed in the municipality MUWSA did not have them. There are respondents who do not find the roles of MUWSA and the Municipality to be complementary. Some even suggested that the Department of Health in the Municipality should be disbanded and its activities to be handed over to MUWSA.

It is unlikely however that MUWSA would be happy to be handed over the whole sanitation task in Moshi. Autonomous sanitation comports serious incertitude concerning profitability of the sanitation activities. Indeed efforts by the Municipality to entice the private sector to participate in solid and liquid waste disposition have not been very successful. Twice the Municipality invited private operators to take up solid waste disposal activities. There were no responses. Many businessmen believe that solid waste disposal is unlikely to be profitable because many people would be poor payers for sanitation services. Some operators were involved in cesspit emptying but did not last long. They abandoned the activity after a short time because of low profitably. (Kombe, July 2002).

There is potential for Ward Development Committees to be involved in sanitation improvement and regulation. What is needed is adequate transfer of knowledge of

sanitation and correct methods of pursuing sanitation improvement. Already a lot of the committee members are involved in the sustainable environmental program of the municipality. The weakness of the program is that it does not give adequate attention to sanitation. There is therefore potential in bringing sanitation into the core of the activities of the Ward Development Committee and the Ward Secretary.

Other potential actors are Community Based Organizations. There are many groups, which mobilize voluntary contributions for the construction of roads or seeking to deal with, such infrastructure needs as electricity and water availability.

However organizations to improve sanitation are only slowly emerging. Many start as environmental groups and then move to sanitation. In Moshi West Division there are 15 environmental CBOs in Moshi East there are two which have registered as NGOs in the wards of Rao and Kilimanjaro (Cooperative College/DANIDA, December 2001). The environmental CBO of Rao is the pioneer in taking up sanitation (Kombe, July 2002). Most of the other groups are dealing with tree planting and preservation of water sources. They are however occasionally involved in general cleaning. The Rao group has taken up the task of dealing with solid waste in their area and in the industrial sector at a cost. Bondeni group is also showing interest in sanitation and has contacted the Municipality to see to which task they might take up.

Since our study has shown the presence of willingness to pay for improved sanitation services, what is important is to identify the appropriate technology, which can be, proposed, the organizations, which can undertake such tasks and the institutional framework to facilitate such efforts.

VIP latrines and improved cesspits need to be encouraged in the areas of autonomous sanitation. MUWSA also will have to find more efficient ways of encouraging more people to connect to their network. Many residents are said to be very cost conscious. Sensitization and cost reduction is likely to be the test of an appropriate sanitation technology. At the same time the municipality could exert some pressure on the residents to take up to correct sanitation practices. Sanctions on polluters can encourage them to understand the importance of proper sanitation and the needed investment have to make in order to ensure it. In such a way it could be profitable for private actors to enter into its business.

1.7 Conclusion: Institutional Arrangements, which can facilitate improved sanitation in Moshi.

All the above institutions have interest in improving sanitation in urban areas and there currently plans to establish programs to expand to rural districts. One can say that Sanitation in Moshi town is not the worst in Tanzania but it is also inadequate. The people of Moshi have been lucky in that since 1997 there hasn't been serious health crisis related to water pollution. Before that however there have been some cholera epidemics. There is no guarantee it cannot occur again.

The sewerage network needs to reach more people. There are also places where there are connections but there are still some problems. An example given are the Police barracks where residents are excessive in small houses and the link to the network receives excessive pressure from the high population in the quarters. The bigger challenge however concerns autonomous sanitation which fall squarely on the Municipality and is likely to remain so for quite some time to come.

MUWSA is unlikely to take the task of sanitation in those areas from the municipality because there is pressure from the Ministry to achieve certain performances. There are therefore two Ministries dealing with sanitation. The first of the Ministry of Water and Livestock Development and the second is the Ministry of Regional Administration and Local Government, which is located in the President's Office. The first oversees MUWSA while the second oversees the Municipality.

The two Ministries are connected by donors through programs, which deal with urban rehabilitation which have components of water and sanitation. Some of the programs are located in the Ministry of Water while others are located in the Ministry of Regional Administration and local government, because municipality is under that Ministry. The Coordination of these programs is not always evident. One example of that has been studies which have been done by consultants are no where to be seen. Like in many Ministries, programs are opportunities for Empire building.

In Moshi the extension of the sewerage network was done by donors, linking up with the Ministry of Water which is monitoring the performance of MUWSA who are running the network. DANIDA for its part is supporting an environmental program, which could have a component of sanitation. As it happened in the practice the program has very little on sanitation.

The Ministry of Regional Administration and Local Government need to give more attention to sanitation problems in the urban areas. At policy level there is need for delineating more clearly the task of municipalities in on-plot sanitation monitoring. This however depends on appropriate technologies to be proposed for on-plot sanitation.

The relationship between MUWSA and the municipality is not very formal. The position of the municipality does not appear in the organizational structure of MUWSA. There is need to establish the formal link in the context of the global sanitation task of Moshi. Instead of the municipality being on the margins it should be responsible for charting out and monitoring the strategic sanitation issues of Moshi. Without marginalizing any actors or acting in contradistinction with MUWSA, it could chart out ways of involving appropriate actors in different aspects of sanitation in the different parts of Moshi municipality.

Instead of marginalizing the sanitation unit of the municipality it seems to us that it needs to be elevated so as to be able to chart out the sanitation policy of the Municipality as well as monitoring the different sanitation practices in Moshi in order to fulfill the mandate of the Municipality as contained in the Local Government (Urban Authorities) Act of 1982.

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Appendix 1

Questions on Institutional Regulation

Purpose: Examine institutional arrangements pertaining to the different organizations involved in sanitation in light of the magnitude of the task.

1. What responsibilities still remain with the municipality in the area of sewerage after the creation of MUWSA.
2. Has the municipality any oversight powers over MUWSA as a way of regulation of sanitation activities.
3. What are the formal links between MUWSA and the municipality.
4. Traditionally sanitation has been undertaken by a sub-department in the Department of health. Is this organization set-up adequate today in light of the magnitude of the task.
5. At present MUWSA services covers only part of Moshi. How would you evaluate the adequacy of sanitation interventions in the other areas of Moshi not covered.
6. What other actors could intervene in the area of sanitation especially sewerage.
 - a) The Private Sector
 - b) Community Based Organizations (CBOs) which are currently active in the area of road construction.
7. Do you think people could come together to build local based sewerage systems (condominial) which then could be joined to the sewer network?
8. What is the contribution of Ward Development Committees to improvement of sanitation services?

APPENDIX 2: MANAGEMENT OF SANITATION SERVICES: THE CASE OF MOSHI

QUESTIONS TO MUWSA: INSTITUTIONAL REGULATION

1. How autonomous is MUWSA?
 - a) What are the formal links to the Ministry of Water/Local Government?
 - b) What are the formal links to the Municipality?
2. History has shown changes in the institutions and organizations dealing with Sanitation. The precursor to MUWSA, DSSD started in the Ministry of Lands and ended in the City in Dar. How stable do you think is the institutional framework dealing with sanitation.
3. At present MUWSA has the potential of reaching 37% of the population of Moshi Municipality – what are other actors could be used in conjunction with MUWSA to reach the population not yet reached.
4. Do you think there is room for other for profit private actors in the sanitation sector in Moshi.
5. Would you allow collective efforts of people to build local sewerage depots, which would then be joined to the network?
6. What role do you think the civil society can play to enhance sanitation in cooperation with MUWSA.

2 Financial Regulation - *Dr. Bernard Contamin*

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(Water and Sewerage Component).

2.1 Methodology

We have done four weeks of field investigations in Tanzania, from the 15th of April to the 11th of May 2002 (11 open working days in Moshi).

In Dar es Salaam we have met:

- the Head of the Department of the Ministry of Water and Livestock in charge of the control of the urban water and sewerage authorities and of the elaboration of the annual evaluation report of these authorities. The last report available was the one of 1999/2000.

- The Head of the Sanitation Department of the Tanzanian Infrastructure Rehabilitation Programme. Despite his efforts, he didn't succeed to find all the preliminary surveys of this programme. It is only indirectly that we could find some partial elements of financial analysis carried out in 1995.

In Moshi we have worked with these sources of information:

- The MUWSA put many documents at our disposal and allowed us to carry out several interviews. The reliability of some of the numbers and the incoherencies of some data needed a deeper analysis by the different departments. As it was planned, two missions of field investigations would have been necessary to make a first assessment and then submit the results to the financial department for discussion and validation. As we grouped the two missions together, this validation has not been possible. We therefore set out to moderate our comments and to underline the hypothesis of our calculations.

- The Health Department of the Municipality which is in charge of the on-plot sanitation in Moshi gave us information about their actions which still remains limited.

- A survey with 30 craftsmen implemented by Julien Milanese has been used.

- Apart the Managing Director of the MUWSA whom we met several time, we had interviews with two members of the Board of Directors of the MUWSA.

2.2 Findings and recommendations

The findings and the recommendations following our investigations on the financial regulation of the sanitation sector of Moshi are the following:

The MUWSA has strengthened its financial autonomy

Subject to confirmation, the accounts of the MUWSA show a substantial increase of the receipts and a control of the costs. Finally, the authority seems to be able to release important funds for investments. Compared to the past situation of direct management by the departments of ministries, the creation of an autonomous authority is undoubtedly a progress, at least from a financial point of view.

A rigorous technical and commercial management of the sewage network

More than the increase of the water production it is the reduction of the water losses which allowed the MUWSA to increase substantially its receipts. A better technical management and the rehabilitation of the network led to a reduction of

these losses. A tough policy of invoicing and bill collection (22,8% of disconnection of water supply) has increased the payments.

The water is (probably) paying the sewerage

In the absence of management accounting, it was not possible to extract the part of the expenses related to water or sewerage. It is however probable that the receipts for sewerage are not covering the cost of this activity. This adjustment is highlighting the question of a possible partial financing of on-plot sanitation programmes through the receipts collected from the water.

Lack of strategic visibility on sanitation matters at the city level

The shortcomings of the information system and of the sewerage department of the MUWSA (the appointment of a sewerage engineer is very recent) show that there is a lack of clear strategic direction.

The new connections to the extended sewerage are progressing very slowly. Costs of connection are still a barrier, notably for the households who already have equipment (see the report of Julien Milanese). A commercial strategy needs to be defined after a clear estimate of the possibilities and the limits of the network.¹

The recognition of the necessity to develop and reinforce the on-plot sanitation is still to be confirmed. It should lead to a zoning of the city which would allow to identify clearly where the different solutions of sanitation could be spread.

Cheap pilot projects

In order to test financial innovations, two projects could be planned: the implementation of a programme of subsidies for connection and the development of solutions of co-financing.

As the strong reluctance of the MUWSA towards condominium sewerage has favourably changed, all the conditions for this type of pilot project are fulfilled. As several experiences showed, this type of project needs high technical and financial skills but also the mobilization of abilities in social marketing, consultation and coordination. In this field the MUWSA needs to acquire the necessary skills.

A municipal regulation to be redefined and reinforced

In charge of the on-plot sanitation, the Municipality is only doing little intervention through awareness campaigns and incentives to households and craftsmen (indicative standards for building of equipments). And yet the sanitation market in Moshi is not working well, in particular concerning the coordination between landlords and tenants (see demand analysis).

Promoting agreements between different actors of the sector could be the major axis of development of the municipal project of a Sanitation Centre.

The development of an environmental system of information (see report of Elisabeth Palela) could also be one of the major aspects of the Municipal intervention.

¹ It seems that progress has been made on this issue, see report on Demand analysis

From an institutional point of view (see report of Amos Mhina) and on the condition that minimum self-resources can be secured, we can wish that this Sanitation Centre becomes a municipal autonomous authority following the MUWSA model.

On the other hand we can wonder if it wouldn't be better to attach the services of trucks for pit emptying to the MUWSA. This service is indeed complementary to its activity and according to its freedom to set prices and its ability to manage efficiently a production tool, the MUWSA has the assets to develop a profitable service.

Establishing the missions of the MUWSA and the Sanitation centre through a contract

The management of sanitation matters by autonomous entities presupposes that their missions (commercial and public service) are clearly defined under fix-term contracts. The current trend is to leave the managing entity free to use the means of action but to define the results to achieve. The main problem is then the control of the fulfilment of the contract (see the set up of indicators by the Ministry of Water)

If a contract was drawn up, there would be a problem to be solved: the legal status of the equipments (see report of Amos Mhina): who is the owner of the treatment plant, of the water and sewage networks? The municipality, the MUWSA, the Region or the State? In this legal question it is actually the direction of the decentralization policy and of the new institutional regulation which is at stake.

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Annexe 1

Moshi Urban Water and Sanitation.

Board directors members.

	<u>July 1999</u>	<u>April 2002</u>
Chairperson	Doctor Maria KAMM <i>Deputy</i>	Ms Elisabeth MINDE
Ministry of Water	W.E.M. URONU <i>Engineer</i>	C.S. SAYI <i>Engineer</i>
Regional Administration	P.O.CHIKIRA <i>Regional Administrative Secretary</i>	P.O.CHIKIRA <i>Regional Administrative Secretary</i>
Municipal director	Shaibu Z. MUYINGA <i>Municipal Director</i>	Shaibu Z. MUYINGA <i>Municipal Director</i>
Local councillor	Denis N. CHUWA <i>Mayor</i>	Lucas S. TARIMO <i>Mayor</i>
Managing Director	E. MARANDU <i>Engineer</i>	A.S. KASONTA <i>Engineer</i>
Local commercial sector	Lucas S. TARIMO <i>Brewer</i>	J. SWAI <i>Executive Director</i>
Large scale consumers	Zebadiah S. MOSHI <i>Coffee manufacturing</i>	Zebadiah S. MOSHI <i>Coffee manufacturing</i>
Domestic consumers	Franck MUSHI <i>Accountant (Bank of Tz)</i>	Franck MUSHI <i>Accountant (Bank of Tz)</i>
Women	Ms Redemta L.MINJA <i>Accountant (Bank of Commerce)</i>	Ms SHALLY J.RAYMOND

Annexe 1.1 Performance indicators July 1999 – June 2000

S/No	PERFORMANCE INDICATORS	ARUSHA		MOSHI		RWANZA		TANGA		MBEYA		MORO		TABORA		BUKOSA		DODOMA	
		ACTUAL	TARGET	ACTUAL	TARGET	ACTUAL	TARGET	ACTUAL	TARGET	ACTUAL	TARGET	ACTUAL	TARGET	ACTUAL	TARGET	ACTUAL	TARGET	ACTUAL	TARGET
(a)	MANAGEMENT INDICATORS																		
	* Frequency of UWSB regular meetings	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	5	4
	* Frequency of tariffs review	done	annual	done	annual	annual	annual	done	annual	done	annual	none	annual	none	annual	done	annual	done	annual
	* No. of monthly reports	12	12	12	12	12	12	12	12	9	12	9	12	10	12	11	12	12	12
	* No. of weekly reports	50	52	15	52	48	52	30	52	37	52	44	52	46	52	34	52	38	52
(b)	GENERAL INDICATORS																		
	* Average quantity of water produced (m ³ /month)	1127834	1 350 000	800000	591 000	1 200 000	1 340 000	744539	751 000	510000	820 000	745320	930 000	567000	372 000	198300	199357	778185	820 815
	* Average quantity of billable water (m ³ /month)	845875	1 012 500	380000	443 250	950734	1 050 000	521177	562 000	406000	465 000	447876	697 500	256000	279 000	138810	148 025	622548	815 611
	* Quality of water produced																		
	- turbidity (NTU)	2	<5	0	<5	40.3	<5	<5	<5	<5	<5	<5	<5	5.7	<5	0.65	<5	4	<5
	- residual chlorine (mg/l)	0.3	0.2	0.2	0.2	0.3	0.2	<0.2	0.2	0.2	0.2	0.75	0.2	0.1	0.2	0.1	0.2	0.2	0.2
	* TANESCO bills payment (%)	100	100	100	100	44.2	100	100	100	60	100	34	80	10	50	0	50	0	25
	* Quality of (sewerage) effluent																		
	- BOD ₅ at 25°C (mgO ₂ /l)	80	30	5	5 to 10	NM	6 to 10	465	NA	NA	NA	NA	8 to 10	8.8	6 to 10	NA	8 to 10	NA	NA
	- COD (as mg KMnO ₄ /l)	10 to 20	NA	10 to 20	NM	10 to 20	NA	NA	NA	NA	NA	14	10 to 20	NA	10 to 20	10 to 20	NA	NA	NA
(c)	SERVICE INDICATORS																		
	* Proportion of population served with water (%)	90	100	85	75	68.9	80	84.9	85	65	75	68	70	56	68	68.1	70	80	70
	* Average hours of service per day	22	24	12	14	18	20	20	19	14	18	24	24	14	14	23	23	12	8
	* Total No. of water connections	12391	13 000	7513	8 100	10661	10 280	12821	12 583	7657	8680	10645	10 990	8317	5 985	2626	2601	6415	8569
	* Total No. metered connections	9079	12 000	5111	7 280	1631	3 087	8514	8 747	1135	2804	3370	9 891	780	4 768	551	1300	2001	2600
	* No. of metered connections in working order	7663	10 800	5111	6 561	1503	2 778	8149	7 672	1048	2344	3272	8 902	750	4 310	551	1100	1895	2340
	* No. of new water connections at the end of the year	1028	1000	152	500	1631	1 000	170	500	712	300	495	1 000	198	100	280	300	400	300
	* Total No. of public kiosks	48	48	24	24	70	70	100	72	64	64	140	120	39	31	5	5	44	27
	* No. of public kiosks in working order	27	48	24	24	55	70	71	72	50	64	124	120	39	31	5	6	43	27
	* Cost of 20 litre Jerry can of water by vendor	10/=	10/=	20/=	20/=	10/=	10/=	10/=	50/=	10/=	50/=	50/=	40/=	10/=	20/=	50/=	50	20/=	20/=
	* Sewerage service coverage (%)	9	9.5	33	40	13	20	15.7	15	NA	NA	NA	NA	20	11	NA	NA	NA	NA
	* Total No. of sewerage house connections	2471	2140	950	750	1288	1 234	1957	1925	NA	NA	NA	NA	83	123	NA	NA	NA	NA
	* No. of new sewerage connections at the end of the year	103	100	13	50	15	100	132	60	NA	NA	NA	0	60	100	NA	NA	NA	NA
(d)	EFFICIENCY INDICATORS																		
	* Unit cost of produced water TSh/m ³	86.1	73.5	59	43	85	79	69	64	150	157.5	132	278	131	127	333	350	112	28.14
	* Unaccounted for water (%)	27.5	30	58	45	28	45	41.16	35	50	35	40	95	40	30	68.3	35	30	40
	* No. of leaks detected (monthly)	820	210	195	45	10	20	52.25	29	58	59	1887	150	20	28	25	30	21	9
	* No. of leaks repaired (monthly)	620	210	195	45	10	20	52	29	58	59	1687	150	20	28	25	30	19	9
	* Billing efficiency (%)	72.5	85	87	80	72	100	84	80	70	70	81.2	90	92	90	80	80	69.4	40
	* Revenue collection efficiency (%)	82.61	75	79	65	79.3	85	71.5	72	87	85	91	88	70	80	48	60	32.8	58
	* No. of employees per 1000 connections	13	15	8	9	14.8	16	10.2	11	14	12	15	15	13	14	23	20	19	20
	* Total Expenditure against Budget (%)	58.8	<100	79	<100	95.4	<100	101	<100	<100	<100	78.4	<100	80	<100	82	<100	109	<100
	* Personnel expenditure as % of overall expenditure	31	<30	25	<30	18	<25	27.5	<30	<30	<30	14.1	<15	23	<30	28	<30	29	<30
(e)	O&M BUDGET ALLOCATION INDICATORS																		
	* Operational expenditure as % of overall expenditure	42.8	43	64.7	55.8	63.8	41.4	40	40	60.5	70	70	59	45	30	58.72	13	15	
	* Maintenance expenditure as % of overall expenditure	9.2	10	6.3	11.8	21.1	5.8	5	5	7.5	16	15	10	25	38	23.2	15	17.5	
	SCORE (%)	62		52		45		82		80		88		65		71		62	
	OVERALL ASSESSMENT	FAIR		FAIR		POOR		FAIR		FAIR		FAIR		FAIR		FAIR		FAIR	
	NOTE: >75% = GOOD																		
	50% - 75% FAIR																		
	< 50% POOR																		

Source : Ministry of Water, Urban Water Supply and Sewerage Division, march 2001, Appendix J

Annexe 1.2 UWSAs Details of performance evaluation, July 1999 – June 2000

S/N	DESCRIPTION	PERCENTAGE	ARUSHA	MOSH	MWANZA	TANGA	MBEYA	MORO	TABORA	BUKOBA	DODOMA	IRINGA	KIGOMA	LINDI	MTWARA	MUSOMBA	SINYANGA	SINDIGA	SONGEA	SHWAGA	
1 CONSUMER SATISFACTION																					
	Production/Demand	> 50		10						10											
		61-90	8			6	6	8		6		6	5	6	6	6	6	6	6	6	8
		31-60							6		6										
		<30																			
	Water Availability	>22hr			8	8		8		8		8				8			8		
		15-22hr	8																		
		6-14hr		8				6	8		6		6				6		2	2	6
		<6hr													2	2				2	
	Water Quality	Good	10	10		10	10				10		10			10				10	
		Fair						5	5	5					5				5	5	1
		Poor			1							1									
2 WATER DEMAND MANAGEMENT																					
	Unaccounted For Water	<25																			
		25-39	10			6		5		10			5		5		5		5	5	2
		40-50		8																	
		> 50			2		2			2		2			2				2		2
	Leakage	>90																			
		61-90	10																		
		25-60		5		8		5					6							2	2
		<25			2		2		2	2	5	2		2	2	2	2	2	2	2	2
3 FINANCIAL RESOURCES MANAGEMENT																					
	Operating Ratio	<1.0											5								3
		1.0 - 1.5	3	3	3	3	3	3	3	3	3	3			1	1	1	1	1	1	1
		> 1.5																			
	Accounts Receivable	<3 Months				5				5			5								
		3-6 Months	3	3	3						3	3			3				1	1	1
		>6Months					1	1	1												
	Revenue against bill	>90											6								5
		60-90	3	3	3	3	3	3	3	3					3					3	1
		<60									1	1		1		1	1	1	1	1	
4 HUMAN RESOURCES MANAG.																					
	Staff/1000 connections	<15	8	8	5	6	5		5												
		15-20						3			3	1	3	1	1	3		1	1	3	3
		>20																			
5 ACCOUNTABILITY																					
	Annual Accounts	<2Months																			
		2-4Months	5	5	8	5	5	5	5	8	5	6	6	5	5	5	5	5	5	5	5
		>4Months																			
6 COST RECOVERY																					
	OS/AR revenue	< 1.0				10															
		1.0 - 2.0		5	5			5					5			3	3	3	3	5	5
		2.0 - 3.0							3	3											
		> 3																			
TOTAL SCORE			75	60	45	66	60	48	48	47	48	34	60	31	33	48	38	33	47	41	

33

Source : Ministry of Water, Urban Water Supply and Sewerage Division, march 2001, Appendix I

Annexe 2.1 Standard septic tank and soakage pit. Moshi Municipality. Health Department.

JOB
STANDARD SEPTIC TANK AND SOAKAGE
PIT.

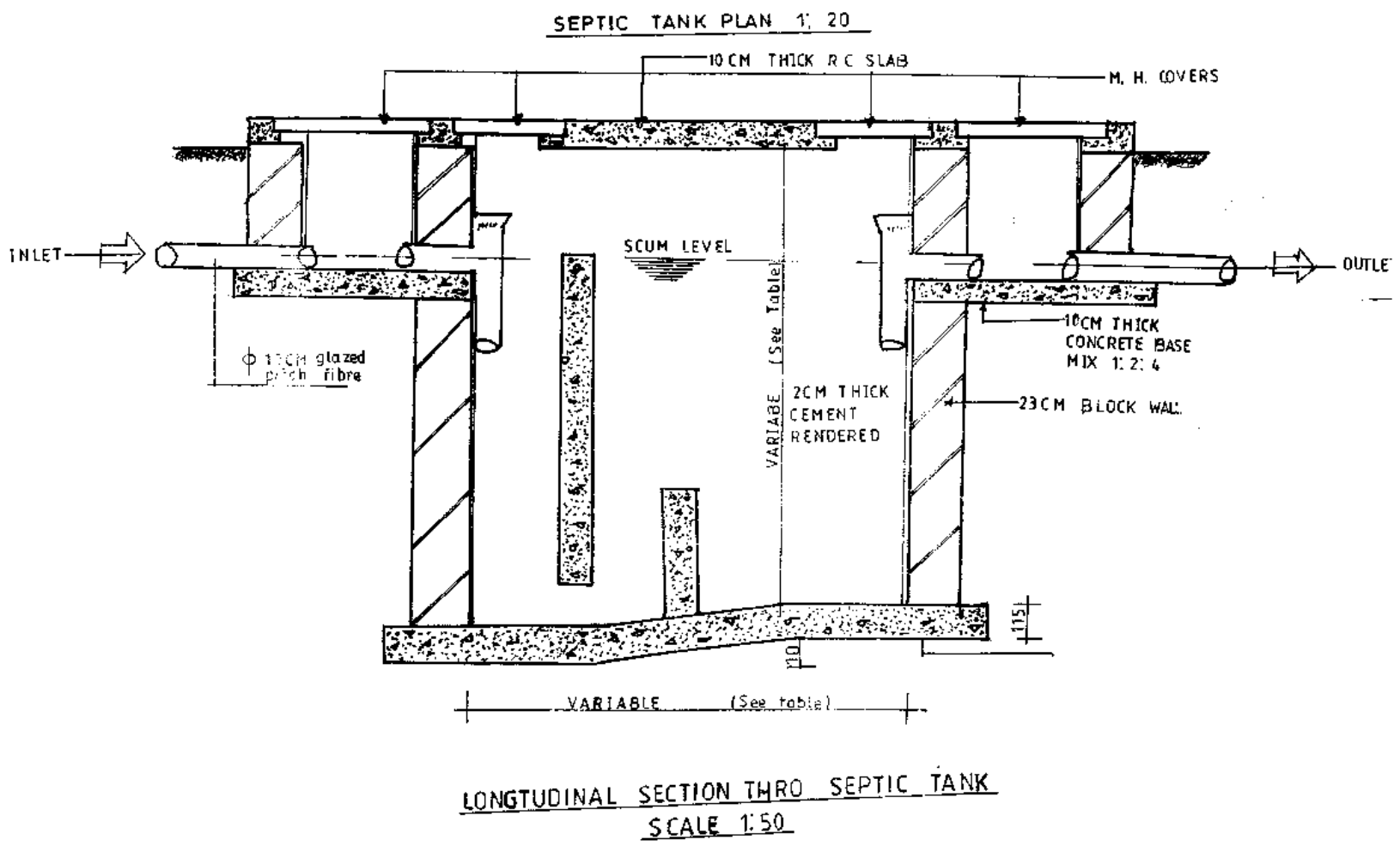
TITLE
PLANS AND SECTIONS FOR S.TANK
AND SOAKAGE PIT.

SCALE 1:20

TYPE	ALL WASTE NUMBER OF USERS	SOIL WASTE ONLY No OF USERS	DIMENSIONS			VOL		CAP
			LENGTH	WIDTH	DEPTH	CUM	GALL	
1		10	2134	640	1320	17040	431	
2	7	20	2590	752	1676	5318	736	
3	15	30	3048	914	1676	45137	1058	
4	30	45	3506	1119	1829	6570	1512	
5	40	60	3962	1211	1929	8391	1250	
6	50	75	442	1295	1929		2310	
7	60	90	4877	1372	1929		2390	
8	75	105	5182	1524	1929		3180	
9	85	120	5685	1524	1905		3680	

ALL WASTE NUMBERS OF USERS	SOIL WASTE ONLY No OF USERS	PERCOLATION FACTORS								
		4	9	16	25	36	42			
		DIA	DIA	DIA	DIA	DIA	DIA			
	10									
7	20	2743	3048	3505	3810	4420	4807			
10	30									
30	45	3048	3734	4282	4901	5258	5639			
40	65									
60	76	3353	4115	4724	5334	5944	6248			
66	90									
75	105	3658	4420	5105	5715	6248	5706			

Annexe 2.2 Standard septic tank. Moshi Municipality. Health Department.



3 Environmental Regulation– *Elisabeth Palela*

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3.1 Introduction

3.1.1 Background

Most urban centres in the developing world, and in Tanzania in particular, have been over recent years experiencing sanitation and health related problems. These problems have been compounded not only by increasing urban population growth rates but also by a combination of poverty, illiteracy and in adequate and in appropriate urban management. Thus poor sanitation is a problem not only in unplanned areas, but also in planned areas. According to Wright (1977), the urban poor, the largest group lacking sanitation services, make up more than half of the urban population in the developing world.

The percentage of people without access to sanitation services continues to increase. In 1990, at the end of the International Drinking Water & Sanitation Decade, 453 million urban people (or 33% of the urban population in developing countries) had no sanitation services. In the following four years, investment programs brought new or improved sanitation to 70 million city dwellers. In the same four years the urban population in developing countries rose from 1.4 billion to nearly 1.6 billion people. By 1994 the number of unserved people had risen to 589 million or 37 percent of urban population, (Wright 1997).

The urban poor are often not taken into account in municipal programs of improving services such as water, sanitation, garbage collection, roads, health care and education. And this is very evident in Tanzania and Moshi Urban is no exception.

Cramped and precariously constructed housing also creates physical problems in infrastructure development. For example construction of latrines or conventional sewers is much more difficult in the congested narrow streets and alleys of many of these settlements.

According to Kironde (1996), high density in urban areas necessitates advanced sanitation arrangements to minimise the risk of epidemics. Pointing out that the sanitation situation in Tanzania still leaves a lot to be desired. He adds that this is especially so in the densely occupied areas in unplanned settlements. Only a minority of urbanites is connected to central sewer networks or to septic tanks. By far, the majority rely on pit latrines.

Health indicators such as infant mortality and the incidence of diarrhoea have been shown to be much worse in crowded tenements and squatter settlements than in other areas. The Moshi District Medical Officer confirms this situation by saying that communicable diseases are most common in the low-income areas of Urban Moshi.

Human and domestic waste from any area has the potential to contaminate not just the local environment but also ground water, lakes and rivers used by many others for supplies of fresh water. Thus the sanitary crisis can take its toll on all city residents and on the national freshwater resources of developing countries (Wright, 1997).

Planning for the best management of sanitation is essentially a process of arbitration weighing up a wide variety of factors before deciding whether or not to promote a particular development or to go ahead with maintenance program. **One of the factors that is of increasing significance in weighing up the advantages and disadvantages of in understanding the impact of such management on the environment.**

Management of the environment is closely linked to sustainable development, i.e. the use of renewable and non-renewable resources for present needs without jeopardizing future/long term needs of the other biotic components.

Therefore to insure sustainability in development, the environment becomes a major concern that needs special guidance in managing. The focus of the conducted study was on environmental regulations seeking to find out to what extent they are reflected in sanitary practices in Moshi urban district.

3.1.2 Study objectives

This study is looking at the environmental aspects of sanitation management in Moshi Urban. It has been conducted with the objective of:

- Evaluating the capacity of areas to absorb waste and refuse in the context of high demographic growth

3.1.3 Questions to be asked included

- What is the impact of sanitation practices in localities?
- Does the data available allow the establishment of state of matters in the localities and to chart out the volume of refuse and the absorption capacities of the soils?
- What information is necessary in the light of evolution of urban densities, to allow the monitoring of zones in which autonomous sanitation is possible?
- How can one create a system of information, which can be shared by different actors in order to give greater attention to the environmental quality of localities?

3.1.4 Hypothesis

The study is guided by the following hypothesis.

- The impact of sanitation practices is not well known especially because of insufficient data available

3.1.5 Methodology

The environmental study was conducted in early 2002 through the use of questionnaires and interviews, which were conducted with officials of Moshi Urban Water Supply and Sanitation Authority (MUWSA), the Municipal leaders (especially the Health Officers) the Drilling and Dam Construction Agency, the Pangani River Basin Project, (Moshi and Tanga offices), and the Urban Planning Department in Moshi .

Physical surveys and observations were made to various localities within the Municipalities to examine sanitary practices in the areas. The major focus was on the high population density areas of Njoro, Kaloleni, Mji Mpya, Pasua and Majengo. Shantytown was also observed to represent a medium/ low density unplanned area.

This selection was made considering the fact that poor sanitary practices, if present, would have more environmental and hygienic impacts on high-density areas than elsewhere.

Observations methods of liquid and solid waste management, and sewerage disposal in these different localities. Moreover the income status of the people in different localities was assessed, in order to understand how their income influenced their type of access to sanitation services. Visits were made to the MUWSA waste stabilization ponds, the Municipal dumpsite and some water sources such as Njoro spring so as to assess the situations in these areas.

3.2 Environmental Regulations

Like many other developing countries Tanzania has recently realised the importance of environmental management in all sectors be they profit making or service providers. To ensure that there is effectiveness in achieving this goal, there are sets of policies, laws, by-laws and regulations that have been put forward to guide the process.

Sanitation is one of the areas, which have been given some consideration in policy statements', laws, regulations and the like. The only concern is to what extent these policy statements; laws and regulations are actually being implemented on the ground. This section highlights some policy statements, laws and regulations focusing specifically on sanitation practices and the environment.

3.2.1 Policy

The National Environmental Policy (1997) has stipulated policy objectives which incorporate sanitary practices in the following areas:-

Technology: "The primary policy objective shall be the promotion of the use of environmentally sound technologies, that is, technologies that protect the environment, **are less polluting**, use all resources in a more sustainable manner, **recycle more of their wastes and products, and handle residue wastes in a more acceptable manner** for which they are substitutes."

This objective is meant for the industries and how they should take care of their waste.

Health: "The main objective here is to protect public health, not in the narrow though indispensable sense of airing diseases, but in the broad sense of promoting human well-being and informed participation in primary environmental care. The policy objectives to be pursued are: -

- a) Provision of community needs for environmental infrastructure, **such as safe and efficient water supplies, sewage treatment and waste disposal services**; and
- b) Promotion of other health-related programmes such as food hygiene, **separation of toxic/hazardous wastes and pollution control at the household level.**

These policy objectives reflect on the health sector or in this case the Municipal council where by the health department would be responsible to ensure that these objectives

are met. Unfortunately., the Moshi municipal council has not been able to achieve these objectives mainly due to lack of resources, but efforts are still in progress.

3.2.2 Laws, Acts and ordinance

3.2.2.1 The Local Government (urban authorities) Act No.8 of 1982.

Functions and Duties of Urban Authorities

54 (1) It shall be the responsibility of each urban authority as a local government authority, subject to this Act-

to promote the social welfare and economic well-being of all persons within its area of jurisdiction;

Subject to the national policy and plans for rural and urban development, to further the social and economic development of its area of jurisdiction.

55 (g):- “To keep and maintain, in good order and repair all public latrines, urinals, cesspits, dustbins and other receptacles for the temporary deposit and collection of rubbish, and public bathing and washing places, and to provide for the removal of all refuse and filth from any public or private place, and provide for the removal of night soil and the disposal of sewage from all premises and houses in its areas, so as to prevent injury to health.

This concerns the Moshi Municipal Council but through observation this is not being effected (at least not sufficiently). Apart from not being able to provide exhaustive and proper sanitary services to all private places (residential ones inclusive), the public places are not well maintained either. This was evidenced at the Njoro market place whereby the latrines were full and according the market traders the situation had been that way for some time and they were not sure when it would be dealt with.

3.2.2.2

Sewerage services for Moshi Municipality was handed over to Moshi Water Supply and Sewerage Authority (MUWSA) in 1st July 1998 following amendment and enactment of Urban Water Supply Act No 8 of 1997 and Water Ordinance Cap 281 by the government of Tanzania .The primary objectives for the provision of services by MUWSA are:

To safeguard the health of Municipal residents and neighbouring villages and

To maintain the environmental status of the Municipality against the effect of unsafe disposal of wastewater from domestic, commercial and industries. (MUWSA 2002).

3.2.2.3 Ward Development Committees Act, 1969 No.6 revised 1996.

The Function of Ward Committees among others is:

1. Committee may:-

- a) subject to the approval of the minister, initiate schemes for development of the area constituting the ward;
- b) do such other acts and things as the minister may direct

2. For the purposes of subsection (1) a scheme for the development of the area constituting a ward includes a scheme:-
 - c) For the construction of works or buildings for the social welfare of the people residing within such areas.
 - e) For the construction of any work of public utility.

Powers of the committee

Every committee shall have power to make an order requiring all adult citizens of the United Republic resident within the area constituting the ward for which the committee is established to participate in the implementation of any development scheme and to require persons who are liable to participate and who fail to participate and who fail to participate without reasonable excuse, to make such contribution either by payment to the committee of such sum of money being in excess of the maximum sum prescribed by regulations made under this Act or by delivery to committee of such goods or other property as may be so prescribed.

With these functions and powers vested on the committees, it means the committees are in a position to effect schemes focussing on proper sanitation practices and environmental management with full participation of the people.

3.2.2.4 The Public Health (sewerage and drainage) CAP 336 of the laws annual-Supplement 1955

Under **protection of public sewers** states that:

1. No person shall construct or cause to be constructed any building over a public sewer save with the written consent of the authority first obtained.
2. The authority may give written consent to the construction of a building over a public sewer provided that such sewer is constructed of cast iron or steel or if of stoneware, concrete or asbestos cement the sewer is encased all round and throughout the length of sewer which may be under the proposed building in not less than 6 inches of 1:3:6 concrete; consent shall not at any time be given to erect a building over a man-hole or other means of access to a sewer.

Under part VIII **offences** it states that:

3. Any person who pollutes the water in any river, stream or watercourse or in any body of surface water to such extent as to be likely to cause injury directly or indirectly to public health, to livestock or fish, to crops, orchards or gardens which are irrigated by such water or to any product in the processing of which such water is used shall be guilty of an offence and liable upon conviction to a fine not exceeding one thousand shillings or to imprisonment for a period not exceeding six months or to both such fine and such imprisonment or in the case of a second or subsequent conviction to a fine not exceeding two thousand shillings or to imprisonment for a period not exceeding one year or to both such fine and such imprisonment and in every case where the offence is a continuing one to an additional fine not exceeding one hundred shillings in respect of every day during which the offence has continued.

These laws clearly state that waters should be protected from pollutive acts hence sanitation inclusive. With the kind of river and stream pollution present within the Moshi Municipal, it means someone should take responsibility. The question would remain whether it is the individuals carrying out these pollutive practices that should be held accountable, or the responsible authorities who are vested with the responsibility of ensuring that these improper practices do not exist to begin with.

3.2.3 Other sectoral legislations

Other sectoral legislations responsible for improvement of specific aspects of the environment that could be applied include :

- ◆ The Water Utilization Act No. 42 of 1974 with amendments e.g. No. 10 of 1981, and 1998 governing water resources.
- ◆ The Land Act No.4 of 1999 and the village Land Act No. 5 of 1999 controlling land development in urban and rural areas respectively.
- ◆ The National Environment Management (NEM) Act No. 19 of 1983.
- ◆ Water Utilization (Miscellaneous Amendments) 1997.
- ◆ The Urban Water Supply Act, 1981.
- ◆ The Water Act. No. 8 of 1959

3.3 *Moshi Municipality*

3.3.1 Location

Moshi has an area of 58kms², it lies approximately 3°18'S and 38°20' E on the Southern slopes of Mt. Kilimanjaro. It is the administrative, commercial and tourist centre of Kilimanjaro Region and the entire Northeast Tanzania. (Moshi Environmental Profile 1999).

3.3.2 Population

The population of Moshi has grown from 8,048 inhabitants in 1948, to a projected 216,375 in 2001. The annual population growth rate is 6.2% and doubling every decade (Ibid 1999). The estimated number of households is 21,600, with an average of five people per house. The population density is estimated at 3.275 people per sq. km (Moshi Municipality 2002).

3.3.3 Socio-economic activities

The main activity sectors in Moshi include, housing of which 51% are built on planned areas and the rest in unplanned areas the unchecked rate of rural urban migration has led to higher residential densities in unplanned areas. Other sectors include, water supply, industry, solid waste management, liquid waste management, tourism recreation and forestry, Transport and communication, commerce and finance, energy supply, urban agriculture, health services and education.

3.4 Sanitary Practices

3.4.1 Sewerage services in Moshi Municipality.

Moshi town has an advantageous topography that provides a necessary gradient for natural drainage into Karanga, Rau and Kiladeda Rivers and ultimately the Indian Ocean. Njoro juu stream also drains into Rau River after collection of run off from a number of natural gullies. Of the total cubic metres discharged daily only about half is disposed through the central sewerage system (Moshi Environmental Profile 1999).

Moshi urban has 4 types of sewerage sanitation systems:

1. Sewage system
2. Septic tanks
3. VIP latrines (ventilated improved pit latrines)
4. Soil pits

The most dominant sanitation systems are the use of septic tanks, VIP latrines and soil pits. The soil pit is just a hole without lining. The durability of the soil pit latrines depends very much on the geology of an area it is located. It is important that the toilet is not built on a rock to allow waste to filter through.

3.4.1.1 The Municipal sewerage system

The Moshi Authority is running a conventional system of collection, treatment and disposal of sewage from domestic, commercial, institutional and industrial centres within the Moshi Municipality.

In 1999 improvements were made to the central sewerage system. This involved two central lines passing Kiusa and Kilima, followed by extension of new system around Majengo area also in the same year. Later on there was construction of conventional waste stabilisation ponds hence leaving the trickling filter system, which was used at the time. The rehabilitation was partial focusing on just 2 lines that were not functioning properly and which were seriously blocked and leaking. The general performance of sewer line was poor.

A MUWSA official pointed out that the remaining (un-rehabilitated) system was not very bad, but some parts were still not functioning well due to poor design and material. He said the increase in population was leading to frequent cases of leakages and blockages. The MUWSA official gave examples of such areas being ; Mission Street- Bondeni Ward, Mbuyuni Street- Bondeni Ward, Lenguo-Mawenzi Ward and Njoro Street, which is also in – Bondeni Ward. He said problems in the areas were caused by the old age of the pipes, which had grown weak, revealing that the original system was established in 1954. He also attributed these problems to population growth, and poor planning, which had led to haphazard construction of residential units done on top of sewerage pipes and even worse, on top of manholes (an offence under The Public Health (sewerage and drainage) CAP 336 of the laws annual– Supplement 1955). Thus, it is difficult to trace a leak or blockage in such cases. The situation is very dangerous in term of ground water and soil contamination and people's health status.

The sewerage network coverage at the time of the study (2002) was about 4.06 out of the total 58 square km. of Moshi Municipality. This coverage is realised after the support from The Urban Sector Rehabilitation Project (USRP) for

rehabilitation of 5000m of the existing network and construction of new network of about 8411m that aimed at improving the status of services provided and increasing the number of customers connected to the services. Following its expansion, the population that was served with sewerage services in Moshi Municipality, had increased from 7% to 37%, which was about 65% of the total area covered by the sewerage network within the Central Business District (CBD).

The sewerage system is directed southward of the town to stabilization ponds in Mabogini area where the effluent enters river Rau into the Pangani basin ending up in the Indian Ocean. There is no treatment, but rather natural stabilization of wastewater.

The treatment plant is designed to receive 4,500 m³ per day but at the time (2002) it was receiving only 2,592-3,456 m³ per day depending on season. During the rainy season or when there was high consumption of water, the amount it received increased. Septic tanks were disludged by cesspits, which was the responsibility of the Municipal Council. The cesspit tanks/or trucks made about 90-100 trips per month.

According to MUWSA, a regular quality control and monitoring is done considering the amount of suspended solids. The parameters tested are according to the, (WHO) and Tanzania Temporary Standards (TTS). Unfortunately not all recommended parameters are measured due to lack of laboratory apparatus. Moreover the Municipal health department is also responsible for testing the effluent quality. According to the health officer this is conducted every after three months.

Table 1 showing some of the tested parameters of effluent at the end point of the waste stabilization ponds according to WHO standards. (Jan.2002)

	WHO	Effluent actual (January 2002)
1) Suspended solids	100 – 800 92
2) Temperature effluent	5°C 22 °C
3) PH	6.5 – 8 8.9
4) Electroconductivity	300 – 1,200 3.7
5) Biological oxygen demand	100 – 600 35mg /l
6) Nitrate	0 – 30 8.2mg/l
7) Sulphide mg/l... ..	NIL 0.105
8) Herminth eggs	NILNo reagents

-----→**Source :-** MUWSA January 2002

The missing measurements are many if compared to the effluent standards (see appendix 1). This indicates that the quality of the effluent could in fact be acceptable in relation to the tested parameters but we are not sure whether the degree of acceptability would still be the same were other parameters also tested. The uncertainty of this alone, poses a threat to the users of the receiving rivers and streams, and to the environment in general.

Although there has been some improvement in the coverage of the sewerage system, still it is very small, and even in the area where the network is available, very few households have been connected. Before these improvements only 195 households were connected to the system, however, after the improvement in 1999-2002 about

1,561 households were connected to the system. According, to MUWSA, the main reasons for the hesitations on connecting are basically financial and lack of understanding or information about the system. The effectiveness of the system may still not be very clear.

This being the case, most of the households are using simple systems such as septic tanks, VIP latrines and soil pits for disposal of sewerage since these are more economical and convenient to them. But the main concern is that there is a large number of houses that have opted for this type of sewerage disposal while its reliability in terms of the environment is not well understood.

Some of the areas visited e.g. Njoro have revealed very threatening realities in relation to sanitation practices. The area has high population density and is dominated by a low-income population that uses pit latrines and soil pits as a common disposal system. Due to the fact that a considerable part of the area is located on top of a rock, the pit latrines are shallow in nature and hence experience a lot of over flowing especially during rainy seasons.

River Njoro is running through the area, and as a result, it is highly polluted from these over flows and other domestic waste that flows into it. This has resulted in health problems for the people living in the areas as they use this river water for domestic purposes.

3.4.1.2 Industrial wastewater and sewerage disposal

There are about 6 industries on the Western part of the Municipal namely Kibo Match and Kibo Paper, which release their effluent into the Njoro stream; Bonite bottlers and Kibo Breweries, that release into Karanga river and Moshi Leather industry that releases into Njoro stream. On the South, there is the Municipal treatment plant, which is relatively not very pollutive compared to the past when the tricking filter was in use.

The Coffee curing industry is the only industry that is connected to the sewerage network. According to the MUWSA Office, the remaining industries have their own treatment plant (or rather disposal mechanisms) and make pre treatment of the effluent.. e.g., these industries include among others, Kibo Match, Bonite Bottlers, and Kibo Breweries. According to the Pangani River Basin official responsible for water quality, these industries have private ponds of which during rainy season they over flow into the streams, thus causing pollution.

According to the municipal health officer, Kibo Match industry is producing very little water and that the affluent is treated through sedimentation tanks, slow sand filter and 2 ponds, which are exposed to evaporation. She pointed out that the industry had not had problems of sludge. On the other hand an officer responsible for water quality in the Pangani Basin revealed that the same industry was responsible for discharging raw flows into the river. This is probably the reason why the health officer pointed out that in 2001the tested parameters for effluent had exceeded Tanzanian Temporary Standards (TTS). In this, case the Industry was advised to use supplementary material.

The health officer revealed that two industries, Kibo breweries (seized production this year (2002) and Bonite Bottlers are permitted to release water / effluent into the rivers. The data provided by Pangani River Basin on quality of wastewater produced by the industries in Moshi (table 2) reveal that the standards are in some cases extremely exceeded, which is an indication that the industrial wastewater is not safe. The data reveals that on this particular occasion Kibo match , Kibo Paper and Kibo breweries had some parameters which were way above the acceptable standards (table 2).

Like the wastewater treatment ponds, the health officer explained that industrial effluent is also checked after every three months adding that surprise visits are made when the office feels there is a problem as a strategy to keep the industries in check all the time. She added that after the tests / measurements are made; the results are communicated to the council and community.

Table 2 Wastewater analysis results for Moshi industries (18/3/2002)

Sampling position/ Sample source ()	Kibo Match last evaporating pond (waste water)	Kibo Paper outlet to paddy fields (waste water)	Kibo breweries discharge point Karanga River (waste water)	Moshi wastewater stabilization ponds. (Wastewater)	Maximum permissible value, water utilization Act, Amendment 1981	NEMC proposal 1997	World Bank, general guidelines 1998
Ec. $\mu\text{s}/\text{cm}$	2270	434	1516	339	-	-	-
Temp. °C	27.0	28.0	29.0	30.0	See appendix 1		
pH	6.60	6.50	4.47	10.3	6.5 - 8.5	6.5 - 8.5	6 - 9
DO mg/l	1.3	0.1	0.0	9.7	-	-	-
BOD5 mg/l	80.0	180.0	235.0	45.0	30 - 40	30	50
Phosphates mg/l	6.5	21.0	10.5	3.3	6.0	-	-
Ammonia mg/l	48.5	38.5	13.5	8.5	10	-	10
Zinc Mg/l	56.5	-	-	-	1.0	5.0	2
Cr VI mg/l	6.25				*	0.1	0.1
Cu mg/l	0.19	-	-	-	1.0	2.0	0.5
AL mg/l	-	0.11	-	-	-	-	-

Source: Pangani River Basin Tanga 2002 / Ministry of Water river basin Management (see Appendix 1) .

The following table (3) gives the sewerage production estimates for industries not connected to the sewer. (some are not operating at present)

Table 3 Sewerage production (own disposal)

Industry	Daily Average Flow	BOD (mg/l)	PH
Kibo Paper Mill	2,700m ³	2400	6.71
Tanzania Malting	1,500m ³	2000	6.84
Moshi Textile	52m ³	-	-
Bonite Bottlers	120m ³	-	-
Tanzania Bag Corp.	52m ³	-	-

Source:- Urban sector engineering project (1995)
Final preliminary engineering design. Page (7/5)

Apart from the industries that release their effluents into the Njoro stream, the stream also receives all surface runoffs from the town. The stream is also the main source of water for lower Moshi irrigation scheme. The unfortunate fact is that people in Mabogini and elsewhere along the stream path also use this same stream. With the realisation that there is overflow of waste water from the waste water ponds from the industries, and town surface runoff, it is no surprise that there are frequent outbreaks of water born diseases such as dysentery and cholera in the down stream.

According to the 2001 environmental profile at ward level for Moshi West Division among others, the pollution of River Karanga results from effluents from Kibo Pulp and Paper Factory and Bon Bosco limestone industry. Also building of houses close to the river, bathing and disposing human waste in the river contributes to pollution. Hence causing down stream users to be affected by water borne diseases.

3.4.2 Solid waste services in Moshi Municipality

3.4.2.1 Waste collection

According to the Director of Moshi Municipal Council, one of the biggest problems facing Moshi Municipal is solid waste management. A Municipal health officer pointed out that a total of 200 tons were being generated daily but the council manages only 100 tons and out of which only 60 tons are collected daily (table 3).

Another official from the Health Department within the municipality revealed that 145 tons of solid wastes were being produced per day as domestic and commercial waste (.table 3) This shows an increase of 45 tons compared to the estimated 100 tones which was recorded in the 1999 environmental profile. And while in 1999 the amount of solid waste collected was about 55 tones daily the officer said at present only 60 tons out of the total waste is collected by the municipal and most of this is being produced in the CBD.

This means that about of 85 tones of waste is un-disposed of and this is only for the CBD.and other areas, which are provided with the service. If one is to add the amount of waste generated from the unplanned or unserved areas, than it would mean that an alarming figure of uncollected waste is generated. This is very hazardous both environmentally and hygienically as the 1999 environmental profile indicated that an average 47 tones of estimated solid waste per-day were left uncollected. However out that 30% was used as animal feed and compost while 20% was either burned or buried leaving a daily estimated 24 tones uncollected or unmanaged. These alternative practices are still being used to date and the rates may have increased in terms of numbers but the problem is growing even worse due to population growth. If in 1999 uncollected waste was 47 tones per day and at present it is 85 tones, then it means the situation is getting worse. While the estimated waste produced has risen by 45 tones from 1999 – 2001/2, the amount collected by the Municipal has only increased by 7 tones.

Table 3 Estimations and distribution of waste generation in the Moshi Municipal

Total generation	200 tones daily		
Domestic and commercial:	145 tones		
Institutions:	8 tones		
Industries:	47 tones		
	High income	Medium income	Low income
Total population (2001)	54.899	90.217	71.216
Generation per capital (kg/day)	1	0.6	0.5
Quantity / day tones	55	54	36

Source: - Moshi Municipal councils collection inventory year 2000

This situation is worsened by the fact that the town's terrain slopes towards the south hence during the rainy season the heaps of uncollected waste are washed away by rain water, thus blocking drainage systems and polluting streams. Likewise the flooding aggravates seepage from the disposal site into the nearby river. (Sustainable Moshi Programme 1999).

Matters are even worse in the unplanned and squatter areas where due to inaccessibility and shortage of trucks, uncollected piles of garbage are building up. This is not only unattractive for the eye but the longer the piles remain, the more hazardous they become as leaching takes place hence affecting the underground and surface water. Moreover, the decaying garbage produces fault smell, which attracts flies, rodents and other insects that accelerate the spreading of diseases in an already poor hygiene area.

3.4.2.2 Dumping site

Haphazard waste disposal has been observed at the dumping site at Kaloleni, no sorting of different categories of waste is done hence one would find metals, plastics, food stuffs, papers etc all piled up in the same area. Even some industrial

waste is found in the area. This is a very dangerous method of waste disposal. The report indicated that uncontrolled dumping leads to seepage, water contamination and the spread of water-borne diseases. Also incidental fires at the dumping site are likely to cause Upper Respiratory Tract (URT) and carcinogenic infections.

The dumping site is located near a residential area although the Health Municipal Officer pointed out that the dumpsite has been there for the past 30 years and that the people and the industries have encroached into the area much later. This situation creates risks to those who live near-by because scavenger birds tend to move from the dumpsite to the peoples' homes hence carrying along some items or garbage to the settlements. This causes the spread of diseases and if the scavenger is to land near or in a stream, for a drink then the water will also be contaminated.

The Municipal director pointed out that there was a crude dumping site in Kaloleni, which was full, and in desperate need of replacement. He revealed that after trying unsuccessfully to secure land within the Municipal area, the Municipal managed to secure a 4 hector piece of land earmarked as a dumping field at Bomang'ombe about 30 km away from Moshi. Preparations for this project though, were still underway.

3.4.2.3 Initiatives to improve situation

According to the municipal health officer, the plans to sustain the new Bomang'ombe landfill include:

- ◆ Increasing the present fleet of 2 skip loaders to three.
- ◆ To increase the number of buckets from the present 30 to 60 in five years time
- ◆ To increase revenue towards solid waste management. This will be in accordance to the current Bylaw amendments in process, which is geared towards enabling the council to collect fees and charges in areas which are not contributing towards solid waste management expenses these include households in peri-urban areas, markets, bus stands and institutions.
- ◆ To privatize refuse collection to CBOs in peri-urban areas. Reducing the current workload to the department.
- ◆ To improve enforcement of the principal legislation and Bylaws governing management of solid waste.
- ◆ To sensitize the public on waste separation and recycling.
- ◆ To prepare a sustainable council's waste management policy by June 2003.

3.4.2.4 Industrial waste disposal

According to the Municipal Health Official, all industries are responsible for the collection and transport of solid waste to the dumpsite at their own costs. Where the Municipal finds it necessary then the Municipal collects the waste and the industries pay for the number of trips, the digging and burying of the waste within the dumpsite. This was done for the leather industry (now not operating) because of the nature of the waste produced, in order to ensure proper disposal.

With this self-service kind of management, it is not easy to control and to ensure that these industries are really following the proper procedures of industrial waste disposal. This is dangerous especially if there are industries, which produce hazardous wastes. The 1999 environmental profile for Moshi confirms this argument as it says: - “There is grave danger of ground water contamination due to crude dumping of untreated wastes and lack of necessary expertise and equipment to monitor the quality of industrial discharges.”

The profile goes on to highlight the possible impacts on human health for those using the water both for domestic and agriculture. It mentions the contraction of debilitating intestinal and skin diseases as being among the health impacts resulting from intake or external use of the contaminated water, food etc.

3.4.2.5 Hospital waste disposal

According to the Municipal health department, KCMC and Mawenzi hospitals wastes are incinerated in respective hospitals. The Municipal Health Officer said that there was an idea of using the old trickling filter plant site for hospital waste incineration. If this is to be done then there is a need for a lot of precaution on how this hospital waste is going to be transported to the site as the site is located some distance from the town centre. Any leakages or outlets from the containers could be catastrophic to those living along the path taken by the carrier and the nearby population. Likewise, even more consideration should be given to those located near the proposed site. This decision need not be rushed. A comprehensive Environmental Impact Assessment (EIA) needs to be conducted before anything is put in place.

Hospital waste such as needles are supposed to be disposed of in containers, and protected in pits that are lined and tightly sealed. The health officer though, expressed that with the growing numbers of private health facilities, it is not easy to monitor or to ensure that all practitioners are following the proper procedure of hospital waste disposal. This situation is very discomfoting as far as human health and the environment is concerned.

3.4.3 The Relationship between Income Status, Sanitation and Environment in Urban Moshi

Observation made have revealed that there is a close link between the income status of the people, the type of environment they live in, as well as their sanitary practices.

These observations involved seven areas within the Municipal being both planned and unplanned areas, and of high, medium and low-income status. The income status was purely from observation of the type and quality of houses (i.e. materials used in construction, whether temporary or permanent the size and other aesthetic factors) found in the area. The areas in which the houses were situated were also used as an indication. Referring to whether the area was easily accessible, organised, squatter, availability of services such as water, roads, electricity ect, and whether or not it is a marginal area.

Areas of poor economic status such as Njoro are characterised by temporary building materials such as mud and wood. Also the environment proved to be very poor as solid waste collection seems to be very minimal if at all present. Most residents are practicing autonomous sanitary management i.e. in sewerage and domestic waste disposal. .

Moreover it is a squatter area to a great extent established on marginal land. Not all parts of Njoro are accessible due to the overcrowding and haphazard construction of low quality houses and also due to the character of the terrain in the area. The area has suffered great erosion resulting from rain water flowing towards the area from the town into the Njoro stream hence causing gullies and exposure of the wider lying rocks.

The level of income of most people in these areas results to poor handling of both solid and liquid waste (human excreta inclusive) as they are not able to afford the construction of proper sanitary facilities. Most of the people living in these areas depend on very small scale informal activities such as selling food stuffs, either in the market place or on the road sides others especially women sell baked foods such as donuts and the like or vegetables and fruits by caring them around or putting them on the front of their homes. Many seem not to have permanent employment. None of these activities really could enable these people to afford to have a decent life in terms of material wealth. Therefore these people tend to do whatever basic practice will pull them through with the little resources they have the main target being to survive.

Making matters worse, the Njoro area is on top of a rock, which makes it impossible (with the resources available) for the people in the area to dig deep latrines, septic tanks or even solid waste disposal pits. This being the case most pit latrines in this areas are built with the depth being established by elevating the latrines but in some cases even that is not affordable so the latrines are very shallow.

The result of this practice is overflowing of these pit latrines especially during the rainy season. The overflow may also result from the fact that the latrines are filled up. This is dangerous health wise as it leads to outbreak of diseases such as diarrhoea, dysentery etc. But more dangerous is the fact too that once the outbreak takes pace people are not economically in a position to protect or treat themselves and with their already poor diet, recovery is also very difficult.

What is even more critical is the fact that some of these pit latrines/ soil pits once full, are emptied manually by human means e.g. use of a bucket and rope. This threatens the health of those carrying out the exercise, as they have no protective gear. Also, another matter of concern is the dumping site/destination of this liquid waste. The point of destination will not only be experiencing excessive organic material disposal in the soils ,but this material could easily be carried into a river or spring, hence causing water contamination and pollution.

Moreover children tend to walk and play bare foot and even bath in the contaminated water (of course not only contacting the contaminated water but adding to it as well), which result to diseases such as worms and skin diseases.

Solid waste disposal in areas like Njoro, include throwing garbage on the banks or within the river Njoro and even a greater portion of the solid waste is dragged into the river from the surrounding settlements especially during the rain season. (Plate 6) This, plus the overflowed latrines create a very dangerous health hazard to those using the water of this and any other river, experiencing the same situation. This situation is a result of not having waste collecting services in these areas the one municipal skip basket was spotted at the Njoro market but due to the inaccessibility of the more interior parts (where the situation is critical) this services is not available letting the people use autonomous alternatives.

The unfortunate fact is that the people who use these rivers are the same ones who are responsible for this contamination. The rivers provide water for domestic use and to some extent small-scale agriculture. But this could be more a result of lack of clean water supply (tap water) as MUWSA has not been able to cover all areas with this service. It could also be a result of inability to pay for the service large part of urban Moshi has functioning water-meters for every customer.

Also observation reveals that areas with medium to high income status, such as, Shanty town have a much different approach to sanitary management. In some cases those which are near to the CBD are connected to the central sewerage system (these are very few) but for those who have to connect, or are living in the unplanned areas of the municipality, they tend to use more decent or favourable kinds of sanitary practices including construction of septic and seepage tanks which indicates that even their toilets are more modern, such as flush toilets and the like. These are in most cases facilitated by Municipal Cesspit trucks, which are responsible for the emptying of these septic tanks. The individual pays for the service.

Also being well off economically, it is probably easier to educate and make aware this category of individuals on the importance of connecting to the sewerage system than it is to those living in more or less poor economic situation.

Other areas experience a mixture of both high and low income characteristics and sanitation practices hence become mixed e.g. Pasua Majengo Mapya, Majengo and the like. These areas tend to have very well built houses and modern toilet facilities using septic tanks or in cases such as the Majengo area some are even connected to the main sewerage system. On the other hand there are those with not so attractive houses, permanent, but poorly built or even those with day houses these tend to have either pit latrines some VIP's and others can only afford to use the most basic means which is the soil pit. With this kind of mix, diseases are likely to affect all economic categories regardless the practices used by others in the area.

These improper autonomous sanitary practices are of great concern especially environmentally because large part of Moshi urban is not planned and that being the case, Municipal authorities are not in a position to advise on the construction of septic tanks or pit latrines, as these are not official sites. As a result, the people have to a great extent depended on autonomous builders who may not be well informed on

the designs and environmental precautions to be taken into consideration during construction.

Hence, these autonomous builders tend to build through experience or in other worse cases such as construction of soil pits no experience is even considered. It is just a matter of digging a hole (depth of choice or convenience) and constructing a shed over it and covering the hole with materials such as wooden boards, iron sheets and any other materials that may seem suitable. This is not only dangerous environmentally and hygienically, but could also be catastrophic to life if the covering materials are not stable enough.

Environmentally, This haphazard habit of construction of autonomous sanitary facilities could lead to the contamination of underground water, out break of diseases. According to the District Medical officer communicable diseases are most common in the low-income areas. Revealing that in the year 2000 there were 2,702 reported cases of diarrhoea and 3,354 cases of intestinal worms. be this being the case, this situation needs to be seriously considered as always this impact has far more reaching effect, Wright (1997) clearly explains this phenomenon by pointing out that, “human and domestic waste from any area has the potential to contaminate not just the local environment, but also groundwater, lakes, and rivers used by many others for supplies of fresh water. Thus the sanitary crisis cant take a toll on all city residents, on the national freshwater resources of developing countries.”

This means ignoring the improper practices that are being used by the poor who have no assistance in improving their economic situation, could actually jeopardize the whole community poor and rich.

3.4.4 The Impacts of improper sanitation practices.

According to Winbald et.al. (1985), Many infections of human beings are spread through inadequate sanitation. Viruses, bacteria, protozoa and worms may spread through direct contact, indirectly via food, water and soil or via carriers and vectors. He adds that infection from taking in food or drink contaminated with faeces may lead to viral diseases like poliomyelitis, infectious hepatitis and gastroenteritis; bacterial diseases like cholera, typhoid, paratyphoid and bacillary dysentery; protozoal disease like amoebic dysentery and giardiasis; and worm infections like ascariasis, trichuriasis and pinworm are passed on when people touch faeces and then food or drink.

According to the Municipal Health Officer, common health problem in Moshi Municipal, include malaria, dysentery and diarrhoea. According to the Health Officer, poor sanitation practices contribute more than 60% of all health problems mentioned above. These diseases may be transmitted through –

- Contamination of water sources
- Improper use of water sources
- Poor disposal of liquid and solid water
- The prevailing of vectors that carry disease pathogens

Unfortunately ground water has not actually been tested for sanitary pollution.

According to the Municipal Health Office, the environmental threats that may result from sanitation systems include over-flowed pit latrines, odour/foul smell from pit latrines (due to poorly constructed), sewerage water from domestic houses to the streets and old age of the system and uncontrolled dumping site. The officer also confirmed that there have been several reports of these problems to the office. The health officer though, explained that a greater percent of these problems is reported from the outskirts of the Municipal due to probably poor infrastructure including water supply, roads, housing etc.

According to the MUWSA sanitation engineer, traditional pit latrines/ soil pits cause 100% pollution. According to him, this is in terms of producing odour that results from lack of oxygen, as there are no significant processes taking place inside the pit latrine. Secondly he pointed out the danger of underground water pollution/contamination. The engineer also added that VIPs, septic tanks and especially seepage pits were also not very safe environmentally as they allow seepage of wastewater. He argued that the way to remove the pollution, for people to connect to the central sewerage system. The problem with this suggestion though, is the fact that the coverage of the system is still very small and still the issue of poverty is a major hindrance.

3.4.5 Solutions / efforts made

Winbald et.al. (1985), explains that for all the diseases mentioned above, the most important measure is to dispose of faeces in a sanitary way and to protect food and water supplies.

To deal with such problems brought about by improper sanitation practices, the health office said, that her office insures that there is no environmental damage through enforcement of environmental sanitation by-laws. She also explained that her office provides advice on:-

- Proper handling of refuse to the general public,
- Proper sanitation practices to women and NGO groups, and
- Water sanitation to women and other groups

This advice is given several times during meetings, health education programmes, Ward Development Committees (WDCs) meetings, seminars etc. the officer claims that there has been some success in this.

3.4.6 Data / information availability

The data available is very minimal and does not reveal the state of matters in the localities. For instance there is no information on the soil types nor seepage or absorption capacities of Moshi soils in specific localities. Secondly the exact depths of the water table in specific localities is not established hence no precaution taken especially during the construction of autonomous pit latrines/soil pits.

Likewise there is no exact estimate of solid waste produced on daily basis since not all areas within the Municipal (for example Njoro) are served with skip baskets so estimations made are from the areas with such services.

Furthermore data/information on groundwater and surface water contamination resulting from sanitary practices is not well established. For example data on parameters such as faecal coliforms is not readily available. For instance the drilling and dam construction company only measures such parameters as PH, salinity, alkalinity etc but no biological test or measurements are made. This is dangerous to those who utilise water from these wells and dams. Reasons most commonly given both by MUWSA and the drilling company, are that, the test is expensive and they do not have the proper facilities (laboratories) to conduct such testing. Also adding that the test is very time sensitive as a delay in testing by hours may lead to faults result hence even testing this parameter in Arusha or Tanga may not give proper results if a delay is to occur. They pointed out that the tests could be conducted at the KCMC but it would be very expensive.

Nevertheless, the sanitary engineer strongly pointed out that bacteriological, chemical and physical analysis was very necessary and important. He said the office used to test hermnith eggs but this does not give direct numbers of faecal coliform (which goes against the standard guidelines for bacteriological examination. Box 1). He also emphasised that testing faecal coliform was very important and though it was not being tested in the past, arrangements are now in progress to ensure the testing of this parameter.

Guidelines on water quality seem to put great emphasis on this parameter (box 1), and explaining the presence of organisms of coliform group to indicate pollution in the widest sense. Although the stream and river waters in which the effluents are released may not be conventional sources of water, they still need to meet these standards as a great number of people in Moshi urban depend very much on them.

The implication of not having bacteriological testing is very serious. One needs to weigh the cost of measuring or testing such parameters and taking action soon, against allowing the parameters to go untested and incurring more expenses in form of drugs and other medical services. What makes the latter outweigh the other is the fact that a greater price, which cannot be converted into monetary terms, is also paid and that is the loss of human life.

What is even more worrying though, is whether the information / data that is being obtained is accurate. This is due to certain data on BOD5 analysis (figure 1) provided by the MUWSA where there are cases of such extreme abnormalities in measurements that one would have to wonder if the information is correct.

Box 1. Examination of Water Quality

1.1 Bacteriological Examination

It is essential to check periodically during the operation .

SUBSTANCE	UNIT	W.H.O		STANDARD FOR RURAL WATER SUPPLY IN TANZANIA
		ACCEPTABLE	ALLOWABLE	
1. Coliform count per 100ml at 37°C	Each	-	16-3	1-3
2. E. Coli. Count per 100ml at 44°C	Each	NIL	NIL	NIL

1. 98% samples should not contain any coliform organism in 100ml
2. up to 3 contain is allowed in Occasional Samples but not consecutive samples.
3. not occurring repeatedly of which improvement to sanitary protection should be sort, or alternative source should be found.
4. No sample should contain E.Coli in 100ml.

Bacteriological examination should include colony counts of micro-organisms on non-selective media, and examination for faecal streptococci and possibly for costridium per fringes as well as for coliforms organisms and Escherichia

Organisms Indicative of Faecal Pollution

Organisms used as an indicators of pollution are E. Coli and the coliform group.E. Coli is of faecal origin. The Coliform group may be of faecal origin and should be assumed that they are all of faecal unless a non-faecal origin can be proved.
Organisms of coliform group are all foreign to water and their presence should be an indicative of pollution in the widest sense.

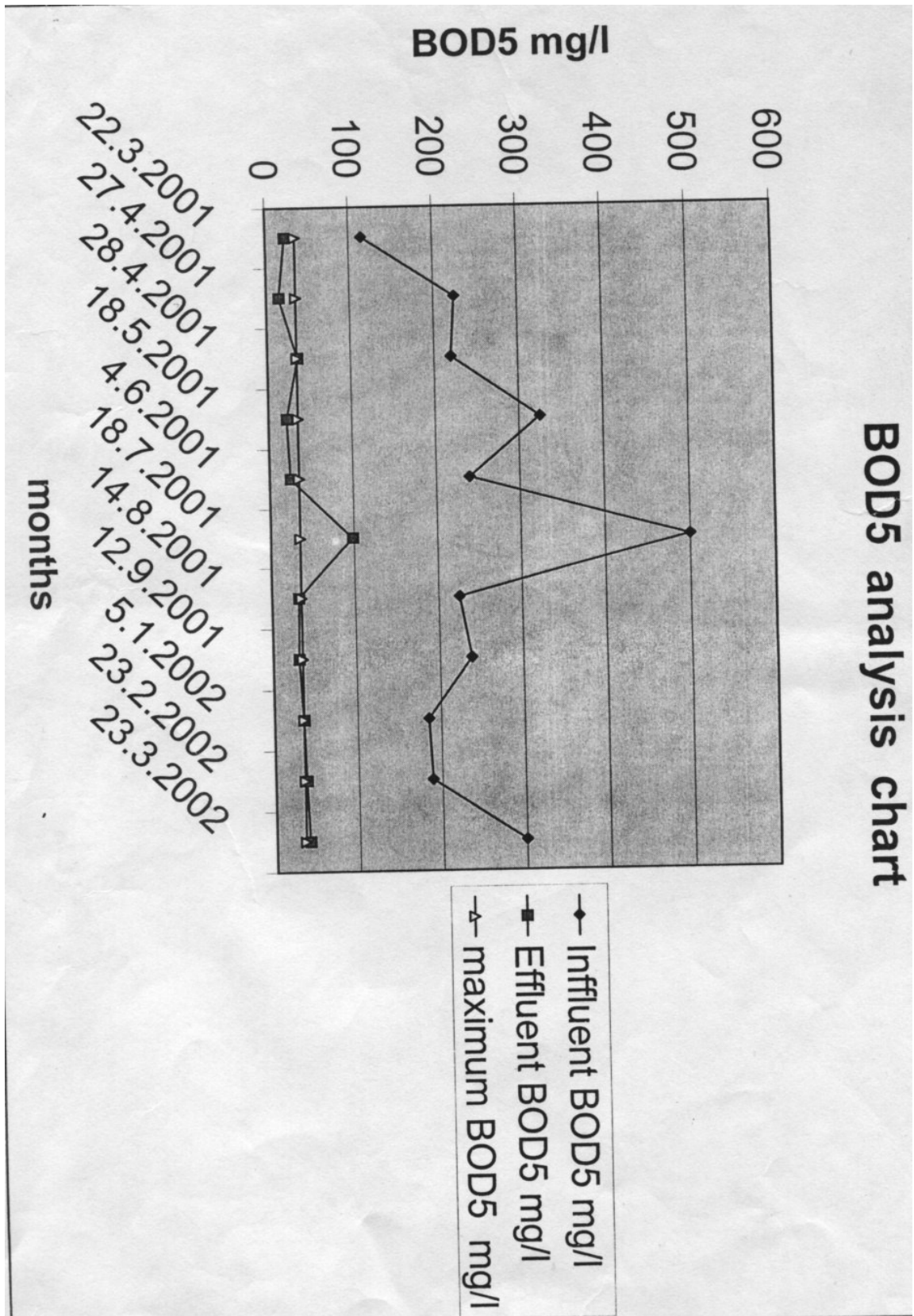


Figure1 BOD analysis chart 22/3/2001 – 23/3/2002. Source: MUWSA 2002

Bacteriological analysis report prepared for a particular association (private) on 11/03/1999, from Karanga spring intake (Njoro) revealed that the water was contaminated by faecal coliforms, (thus unsatisfactory) recommending treatment by chlorine before use or boiling as an initial action to be taken. The bacteriological data collected from down stream (River Karanga) in the village (on the same date) indicated the number of faecal coliforms as being too numerous to count (TNTC) meaning the water was highly contaminated by faecal coliforms and other materials, therefore full treatment was recommended before use. The test was also conducted along the river and from water in a container from a home in the village and the results were 243 faecal coliform/100ml in the first instance and TNTC in the latter (Regional Water Engineer's Office Arusha 13/03/99).

With this kind of data it is evident that River Karanga was facing contamination resulting from sanitary practices, but this analysis was done on request therefore, there is no information on the trend of the bacteriological status of the river and streams so long as there is no private request or intention of installing a water pump in the area for supplying water.

According a hydrologist in Moshi – no hydrological study has been done in Moshi that would provide information such as how connected the aquifers are, flow, direction and velocity of water and the like. He said soil analysis was important as that would provide information on the absorption/seepage capacity of the soil and the ability of the soils of specific localities to perform natural cleansing depending on the soil composition etc.

This being the case it means no exact information or data on the seriousness of ground water pollution caused by sanitary practices can clearly be determined or realised. Bearing in mind that the drilling and dam constructing company does not do bacteriological tests. The chemical tests could help to find out the extent of heavy metal pollution resulting from leaching taking place at the dump site but even that can not be easily associated unless it is with in the vicinity of the dump site.

The sanitary engineer from MUWSA also said that his office does not have the necessary data for sewerage expansion for the specific localities and for charting out the volume of sewerage. He listed that the data needed includes: estimation of waste water generation, the geological formation so that if there is a rock then there will be need for excursion, soil type, level of water table, ground water recharge, flow results from per capital consumption of water.

He pointed out that because of lack of data (in the office) this responsibility is usually given to a consultant who collects the data together with a contractor who will be responsible for the construction but then it seems the information is not surrendered to the office.

3.4.7 Information necessary in light of evolution of urban densities

With an annual population growth rate of 6.2%, Moshi urban is experiencing pressure especially on the provision of social services. In-migrants (from within and outside Moshi), in most cases tend to occupy the marginal areas. This is mostly the

case with rural urban migrants who are usually in search of greener pastures and do not have the financial means to occupy more suitable areas. Since these marginal areas are treated as free zones, the migrants become autonomous in their ways of living as well, and this includes even their sanitary practices.

The danger of this is that in most if not all cases, the practices are without due consideration of the environment, as these people do not have the financial means of providing themselves with even the basic necessities for living. With the rapid trend of population growth therefore, and expansion of the town, there is a need to have in place mitigation measures so as to reduce if not do away completely with the environmental implications of these practices. This can only be done, where there is accurate and reliable information that covers every corner of the Moshi municipal.

Municipal health office suggested that there is a need to have environmental profile data from each ward. If that idea is to be taken on board, then the information that would probably be necessary may include among others:

- Population density, and growth rates resulting from natural increase and migration into the wards would help in forecasting future needs for sanitary infrastructure in the respective wards. It will also provide projections for the number of autonomous facilities to be expected in the future and hence ensure that proper control mechanisms are put in place.
- Population quality in every ward especially in terms of employment and education levels. This will assist in targeting the unemployed and uneducated in sanitary education and proper sanitary facilities as it is this group, which more often than not, practices improper sanitation.
- The social services available in every ward and their sufficiency as compared to the population growth such as garbage collection and disposal facilities, clean water, sewerage disposal facilities,
- There is need to find out the common disease outbreaks in the wards and whether they relate to improper sanitary practices.
- The dominant sanitary practices in the wards e.g. number of V.I.P latrines, soil pits, seepage pits and septic tanks and their conditions.
- The present environmental problems facing the wards, their causes and effects on the people.

3.5 Recommendations

- There is a need for all actors and stakeholders to come together or be involved in the planning, development establishment, monitoring and evaluation of sanitation practices in the localities.

These stakeholders should include:

- The MUWSA
- The Moshi Municipal
- All urban Moshi residents (representative at ward level)
- Local government leaders
- Sustainable Moshi project

- Pangani River Basin
- The Drilling and dam construction company

The MUWSA establishes and controls urban water supplies, imposes water rates and prevents water pollution (Environmental Profile, 1999). It is in a position to provide data on the amount and quality of water supplied, the coverage of conventional water supply in the municipal, main pollutants of the water sources etc.

The Urban Water Board is responsible for the operation and maintenance of water supply systems (Moshi Environmental Profile 1999).

The Municipal Council through the Council Department of public health and social welfare is supposed to maintain public latrines and the central sewer while the works Department caters for surface water drainage. (Moshi Environmental Profile 1999).

The drilling and dam construction company is an independent ground water facilitator to individuals and institutions it is in a better position to provide information on ground water quality.

Pangani River Basin is responsible for all information concerning rivers, springs and streams passing connected or in relation to the Pangani Basin from source of the water, passage, soil etc and testing quality of the water passing through urban areas, from industries etc into agricultural plots and main river channels.

The local government has a responsibility of ensuring the well being of its community in general.

The Moshi residents are the ones who use the resources and hence need to know about their well-being and how to best manage them for sustainable development.

This being the case then, it can clearly be seen that there is an overlap in either the responsibilities or interest in particular resources in this case water seems to have many actor all with different or overlapping intentions but each actor playing an isolated role.

- The Municipal should use the power vested in it by law to provide for private practitioners in the area of sanitation management but with a strong monitoring role on how it is handled to ensure that there is no environmental damage.
- Ward development committees should develop schemes that would improve the economic and hence environmental well-being of its people. These schemes should be the initiative of the people themselves and the people should be willing to participate fully in the planning implementation, monitoring and evaluation stages of the scheme.
- The Municipal Health Office suggests that a working group in sustainable Moshi Programme be established to work on information system. If this is so, then

there is a need to establish a permanent database concerning sanitation management that is frequently updated and revised. The data available should be shared among the stakeholders to ensure that all are well and equally informed. Changes reported should be communicated to all stakeholders.

For instance the type of information should include: the number of connections to the main sewer, number of pit latrines and average depth, ground water quality, type of diseases and causes of outbreaks, as well as data on environmental issue collected by different actors.

- There is need to fill the existing information gaps because the information is non continuous. For instance, there are cases where certain data is only available for several years then there is a huge leap in between before more data is available. Furthermore, storage and handling of this information once acquired is also very important.
- Causes and solutions to environmental degradation or distribution in localities should be discussed collectively and not through instructions and orders to the residents. The residents need to be made a part of the campaign in sanitation management in that way they will be more willing to cooperate in improving the environment in which they live in.
- Education on safe and environmental friendly sanitary practices needs to be given to the masses. There is a need to have practical demonstrations on how best to construct and use the proper sanitary facilities.
- There needs to be a clear demarcation between MUWSA and the Municipal in their responsibilities and roles in sanitation management. the consequence is that there are areas which have serious environmental problems but no one seems to be responsible.
- The urban planners need to plan for the residential areas so as to avoid haphazard construction of houses and hence sanitary facilities.
- There is a need to create a monitoring mechanism that will ensure safe and proper disposal of both solid and liquid industrial and hospital waste. If possible the disposal of such waste should be done under strong supervision of the Municipality, to ensure that proper care and procedures have been taken.

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Appendix 1



Water Resources Management Review
Effluent Treatment and Water Quality Standards

Substance	Maximum permissible value, Water Utilization Act, Amendment 1981	NEMC, proposal 1997	World Bank, general guidelines, 1998
Manganese	3.0 mg/l	5.0 mg/l	-
Mercury	0.005 mg/l	0.005mg/l	0.01 mg/l
Nickel	0.2 mg/l	0.5 mg/l	0.5 mg/l
Selenium	0.5 mg/l	1.0 mg/l	0.1 mg/l
Silver	0.1 mg/l	0.1 mg/l	0.5 mg/l
Tin	2.0 mg/l	2.0 mg/l	-
Vanadium	1.0 mg/l	1.0 mg/l	-
Zinc	1.0 mg/l	1.0 mg/l	5.0 mg/l
Alkylbenzyl sulphonate	2.0 mg/l	5.0 mg/l	-
Aromatic and aliphatic hydrocarbons	1.0 mg/l	5.0 mg/l	-
Aromatic nitrogen containing compounds	0.05 mg/l	0.05 mg/l	-
Chloroform extract	-	10 mg/l	-
Formaldehyde	1.0 mg/l	1.0 mg/l	-
Grease and oils	5 mg/l	10 mg/l	10
Non-volatile chlorinated compounds	0.05 mg/l	0.05 mg/l	-
Organochlorine pesticides (Cl)	0.005 mg/l	0.005 mg/l	-
Other pesticides	0.01 mg/l	0.01 mg/l	-
Resins, tar, etc.	2.0 mg/l	5.0 mg/l	-
Volatile chlorinated hydrocarbons (Cl)	0.05 mg/l	0.05 mg/l	-
Phenols	0.2 mg/l	1.0 mg/l	0.5 mg/l
Coliform Bacteria	-	-	< 400 MPN/100 ml

- = No limit set or proposed
* = Difficult to read

Faecal Coliform < 1000 per 100 ml - WHO (1989)

Appendix 2

QUESTIONS FOR INTERVIEW

Moshi Urban Water and sewage authority

1. What are the main types of sanitation systems in Moshi?
2. Which is the most dominant?
 - How does it operate?
3. What type of central system is being used?
 - What % of the population does it cover?
4. Where is the sewage from the central system directed (outlet)?
5. Is there any treatment of sewage prior deposition?
 - What type of treatment?
6. What is the quality of treated sewage after its treatments? (Below standard, above standards or standard) what are the acceptable standards?
7. Have there been any improvements to the central sewage system?
 - When where they made?
8. Was the rehabilitation/improvement for the whole system or partial? If partial, what percent?
 - How big a difference has the improvement made? (past %)
9. What is the condition of the remaining system (with no improvement)?
10. When was the original system put in place (year)
 - What area did it cover?
11. Does you office/department/project know the estimated volume of refuse in Moshi Municipal?
 - If yes what is it?
12. What are the absorption capacities of the soils in Moshi Municipal? Are they adequate for wastewater management?
13. Was an EIA conducted prior to the establishment of the original structure? What was the conclusion?
14. Was an EIA conducted prior rehabilitation? What were the results?
15. What in your opinion do you think could be done to improve the present situation?
16. Are the industries connected to the central system? If no how do they dispose of their sewage?
 - Is their effluent within acceptable levels if not what does the authority do to ensure quality control?

Municiple Environment Department (no environment department hence health department to respond)

1. What is the role of your office/department/project in the sanitation of Moshi Municipal?
2. Is your office/department/project aware of any environmental threats, which may result from the various sanitation systems?
 - If yes what are they?
3. Have there been any reports of environmental problems resulting from sanitation practice?
 - Which are these?
4. Is your department involved in the planning of sanitation projects/activities in the municipality?
5. If yes what part does it play in the decision-making?
6. Does your department conduct EIA?
7. If yes has it conducted any EIA prior to any sanitation project in the municipality?
8. If yes what were the recommendations given?
9. Has the department given any kind of environmental directives or advice to the public especially where autonomous sanitation is concerned?
10. How is autonomous sanitation monitored to insure there is no environmental damage?
11. Is there any relationship/link between the environment department and MUWSA? What is it?
12. What in your opinion do you think could be done to improve the present situation?

Municipal Health Department

1. What are most common health problem in Moshi Municipality?
2. What percent of these problems are associated to poor sanitation practices?
 - How are they acquired?
3. What advice is given by your office in relation to sanitation management? To who?
4. To what extent has this advice been carried out and to what success?
5. Does the health department have any relationship with the environment department? At what level is this relation?
6. What is the role of your department as far as sanitation is concerned?

7. Is the health department in anyway involved in sanitation projects e.g. Prior, during or after the setting up of sanitary system be they central or autonomous?
8. How much does your department incur for purchasing drugs that are related to sanitary diseases every year?
9. What has been the trend in sanitary health related problems? (i.e. past-present)
10. In what part of the municipal are most sanitary health problems reported?
- Why?
11. What is the estimated amount of effluent from industries?
12. How is solid waste disposal managed in urban Moshi?
13. How do you manage hazardous waste such as hospital and industrial waste?
14. Are there any private initiatives in solid waste management?
15. What mechanism is used in collecting and managing domestic waste especially in unplanned areas?
16. How do you plan to manage the abandoned dumpsite?
17. What in your opinion think could be done to improve the present situation?

The Drilling and dam construction company

1. In what parts of the municipality has your project drilled/constructed wells?
2. What is the average depth of a well?
3. Are your wells shallow or deep?
4. Do you conduct a survey before drilling a wells?
5. What criteria must be met before a site is considered suitable?
6. Have you ever encountered situations where the sites were not suitable?
7. What are the common factors that have led to classifying a site unsuitable?
8. Do you test the quality of the water?
9. Have there been cases of contaminated water in some localities? If yes, which localities are these?
- Does the contamination have anything to do with improper sanitation practices?
10. Does the project conduct any monitoring of the wells after completion if yes what is the interval?

11. What is the absorption capacity of the soil in various localities of the municipal?
12. Is the effluent deposition within the soils absorption capacity?
13. Does the project think that the sanitation practices in the municipality pose any threat to the underground water supply?
14. Is the project in any way involved in the planning of sanitation projects? (Participation)
 - Is yes what is the projects role in the decision making for sanitation practices.
15. What should be done to improve the present situation?
16. Have there been cases of contamination sometime after completion and use of the well?
 - What are the common contaminating elements?
17. In such cases what does the project do?
18. Does your office conduct a bacteriological test of the water?

PART 2

THE IMPROVEMENT OF THE SANITATION SERVICES IN MOSHI (TANZANIA)

ANALYSIS OF HOUSEHOLDS DEMAND

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- Msuya Benson : Interviewer for the landlord survey
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- Mushi Charles : Interviewer for the landlord survey
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0. Introduction

In this report, we summarize the results of the study on the households demand for sanitation. Together with the regulation analysis, which focuses on the institutional supply and management of sanitation services in Moshi, the demand analysis mainly focuses on households. Studying the demand of households for sanitation services means assessing the current situation of the sanitation on the plots of the town - including perceptions, behaviours and equipments- and the willingness and ability of the households to improve this situation.

The households' demand for improved equipments was assessed by using a contingent valuation method with "willingness-to-pay" bidding games. The contingent valuation method consists in submitting a scenario of improvement to the people and asking them how much they would pay to get this improvement. The willingness to pay questions were asked by using bidding games which recreate the common habit of people of bargaining to purchase goods. Comparing the willingness of the interviewees to pay for improved facilities with the current prices of the market then allows to draw conclusions on prospects for improvements and recommendations for public policies.

Five months of field investigations including different methodological tools and approaches were necessary to devise the final household survey and its "willingness-to-pay" questions. We will explain in the first part of this report this methodological process and the rationale for using these different methodological tools. We will begin by describing how collective interviews and key-actors interviews helped to find a first set of answers. We will also see that these preliminary investigations, together with two surveys focused on the craftsmen of the sanitation sector and the micro-credit market, were useful to correctly design the questionnaires of the household-survey. Focusing on the final investigations, we will then present the questionnaires used for tenants and owners of plots who were interviewed randomly, and the questionnaire especially designed for landlords of rented plots. After explaining the sample process, we will finish this part by describing the culmination of these field investigations: the implementation of the household and landlord surveys.

After this methodological part we will focus on the current situation of sanitation in Moshi. We will begin by showing that, even if they are aware of the risks of water-born diseases, people do not rank sanitation problems as a major issue compared to other environmental problems. In order to put the households' behaviours and choices of sanitation equipments into the perspective of public policies, we will then trace the history of the sanitation policies and programmes in Moshi since the independence. By doing so we will review the different collective equipments which exist in Moshi and we will then be able to look at the households' behaviours and facilities which include on-plot facilities. We will detail the characteristics and prices of every kind of equipment.

The last part of the report will be devoted to the study of the households' demand for improved facilities. Investments in rented plots need an agreement between landlords and tenants; taking this constraint into consideration, we will see that in the current market situation, there is only a demand for two kinds of improvement on these plots: the improvement of existing latrines to ventilated ones and the connexion to the sewerage. On the owners' side (people living on the plot they own), we have found that there is also a demand for purchasing these two kinds of equipment. There is also a demand for investing in soil pits from owners, which increases if we take into account their willingness to work on building the facilities.

1. Methodology and presentation of the survey

This research work was aimed at drawing up a better knowledge of the current demand for sanitation equipments in Moshi (household’s facilities and behaviours) and valuating and explaining the potential demand for improved ones. We explain in this part of the report how we devised investigation tools and the research process in order to achieve these objectives. Before proceeding with the household’s and landlord’s surveys¹, five months of field work have been carried out including collective interviews called “focus groups”, repeated discussions with key local stakeholders (Moshi Municipality and MUWSA), a survey on craftsmen working on the on-plot sanitation sector, another survey on the microfinance market in Moshi and a cartographic update of the surveyed areas.

January 2002	February 2002	March 2002	April 2002	May 2002
Focus groups Plot interviews		Drawing up of household’s and landlord’s questionnaires	Sampling	Surveys
Microfinance survey				Pre-test survey
Craftsman-survey			Interviewers training	Data capture

Table 1 Investigation schedule

1.1. Preliminary investigations: collective and individual interviews

1.1.1. Collective interviews

Focus groups are discussions in small groups (5 to 20 people) which allow to collect a first set of qualitative information. Conducted before the surveys, these discussions give the main trends of the tackled topics. During the design of the questionnaire this information then allows to select the most pertinent questions, to eliminate the questions with simplistic results and to precise the modalities of the close-ended questions. Eleven focus groups -with landlords, tenants and owners of their plot- and seven semi-directive discussions inside rented plots have been carried out during the first month of investigations.

1.1.1.1. Methodology: Focus Group and plot interviews

Focus Group

Eleven focus groups have been carried out (see Table 2), three in the town centre (Kiusa and Bondeni wards), six in dense sub-urban areas (Mji Mpya, Pasua, Kaloleni and Kiboriloni wards) and two in rural areas (Msaranga and Karanga wards). These discussions were conducted in Swahili by a Tanzanian research assistant well accustomed to this technique, another assistant was taking notes in order to make the transcription from the recording easier. The coordinator was directing the discussion according to a set of topics or general questions related to the type of people met (tenants, landlords and owners of their plots), these discussion guides were evolving interview after interview². All the focus groups have been organised in less than one month:

¹ Hereafter we will call “**owners**” the people living in a plot they own and “**landlords**” the people renting rooms or plots to tenants. The household survey included “tenants” and “owners”.

² Discussion guides are available in appendix in their first and in their last versions: 2 guides for the Tenants and Landlords, only one guide for the Owners.

Date	Location (Kata)	Type of people met	Number of men	Number of women
13/01/02	Kiusa	Tenants	4	6
17/01/02	Kiusa	Landlords	6	0
18/01/02	Mji Mpya	Tenants	0	7
22/01/02	Kiboriloni	Tenants	6	0
29/01/02	Kiboriloni	Landlords	4	0
29/01/02	Pasua	Landlords	7	2
30/01/02	Msaranga	Owners of their plot	4	3
31/01/02	Karanga	Owners of their plot	0	8
31/01/02	Mji Mpya	Landlords	7	0
04/02/02	Bonden	Tenants (4) and Landlords (10)	6	8
05/02/02	Kaloleni	Owners of their plot	7	0

Table 2 Focus groups

Plot interviews

As a supplement to the focus groups with tenants from different plots, seven informal and semi-directive plot interviews have been conducted³. The plots were chosen randomly (or rather according to the “goodwill” of the inhabitants) in pre-selected areas. Conducted by two people including a translator these discussions were most of the time done in such hours that the women, busy with their daily housework, were the only persons to be present in the plots.

Date	Location (Kata)	Type of plot	Number of men attending the discussion	Number of women attending the discussion
16/01/02	Majengo	14 people, 3 families, 8 rooms, tenants only	0	3
16/01/02	Mji Mpya	15 people including six sisters owning the plot, 6 rooms	0	6
16/01/02	Mji Mpya	10 people, 2 families, 3 rooms, tenants only	0	3
28/01/02	Njoro	14 people, 9 families, 9 rooms, only tenants including the son of the landlord	0	5
28/01/02	Njoro	Approximately 40 people, 13 families, 16 rooms	2	2
28/01/02	Njoro	26 people, 7 families, 7 rooms, tenants only	0	3
28/01/02	Njoro	13 people, 3 families, 4 rooms, tenants only	0	2

³ See discussion guides in appendixes

Table 3 Plot interviews

1.1.1.2. Findings and Lessons

Preliminary studies conducted in Moshi in 2000⁴ had pointed out some topics that should be focused on in future in-depth surveys. The collective interviews were therefore used to investigate these new issues like relationships between landlords and tenants and the cooperation inside the rented plots. More traditional issues like gender, financial behaviours and sanitation behaviours were also treated during the discussions. We are presenting now the major findings and lessons related to these subjects and emerging from these first set of investigations.

Sanitation: Behaviours, Satisfaction levels, Willingness To Pay for improvements

The main lesson drawn on the sanitation issue was the validation of the hypothesis that tenants systematically refuse the idea of investing in their plot. Neither do they want to work for the building of new equipments without compensation.

We can illustrate this kind of attitude with some comments heard during a discussion in a big plot in Njoro ward. The tenants attending the interview were asked how they would use the amount of 50 000 Tsh if somebody was giving it to them, the only constraint being that they would have to use it collectively in the plot. Usually the answer was a common investment in business activities but in this case there were too many people living in the plot to allow this kind of agreement. So, after thinking a bit, as nobody had any answer, somebody suggested that they could organise a big party and everybody warmly welcomed the idea. We then suggested that they could use the money to improve the facilities in the plot and they were also unanimous in rejecting this idea. Thus we can see that if the tenants are even refusing to invest external resources in their plot it makes no sense to consider that they could share the initial cost of an investment with their landlord.

It is therefore taken for granted that the landlords have to pay the initial costs of an investment in the plot but that the tenants contribute to these expenses by an increase of the monthly rent. From these results, which also emerged from the discussions with landlords, there are two lessons to be learned:

- In the context of our study the willingness to pay (hereafter WTP) questions for tenants must be expressed in the form of increases of monthly rent.
- Landlords are stakeholders that can not be ignored. Studying the dynamics of the improvement of facilities on the rented plots requires to implement specific investigations on landlords' rent increase and investment behaviours.

Relationships between tenants and landlords

Even if tenants and landlords agree on the way of improving the facilities on the plots all of them have the strong belief that the other side would never have the will to reach such an agreement. Tenants think that the landlords would never want to invest and landlords believe that the tenants would never agree to a rent increase... It is therefore patently obvious that there are communication and coordination problems between tenants and landlords. These problems certainly come from a mutual negative perception of the other group.

We can indeed learn from the discussions that apart from the suburban areas where the relationships seem to be cooperative, conflicts are latent in the city centre, an area where

⁴ See Milanesi, 2000

there is a current shortage of accommodation supply. Tenants accuse landlords of being only interested in the rent they get from the rooms and not caring about their living conditions in the plot: “If we want to see the landlord”, we were told by a tenant from Kiusa ward, in the town centre, “it’s very easy, we only have to delay the payment of the rent and then he’s coming. Otherwise we never see him!” On their side, the landlords often complain about the incessant delays of the rent payments, the damages caused to the plot by the tenants and even sometimes about their morality...⁵

In addition to these first qualitative results about relationships between landlords and tenants, the answers collected during the collective interviews allowed to correctly design the questions included in the “Tenants”⁶ and “Landlords”⁷ questionnaires.

Gender

There are no features common to all households emerging from the discussions on this issue. In some of the households, sanitation and investment matters are shared by wife and husband; in others, the wife is making the decision after consulting her husband... There is actually no typical frame of decision making in the couples, even if some women, due to the development of their economic activities, seem to get a significant influence in the decision making⁸.

Cooperation inside rented plots

Tenants are generally cooperating well in the plots. Many people questioned on this topic were even insisting on precisising that they were living “*kama ndugu*”, which means “like relatives”. Different kinds of solidarity indeed exist inside the rented plots; the people are used to help each other for childminding or in case of difficult situations like illness or death. These plots are also often structures of savings through the “*upatu*” (tontines) and of course, units of collective life with its own rules of tasks and cost-sharing.

This information allows us to assume that plots are quite homogeneous structural units and then, using some precautionary methodological tools⁹ in the design of the willingness to pay questions, to aggregate the households’ demands for improved sanitation facilities into demand by plot.

Financial behaviours

Discussions during the focus groups or plot interviews confirmed that there is a lack of financial institutions in Moshi. According to our interviewees, since the collapse of the Tanzanian Housing Bank there is no public or private institution providing loans for housing improvements. This information has been later on confirmed by the survey on the financial market¹⁰.

Many landlords stated that this lack of credit supply was one of the most important reasons of their absence of investment on improved facilities on their rented plots. Discussions even showed that they often have a precise idea of the borrowing conditions which would allow them to invest (with interest rates between 10 and 15% for instance).

⁵ For more details see in appendix the report « Renting property market in Moshi », Samwel J. Embenezery (Research assistant, University of Dar es Salaam).

⁶ See appendix, Tenants questionnaire, questions III.13 to III.30.

⁷ See appendix, Landlords questionnaire, questions of part II.

⁸ See Creighton, Omari, p146

⁹ By giving time to think and to talk with their plotmates (see questions in appendix)

¹⁰ See 1.2.2 Survey on the financial market

Owners didn't have such kind of concerns about loans for housing improvements. They expressed more needs for loans for economic activities but it is also interesting to note that many of them didn't really know how financial institutions operate. Financial resources are indeed mostly directed to other kinds of channels, "upatu" (tontines) for instance are very widespread and operate on several levels (plot, neighbourhood, working place...). The money from these informal groups of saving is however more intended for small productive investment, small purchases and as an insurance for difficult or unexpected situations. Loans also exist but mostly between individuals like friends, parents or neighbours. Savings, finally, can take very different forms: monetary to banks, postal bank or people (often shopkeepers) or in kind, in crops or livestock kept at home.

1.1.2. Key-stakeholder interviews

As a supplement to the collective interviews and according to our double objective of completing our knowledge of the local context and preparing the questionnaires of the final surveys, we had regular discussions with the key stakeholders of the sanitation sector in Moshi.

The employees of the Moshi Urban Water and Sanitation Authorities (hereafter MUWSA) and in particular M Filbert Nyangwe, the sewage technician, informed us about their technical practices, their problems and their expectations concerning the sewage network. Their collaboration allowed us to design questionnaires close to the local realities, in particular concerning the costs of connexion to the sewer and its availability in the different wards (we thus know for every household surveyed if its house can be connected to the sewer or not). Their good knowledge of the on plot-sanitation sector helped us also a lot for the craftsman-survey¹¹.

As the Municipality, through its health department, is managing on-plot sanitation issues in Moshi we also worked closely with Ms Kombe, sanitation engineer and head of the sanitation sector in the Municipal Council. She contributed to the good functioning of the survey by her advice and in particular by a last check on the households' questionnaire.

Several discussions with the head of the planning office of the Municipality, Ms Kinawiro, have occurred too during this first stage of the research and particularly during the set up of the sample of the survey.

Several lecturers and professors from the Cooperative College of Moshi and the University of Dar es Salaam have been met and consulted too.

1.2. Additional surveys: craftsmen and financial market

1.2.1. Craftsman-survey

29 craftsmen working on the on-plot sanitation sector have been interviewed. The questionnaire used for these interviews was divided into two parts¹².

The first part was concerning their general activity (proportion of activities related to sanitation, legal status, number of employees,...), the state of the on-plot sanitation market in Moshi (competition, partnership, evolution of the household demand), their perception of the difficulties to spread improve sanitation technologies, their socio-economic characteristics and their level of education and professional training.

¹¹ See 1.2.1 Craftsman-survey

¹² See craftsman-survey questionnaire in appendix

In the second part, the craftsmen had to detail the costs in materials and labour of four types of equipments and improvements: improvement of traditional latrines to ventilated latrines, Ventilated Improved Pit Latrines (hereafter VIP), soil pit and septic tank.

1.2.2. Survey on the financial market

Several institutions with different statuses (public, private, non governmental) are providing micro-credits in Moshi. It was necessary to list these institutions and the characteristics of their credit supply to make sure that none of them was providing loans for housing improvement and to design questions of willingness to pay with credits in a realistic way. A questionnaire has been designed to fulfil these objectives¹³ but used for few institutions as we found that it was very difficult to get the information from most of them. We did indeed often get the answer that they were working in a context that was getting more and more competitive and that they therefore have to keep in secret the information we were seeking... Finally, we got all the needed information from a French NGO¹⁴ working on capacity building for micro-credit institutions, which had already gathered all the information about the financial market in Moshi.

The main results from these two surveys are presented below:

Institutions	Characteristics of loans
SIDO	30% per year, 15% per six month period or 2.5% per month
PRIDE	30% per year or 15% per six month period
Wawata	18% per six month period
SEDA	36% per year or 18% per six month period
MISA	25% per year or 20% per six month period
Poverty Africa	25% per year
National Microfinance Bank	2.5% per month
Moshi Municipality	10% per year

Table 4 Cost of micro-credit in Moshi

1.3. Drawing up of the questionnaires of the Household-survey¹⁵

Research objectives and characteristics of local context led us to use three kinds of questionnaires: one for the tenants, one for the owners and another one for the landlords. Owners and landlords were therefore distinguished and not interviewed in the same research framework. The “owners”, met randomly¹⁶ by the interviewers on their plot, were part of the household-survey and were therefore interviewed about their plot of residence. The landlords, on the other hand, were interviewed within a specific survey independent from the household survey; they had to answer questions about the plots they are renting. We will only consider the first group (the owners) in this part¹⁷.

All the questions were asked in Swahili.

¹³ See in appendix

¹⁴ « FERT »

¹⁵ Questionnaires of the household survey, called “Questionnaire Tenants” and “Questionnaire owners”, are available in appendix

¹⁶ For more details about sampling see 1.5

¹⁷ For presentation of landlord survey see 1.4 p101

1.3.1. Household questionnaire: Part 1 to 5

The two types of questionnaires (Tenants and Owners) were almost only differing in the form of the willingness to pay questions. We have indeed seen that the tenants would never pay for an investment in their plot and that the questions of WTP should therefore be expressed in the form of increases of monthly rent. On the contrary, owners were asked about their WTP and their willingness to work (hereafter WTW) for an investment in their plot.

The questionnaires had a similar structure and were both divided into six thematic parts. They also had the same introduction:

INTRODUCTION :

Jina langu ni _____ . Ninafanya utafiti juu ya usimamizi wa huduma ya kukusanya na kutoa maji machafu na kinyesi katika mji wa Moshi .Utafiti huu unaendeshwa na Chuo kikuu cha Dar es Salaam kwa kushirikiana na Chuo Kikuu cha Pau cha Nchini Ufaransa. Matokeo ya utafiti huu yatatumiwa na Manispaa ya Moshi na MUWSA (mamlaka ya maji safi na maji taka mjini Moshi) kuborehsa mfumo wa huduma ya kukusanya na kutoa maji machafu na kinyesi.

Katika utafiti huu tunafanya mahojiano na watu walio katika viwanja kutaka kujua juu ya mfumo wa kukusanya na kutoa maji machafu na habari nyingine za kaya na maisha yenu katika viwanja hivi. Majibu yenu kwa maswali yetu yatatusaidia zaidi kuelewa hali halisi za watu hapa mjini Moshi.

Majibu yenu yatakuwa siri, hakuna atakayeyaona na hakuna taasisi yoyote itakayoyasoma. Yatatumiwa na wanaofanya utafiti huu tu. Unaruhusiwa kukatiza mahojiano haya wakati wowote. Kama unakubali kuhojiwa, tutaomba ujibu juu ya kaya yako tu na siyo juu ya kaya nyingine.Tuna ruhusa kutoka ngazi

Text 1 Introduction and presentation of the questionnaire

After reading this introduction, the interviewer was asking the person met in the plot if he (or she) would accept to spend around one hour answering his questions. If yes, the interview could begin.

1.3.1.1. Part 1: Demographic characteristics of interviewee, household and plot

The questions of this first part were giving information about the sex, the age, the marital status of the interviewee and then about the characteristics of the household and the plot (size, family ties between households, etc). Another series of questions was specific to tenants (questions I.10 to I.14). They were about the monthly rent paid by the household and its accommodation stability.

1.3.1.2. Part 2: Problems, priorities and level of information about diseases

The aim of this part - similar in the two questionnaires- was to rank the problems perceived by the people of Moshi in their ward or in their plot. Answers to open-ended questions were giving an idea of the importance for the people of sanitation problems within global housing and environmental concerns.

In order to observe the people's perceptions of the different local institutions, the interviewees were also asked if they thought that the Municipality, the ward officer, the ward committee and the sub-ward officer were aware of these problems.

The people were then asked if they were disturbed by the different kinds of waste water and what were the levels of these inconveniences.

The last questions of this part were about the water-borne diseases. The level of disturbance caused by waste-water that the people reveal is partly determined by the perception of the danger that they have about bad practices of sanitation and is therefore linked to the level of information the households have about these problems. Several questions about water-borne diseases were therefore asked in order to assess this level of information (II.6 to II.10).

1.3.1.3. Part 3: Housing, Water and Relationship with the landlord

The questions about the nature of the housing (materials of walls and roof, type of flooring, electricity, etc) and the ones concerning the water supply were similar in the two questionnaires. The information collected with these questions was aimed at devising a poverty index. The questions related to water supply are also useful to understand sanitation practices and behaviours.

Several questions asked to the tenants were related to their relationship with the landlord of their plot. They were aimed at deepening the issue, emerging from past studies and collective interviews, of problems of coordination between landlords and tenants that could hinder investment in the plots. In order to fulfil this objective, these questions concerning nature and contents of rental agreements, frequency of meetings of landlords and tenants, general relationships and mutual perceptions were also asked to landlords.

1.3.1.4. Part 4: Sanitation, Current Practices and Level of Satisfaction

Apart from some questions that would have been difficult for tenants to answer (like age or prices of the plot facilities) all the questions in this part were both asked to tenants and owners. The first question was about the type of sanitation equipment(s) for excreta the people had in their plot. If they had latrines, the interviewer was then asking questions about their characteristics, the way they were emptied, the level of satisfaction of their users, etc. If they didn't have latrines the interviewer was straight going to question IV.21 which was about soil pit. Several questions about the equipments for the discharge of waste-water were then asked and followed by questions about the level of satisfaction the interviewee had for these facilities.

1.3.1.5. Part 5: Socio-economical Information

This part was made up of questions from different thematic, they were for instance about ethnic origins of the interviewees, their religion, level of education, job of the main breadwinner of the household, saving behaviours and items owned by the household.

Only one question was particular to the tenants, it was concerning their ownership of a "kihamba" on the mountain and the frequency of their visit to this place. Such kind of ownership could indeed be a strong reason for the tenants to refuse any investment in their plot in town.

On the opposite, some questions were only asked to the owners. They were trying to highlight their financial behaviours in case of investment in their housing (questions V16 to V.18).

1.3.2. Part 6: Willingness To Pay

As the questions of WTP were not similarly designed (increases of rent for tenants and investment and/or work for owners) this sixth part is almost totally different from one

type of questionnaire to another. The preamble and the questions related were actually the only common features in the two questionnaires.

1.3.2.1. Introduction and presentation of WTP questions

Some of the questionnaires had an introductory part informing the people that if they wished to do so, they could take one or two days to think before answering to the WTP/WTW questions. This text also included a presentation of the different equipments submitted:

Tomorrow I would like to ask you how much your household would pay for an improved sanitation system. I would like to ask this question about four possible types of improved sanitation systems.

- The first improvement is called VIP latrine. **Show the photograph**

This kind of latrine is specially designed so that if it is kept clean, it does not smell. It has a vent pipe to eliminate odors, and a fly screen to eliminate flies. This VIP is not like an ordinary pit latrine. It is a permanent facility. The pit is completely lined and you would then have to empty it every two or three years. You wouldn't need more water than with your actual one.

- The second is called soakaway. **Show the photograph**

It is an equipment for evacuation of waste water. You can throw inside all the waste water (I mean dishwater, washwater, shower water). With this facility you have no more stagnation of dirty water around your house and you avoid proliferation of mosquitos.

- The third one is a complete equipment for both evacuation of excretas and waste water. It is including a WC inside or outside the house, a septic tank and a soakaway. **Show the photograph**

The waste are going through a pipe in the septic tank and then to the soil pit. You would have to empty the septic tank every year.

- The fourth type of improved sanitation system is a connection to the Moshi sewer system. You would have to install a WC with siphon inside or outside the house that you could share with other tenants. If it were kept clean, it would not smell. The WC would be connected to a sewer line or pipe outside the house. The waste from the WC and all others waste water would flow into the sewer.

After connecting to the sewer system you would have to pay a monthly service charge to the MUWSA.

Text 2 Introduction of WTP questions with Time to think

This text is coming from the Owners questionnaire but the presentation is the same in the Tenants questionnaires except for the final sentences which are: « *Tomorrow I would like to ask you some questions about the willingness to pay of your household for these facilities, in term of rent increase per month. The assumption will be that your landlord would pay the investment and then would increase the rent of the rooms.* »

If the interviewee accepted to take a day to think, the interview was stopped and started again the day after with this question (VI.0): “*Did you discuss, since yesterday (or the day before yesterday), about the sanitation improvement that I presented to you and about your willingness to pay in order to get these facilities?*”. And then if he/she answered affirmatively: “*With whom did you discuss about it?*” We could then know if the people had used this period to think and if so, how.

The interview could then resume with the questions of the part 6; it would only continue for those interviewees who didn't want to take time to think. Before beginning the bidding games the interviewer had to read a text introducing and explaining briefly this method of investigation:

Sasa tunapenda kujua hiari yako ya kulipia vifaa vya kuboresha mfumo wa kukusanya na kutoa maji machafu na kinyesi katika kaya yako. Tutacheza mchezo ambao tutakuomba utujibu kama kitu halisi lakini sio kweli kwamba utalazimika kulipa kiasi utakachotaja kwa wakati huu. Majibu yako yatatusaidia katika kutoa vifaa vya uboreshaji wa mfumo wa kukusanya na kutoa maji machafu. Iwapo utatupa majibu ambayo yanaonyesha una hiari ya kulipa gharama zaidi ukilinganisha na uwezo ulionao itasababisha mradi kukwama pindi watakapoleta vifaa vya gharama kubwa kuliko uwezo wako . Na vile vile iwapo utatupa majibu ambayo yanaonyesha una hiari ya kulipa gharama pungufu ukilinganisha na uwezo ulionao itasababisha kutokuwepo kabisa kwa mradi endapo gharama za mradi hazitoweza kufidiwa . Tutafanya

Text 3 Introduction of bidding games

The improved facilities submitted were then similar whatever questionnaire used and presented in this order:

- WTP1: Improvement of “normal” latrines by putting a ventilation pipe
- WTP2 or WTP/WTW2: Building of VIP latrines
- WTP3 or WTP/WTW3: Building of a soil pit
- WTP4 or WTP/WTW4: Building of a soil pit and VIP latrines
- WTP5 or WTP/WTW5: Building of a septic tank and a soil pit
- WTP6 or WTP/WTW6: Connection to sewerage system

Interviewers were only asking WTP/WTW questions about facilities not already owned by the household and with a higher “standing” than the current household's equipments¹⁸.

1.3.2.2. Willingness to pay of Owners

Devising and implementation of a bidding game: WTP1

Concerning the improvement of the latrines we learned from the craftsman survey that this operation needs very little labour (only one worker), time (only one day) and materials (a ventilation pipe (14 000 Tsh) and some brackets (3 000 Tsh) to fix it). This work must be done by a skilled worker, the craftsman, and it is thus impossible to imagine any kind of labour participation from the households. The question is therefore only a WTP question:

¹⁸ Ex 1 : if a household had a soilpit, the question WTP/WTW3 was not asked. Ex 2 : No WTP/WTW question was asked to a household having toilets inside the house with a connection to the sewer.

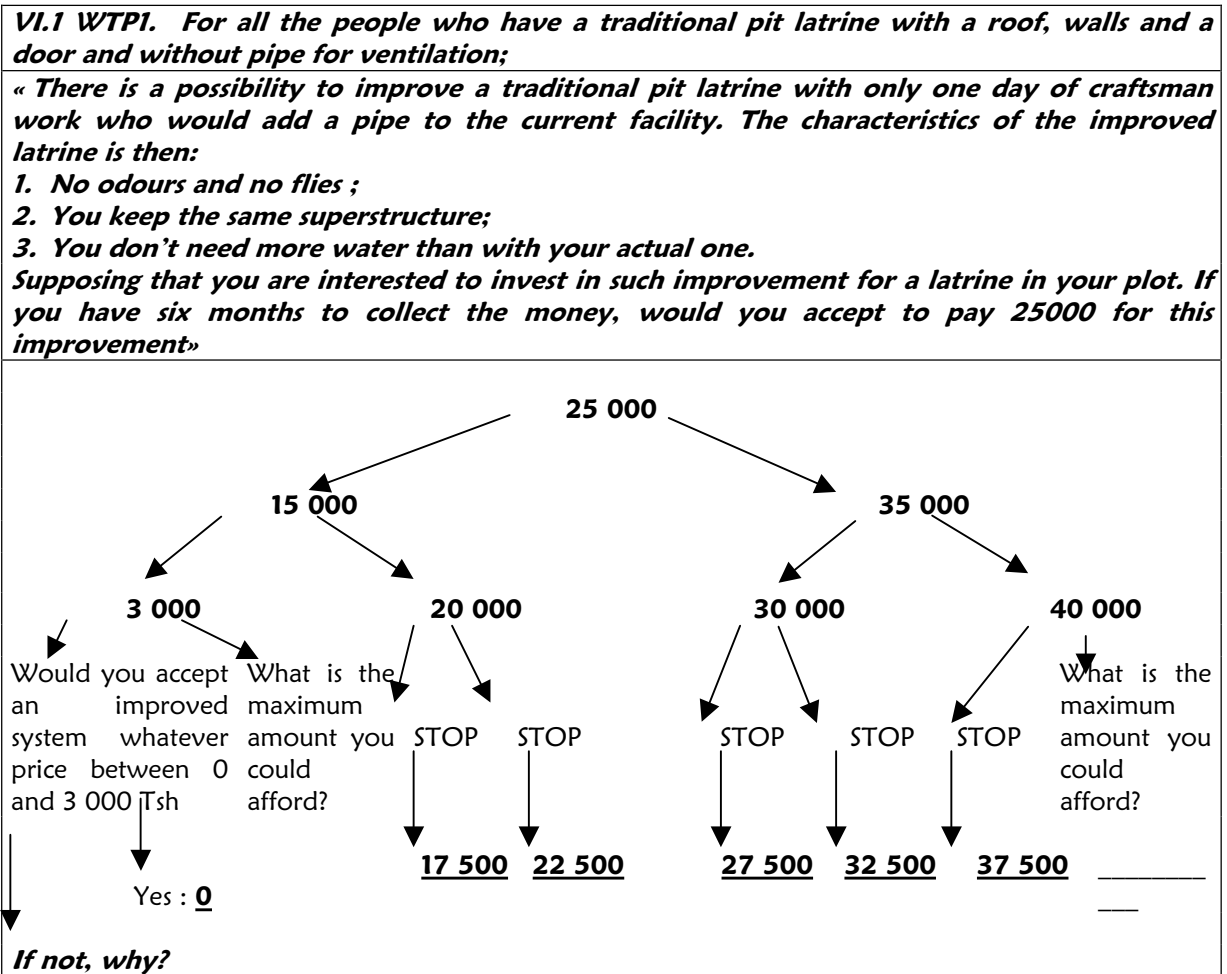


Figure 1 Bidding game WTP1

After describing the characteristics of the improvement (no odours and no flies, same superstructure, no need of more water) and the financial conditions (six months to collect the money) the first bid was made: 25 000 Tsh. The game could then begin, the interviewer was following the positive or negative answers of the interviewee until the third bid and the third answer where he was deducting the result (which is an arithmetic mean of the range reached through the three bids). As an example, if an interviewee was accepting the first bid (25 000 Tsh), refusing the second (35 000 Tsh) and accepting the third (30 000 Tsh), his willingness to pay was estimated by the mean (average?) of the last two bids which is 32 500 Tsh.

If the interviewee was answering negatively to the three bids the interviewer asked him (or her) if he (or she) would accept to pay an amount between 0 and 3 000 Tsh. If “yes”, the household’s WTP was stated to be nil; if “no”, we were considering that the household was refusing such facilities.

On the other side of the bidding game, if the interviewee was accepting the three bids, the interviewer would ask him/her what would be the maximum amount he/she would agree to pay for the facility.

Measurement of the Willingness to Pay and/or to Work: WTP/WTW2

The measurement of WTP1 was the easiest stage of this sixth part. The next questions actually included questions about willingness to work and different options of paying the investment. The design of the questions for the remaining sanitation facilities were all the same, we will use the WTP/WTW2 as an example. Questions began with a presentation of the facility¹⁹ :

VI.2. For all the plots who have a traditional pit latrine without pipe for ventilation or no latrine:

«I would like to know your willingness to pay for a ventilated improved latrine. This kind of latrine is specially designed so that if it is kept clean, it will not smell. It has a vent pipe to eliminate odours, and a fly screen to eliminate flies. This VIP is not like an ordinary pit latrine. It is a permanent facility. The pit is completely lined and you will then have to empty it every two or three years (the cost for a sludge with the municipal truck would be 15 000 Tsh). You don't need more water than with your actual one.

Then the interviewee had to choose between different kinds of participation:

Supposing that you are interested to invest in such facility in your plot, would you prefer to work and pay in order to get it, to work only or to pay only? By "work" I mean some hours or days spent in hollowing out the pit without any wage.

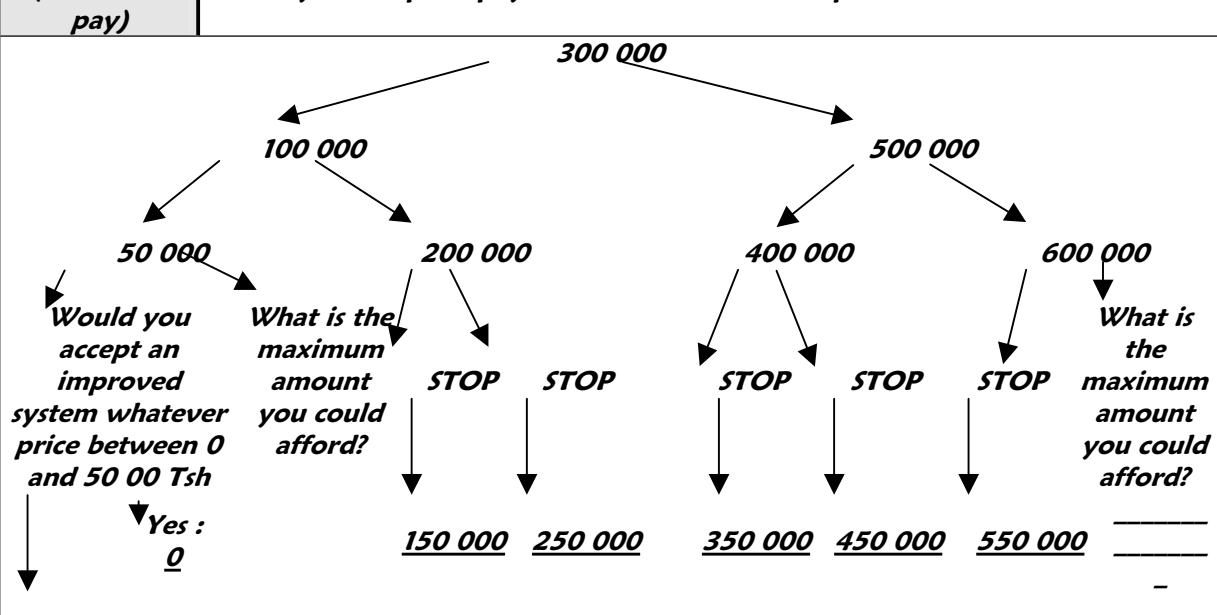
- | | | |
|------------------------|---------------------|--------------------|
| 1. Work and pay | 2. Work only | 3. Pay only |
|------------------------|---------------------|--------------------|

If he (or she) chose the solution 1 « Work and pay » all the following questions were asked, the first one was measuring his (or her) WTW²⁰:

If VI.2 = 1 or 2 VI.3.WTW1 How many hours or days would you want to work in one week (one day is 8 hour of work): _____

Two bidding games with different financial conditions would then follow, the first was proposing an investment after one year of savings (one year to collect the money):

If VI.2 = 1 (work and pay) VI.4. WTP2.1 In addition of work, if you have one year to collect the money, would you accept to pay 300 000 Tsh for this improvement? »



¹⁹ For all the equipments submitted the interviewers could extend their explanations with draws and shemas they received during the training.

²⁰ As a convention, the grey parts of the questionnaire were containing indications for the interviewers.

If not, why? _____

At this stage, the interviewee who chose the solution 1, by doing so had expressed a WTP and a WTW. In order to deepen the understanding of the WTW answer two questions followed:

Only for the respondents who answered "Work and pay" ("1") at the question VI.	VI.5 Would you pay more if you were not working?	
	1. Yes	2. No
	If "Yes"	VI.6 How much would you pay more?
		_____ Tsh

The second bidding game was measuring the WTP of the household with an access to a loan. The characteristics of the loan were described in the preamble of the bidding game:

If VI.2 = 1 (work and pay)	VI.7 WTP2.2. We keep now the same equipment and I still ask your willingness to pay for it, in addition of work, but now we suppose that in order to get this facility, you can get a loan of 3 years with an interest rate of 15% per year. Would you then accept to pay 300 000 Tsh for this improvement, which means that you would have to give back 12 000 Tsh per month during three years (8300 Tsh for the cost of the facility and 3700 for reimbursing the interests)? »
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Would you accept an improved system whatever price between 0 and 50 000 Tsh
Yes : 0

What is the maximum amount you could afford?
STOP → 150 000 STOP → 250 000
STOP → 350 000 STOP → 450 000 STOP → 550 000
What is the maximum amount you could afford? _____

If not, why? _____

In order to clarify the condition of the loan, the interviewer could give for each bid the total amount (including interest) of the monthly repayments (numbers in brackets).

The same question than the VI.5 was then asked:

Only for the respondents who answered "Work	VI.8 Would you pay more if you were not working?	
	1. Yes	2. No

<i>answered "Work and pay" ("1") at the question VI.</i>	<i>If "Yes"</i>	<i>VI.9 How much would you pay more?</i>
	_____ <i>Tsh</i>	

The interviewer was then going to WTP/WTW3.

We have just seen in details the sequence of questions asked to somebody who had chosen to work and pay. An interviewee who chose the solution 2, "work only" was only interviewed on his/her willingness to work through the question VI.3. Somebody who chose to "pay only" (solution 3) had to answer only to the two bidding games.

The design of the WTP/WTW questions set out here was the same for all the facilities submitted, except, as we saw, for the improvement of the latrines and, as we will see, for the WTP/WTW4. However, the difference only concerns the WTP questions.

Open-ended Willingness To Pay questions: WTP/WTW4

The sanitation equipment presented here (VIP latrines and soil pit) was only the combination of two facilities presented separately before. We therefore decided to assess the WTP for this equipment with open-ended questions. The order of the questions was strictly identical to WTP/WTW2; the first question of WTP was therefore offering one year to collect the money before the investment:

<i>If VI.8 = 1 (work and pay)</i>	<i>VI.21. WTP.4 "In addition of work, if you have one year to collect the money, how much could you pay for these two facilities?"</i>
_____ <i>Tsh</i>	

The second one, with the loan, was:

<i>f VI.5 = 1 (work and pay)</i>	<i>VI.22. WTP3.2. "We keep now the same equipments and I still ask your willingness to pay for it, in addition of work, but now we suppose that in order to get this facility, you can get a loan of 3 years with an interest rate of 15% per year. With these conditions how much could you pay for these two facilities?"</i>
_____ <i>Tsh</i>	

Questions with variable modalities:

Although the global design of the WTP/WTW questions was the same for all the interviews, some modalities of the questions were varying in order to test some methodological hypotheses.

We already saw that some households answered after taking some **time to think** and others not. The second difference we can find is in the **formulation of the WTW question**. The first type we already saw is open-ended:

<i>If VI.2 = 1 or 2 :</i>	<i>VI.3.WTW1 How many hours or days would you want to work in one week (one day is 8 hour of work):</i> _____
---------------------------	---

But the second half of the sample was interviewed with this question:

<i>If VI.2 = 1 or 2 :</i>	<i>VI.3.1. Would you work 6 days in a period of two weeks in order to get this facility?</i>	
	<i>1.Yes</i>	<i>2.No</i>
	<i>VI.3.2 WTW.1. What would be the maximum you could work in a period of two weeks to get this facility?</i> _____	

The answer to the question VI.2 indicated if the WTP expressed was the maximum WTP. It would also give an idea about possible migrations within the city in case of rent increases.

The questions VI.3 was aimed at answering to an important question that we had already noted²¹: is it possible to aggregate the households' demands for improved sanitation facilities into demand by plot?

1.4. Drawing up of the questionnaire of the Landlord-survey

As we stated p88 “landlords are stakeholders that can not be ignored. Studying the dynamics of the improvement of facilities on the rented plots requires to implement specific investigations on landlords’ rent increase and investment behaviours.”

A Landlord survey has therefore been implemented with the main objectives of providing information on their capacity and willingness to invest on sanitation facilities in their rented plots and on their increases of rent after this investment. The first set of information (willingness to invest) could then be compared to the price of the equipments provided by the craftsmen and the second one (rent increases) to the willingness to pay of the tenants in terms of rent increase. By doing so, we have been able to explore if there was some possibility of sanitation improvements on rented plots.

In order to understand better the landlords’ behaviours, their characteristics, their relationships with their tenants and other information that could be useful to understand the dynamics of the improvement of facilities into rented plots, a detailed Landlord questionnaire was designed.

1.4.1. Part 1: Characteristics of the rental sector in Moshi

The objective of this part can be summarized in one question: which kind of landlord is the interviewee?

As we wanted to know if there were different types or groups of landlords with similar investment behaviours, we assessed in depth the characteristics of their rented plots. This research of details led to a three-dimensional analysis structure: landlords, plots, households renting out rooms.

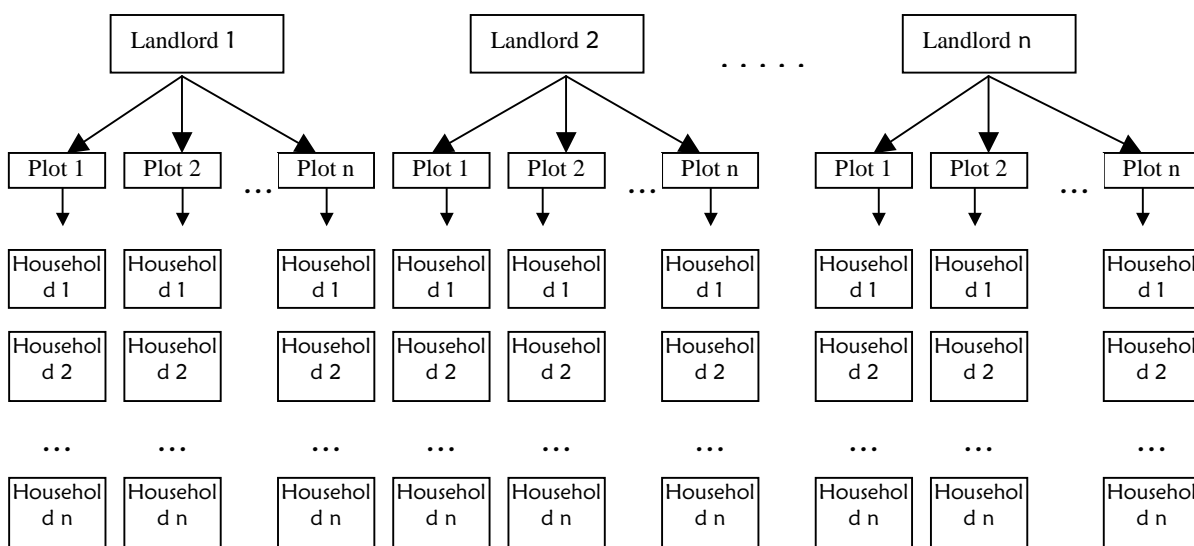


Figure 2 Structure of the Landlord questionnaire

²¹ See 1.1.1.2 p88

The first part of the questionnaire gave information on the three levels. The first question concerned the landlord: it asked how many rented plots he (or she) owned and if he (or she) was living in one of them.

The questions were then going to the second or plot level, and these questions were therefore repeated as many times as the landlord owned plots. The questions were about the location, the type of acquisition, the age, the land status, the number of rooms, the type of sanitation equipments of the plots and the numbers of households living on them.

The last question was going to the third or household level. The landlord was asked to give, for each household, the information about its type of accommodation (rooms or apartment), the number of rooms rented, the amount of rent and the frequency of rent payment.

1.4.2. Part 2: Relationship with tenants

This part of the questionnaire was essentially made up of questions strictly symmetric to the ones asked in the Tenants questionnaires (see 1.3.1.3). This part also included questions related to the landlords' management of his (or her) rented plots, like the amount, the frequency and the reason of the rent increases on the rented plots or the measures he (or she) would usually take when a tenant did not pay the rent.

1.4.3. Part 3: Willingness To Pay and rent increase

The questions of this part were designed with the aim of measuring the WTP of the landlords for investments on improved sanitation facilities on their rented plots. The second issue was to measure the increase of rent they would ask for if they were really investing in these facilities.

The rented plot selected for this part was systematically – by agreement with the interviewers - the first one mentioned by the landlord in the first part of the questionnaire. After giving this information in a short introduction – with a text quite similar to the one used for the household-survey²²- the interviewer would begin with the WTP questions.

Like we saw on the household's WTP survey, the facilities or improvements presented to the interviewee were only the ones that the plot didn't already have, with a superior standing to the existing equipments. The facilities or improvements submitted were also the same and ranked in the same order than in the households-survey. For methodological reasons, the landlords couldn't take time to think before answering.

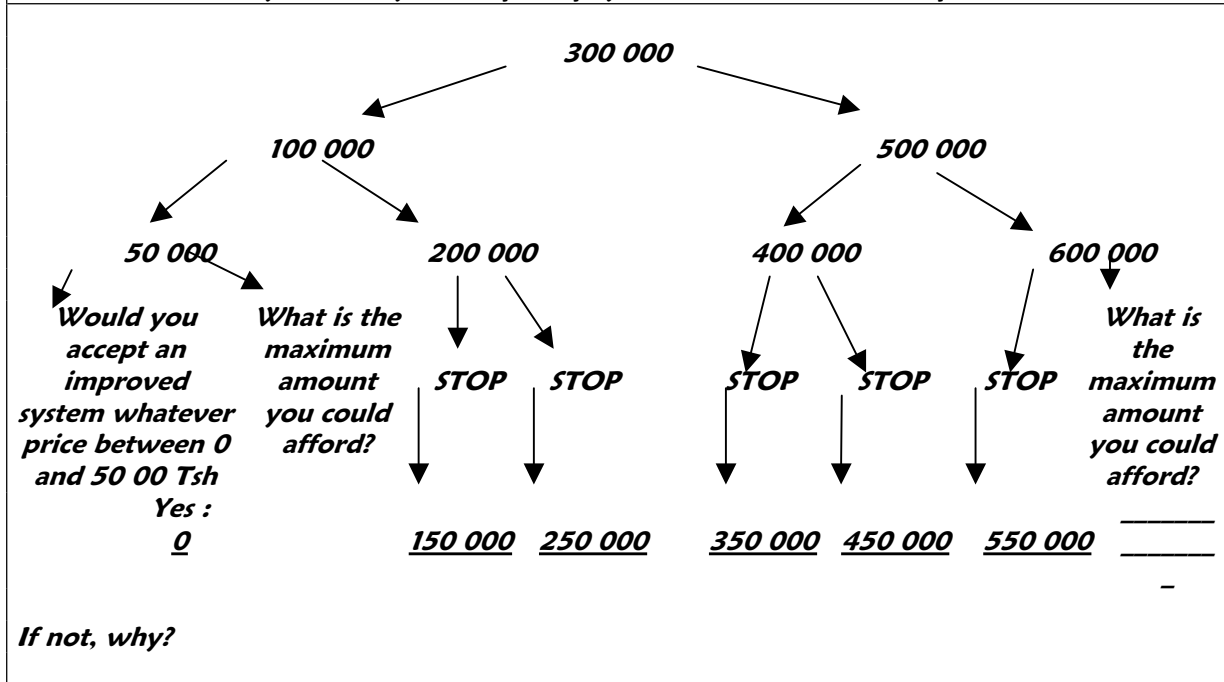
In order to present the structure of this part we will study in detail the WTP questions for an investment in VIP latrines (WTP2). As stated for the household-survey, WTP1 is only a "light" version of the other WTP questions and WTP4, for methodological reasons, is asked with open-ended questions. Apart from these two, the first question for each equipment was asked as follows:

III.4 VDP2.1 For all the plots who have a traditional pit latrine without pipe for ventilation or no latrine:

« Now I would like to know your willingness to pay for a ventilated improved latrine. This kind of latrine is specially designed so that if it is kept clean, it will not smell. It has a vent pipe to eliminate odours, and a fly screen to eliminate flies. This VIP is not like an ordinary pit latrine. It is a permanent facility. The pit is completely lined and the tenants would then have to empty it every two or three years (the cost for a sludge with the municipal truck would be 15 000 Tsh). They wouldn't need more water than with their actual one.

²² See "Text 3 Introduction of bidding games"

Supposing that you are interested to invest in such facility in this plot. If you have one year to collect the money, would you accept to pay 300 000 Tsh for this improvement»



We can recognise here the bidding game used in the owners-survey; the same bidding games than the one used for the owners were indeed used for all the facilities submitted. In this case and in half of the questionnaires, the solution presented to finance the investment was a one year saving. The other half of the interviewees was offered the option of a three-year loan with an interest rate of 15%. This division was the only one made in the “sample”²³ of the landlords-survey.

After interviewing the landlord on his (or her) WTP for an investment on VIP latrines on one of his (or her) plots, the interviewer would ask him (or her) how much he (or she) would increase the monthly rent per room on this plot if he (or she) was really investing this amount:

III.5 If You pay this amount, how much would you then increase the rents in the plot (rent per room)?
_____ Tsh

The interviewer then asked if or she thought that the tenants would accept this amount of increase:

III.6 Do you think that the tenants would accept this increase of rent?		
1.Yes	2.No	3.I don't know

The next questions are about the financial solutions that could help the landlords to invest. We indeed saw in collective interviews that the lack of financial institutions could be an important factor when trying to explain the poor investments in sanitation equipments on rented plots²⁴; the second part of the WTP questions was therefore trying to collect information on the landlords' preferences for financial solutions:

²³ See “1.5” for the selection of the landlords interviewed

²⁴ See “1.1.1.2 / Financial behaviours”

III.7 We suggested here one financial solution (one year of saving) for an investment in a VIP. What would be for you a better financial solution for this investment?	
III.7.1	1. Saving 2. Borrowing
III.7.2	With a duration of : _____ year(s)
III.7.3	With an interest rate of : _____ %
III.8	With these conditions, how much could you invest in this facility? _____ Tsh
III.9	After this investment, how much would you then increase the rent of the rooms (rent per room)? _____ Tsh

Interviewees could thus define their favourite financial solution and were at the same time indicating their WTP and the amount of rent increase they would ask for in these conditions.

1.4.4. Part 4: Demographic and Socio-economical information

The last part of the questionnaires was collecting demographic (sex, marital status, age) and socio-economical (origin, religion, employment, education, income,...) data.

1.5. Sampling

We have up to now presented the first stage of the field investigation and explained the rationale for implementing two different surveys, one for owners and tenants and another one for landlords. We have then detailed the drawing up of the questionnaires of these surveys; we need now to focus on the sampling procedure.

As no data-base for landlords existed in Moshi, we couldn't build up a rigorous sample for the Landlord-survey. Lists of landlords were previously collected during the collective interviews from the ward officers and these lists were the only sources we had to begin the survey. After having begun the interviews we could collect some more names from the landlords interviewed. **We finally conducted 97 interviews of landlords who owned a total of 129 plots on which live 703 households.**

Because of the lack of available and reliable data we implemented a complicated sampling procedure for the Household-survey.

1.5.1. Sample frame

The first task, before the procedure of sampling, was to build a reliable sampling frame. We did a complete inventory of the demographic and cartographic resources available in Moshi and in Dar, in the local and national authorities.

1.5.1.1. Existing data

By this time the last census of the population was the one made in 1988. The projections of the ward and subward population in 2002 were made from these data and

therefore, 14 years after, could not be considered to be reliable. These demographic data being useless we had to focus on cartographic data.

Moshi is divided into 15 wards called *kata* in Swahili, which are in turn divided into 61 sub-wards called *mtaa*²⁵. According to Ms Kinawiro, head of the planning office of the Municipality, the *mtaa* have been delimited in 2000 according to geographical and demographic features. These administrative units have been selected to be the first level of sampling of our three-stage sampling procedure. Although the inventory of this first level did not cause any problem²⁶, the second level (the plot one) was much more problematic: the only information available on these units were maps made on the basis of aerial photographs taken in 1992. Almost as obsolete as the census data of 1988, these maps on a scale of 1/2500 were useless without updating; we therefore decided to carry out this new field work.

1.5.1.2. Updating of maps

In order to reduce this tedious job we only updated the 20 *mitaa* randomly selected in the first stage of sampling. The inventory of the plot has been done by an assistant, Kiba Lushaka, who walked and corrected the maps across all the streets and path of the preselected units.

The job was quite easy in the planned area where the plots were already drawn on the maps, the assistant had only had to check and to correct on the maps if the plots were constructed and inhabited. It was much more difficult in unplanned areas where the assistant also had to make approximate drawings of roads, paths and non-inhabited areas and of course count the plots.

This huge work was first aimed at building up the second level of sampling but has been very useful too during the survey. Copies of the maps completed and drawn were actually used as field maps by the interviewers.

Kiba Lushaka finally counted 5 222 plots on the 20 *mitaa*.

1.5.2. Sampling procedure: Three-stage random sample

The random selection of the households is the best way to ensure the representativeness of a sample. But as we couldn't get a list of the household's living in Moshi we had to implement a sampling procedure with three stages of random selection and therefore to choose three intermediary level of sampling. These three levels were: the *mtaa*, the plot, the household.

The size of the sample was fixed at 600 households but, because of practical reasons, has been increase to 609. Of 61 *mitaa*, 20 were selected at random. With the result of the counting of the plots in each *mtaa* and a simple rule of three we could then decide how many plots, and therefore households, were selected per *mtaa*:

"Kata"	"Mtaa" selected at random	Number of plots counted	Number of plots selected
Kilimanjaro	Makongoro	120	15
Karanga	Bonite	247	30
Korongoni	Vijana	126	15
	Saba saba	515	63
	Wailes	560	68
	Khambaita	197	24

²⁵ We will keep hereafter the Swahili terminology

²⁶ See below for details on sample procedure

Kiusa	Kiusa line	308 (105)²⁷	12
Longuo	Mtaa wa kati	83	10
Rau	Saba saba	208	25
Bondeni	Mbuyuni	171	21
Kaloleni	Kalimani	170	21
Majengo	Shaurimoyo	247	30
	Makange	258	31
Msaranga	Msaranga	160	19
	Mnazi mmoja	392	48
	Lombeta	479	58
Kiboriloni	Sokoni	282	34
Njoro	Dobi	386	47
	Railway	95	12
Pasua	Matindigani	214	26
Total		5222 (5015)	609

Table 5 Sample

The geographical distribution of the *mitaa*, which were selected at random, is quite representative of the different kinds of environment found in Moshi, 13 *kata* on 15 being actually represented. All the suburban ou peripheral and rural areas added to Moshi town in 1978 (Karanga, Msaranga, Kiboriloni, Longuo) are in the sample. The *kata* located near the town centre, be they the result of urban planning (Korongoni, Kilimanjaro, north of Majengo) or of spontaneous growth (Njoro, Pasua, Kaloleni), are also represented. Only Mji Mpya is absent. The town centre is represented by Vijana (Korongoni), Mbuyuni (Bondeni) and Kiusa line *mitaa*. On the contrary, the heart of this centre (Mawenzi, Kiusa Sokoni and Bondeni Sokoni) is absent. As the survey was about the improvement of the sanitation services, this absence of areas covered by the sewage network is not problematic, it however means that the rate of households connected to the network is underestimated in the survey.

The second stage of sampling was made on the plot level. We had for instance to select at random 15 plots within the 120 counted in the *mtaa* of Makongoro. This task has been made easy by the updating of the maps: after having numbered every plot on a map, we only had to select one at random and to count 8 plots up to get to the next selected one, and so on...²⁸

After selecting the *mitaa* and, inside them, the plots, we only had to select the final units of the sample: the households. It is the interviewers who proceeded with this last random selection. On every new plot they were entering they had to choose a different door for the interview (if there were several doors of course). They were thus choosing for instance the right door on the first plot, then the front door on the next plot, then the left door, then the right, etc.

²⁷ 308 plots had indeed been counted in "Kiusa line" *mtaa* but 203 were included in the « Police line Quarters » and we didn't get the authorization to interview policemen. It is therefore on the base of the 105 remaining plots (and so on a total of 5015) that we made the sample

²⁸ 8 because it is the approximation of 8,23 which is the result of 5015/609, the sample rate at the second stage.

1.6. Implementation of the Household and Landlord Surveys

Once the questionnaires and the sample were done, we had to recruit and train the interviewers. Thirty-two Tanzanians who had completed their secondary school were interviewed; seven women and fourteen men were finally selected and attended a one-week training.

Three interviewers were selected for the Landlord-survey. As we didn't have any pre-established sample they had to find the landlords named on the ward-officers' lists and to find others. They were managing themselves their appointments and the organisation of their work in the areas they had initially received.

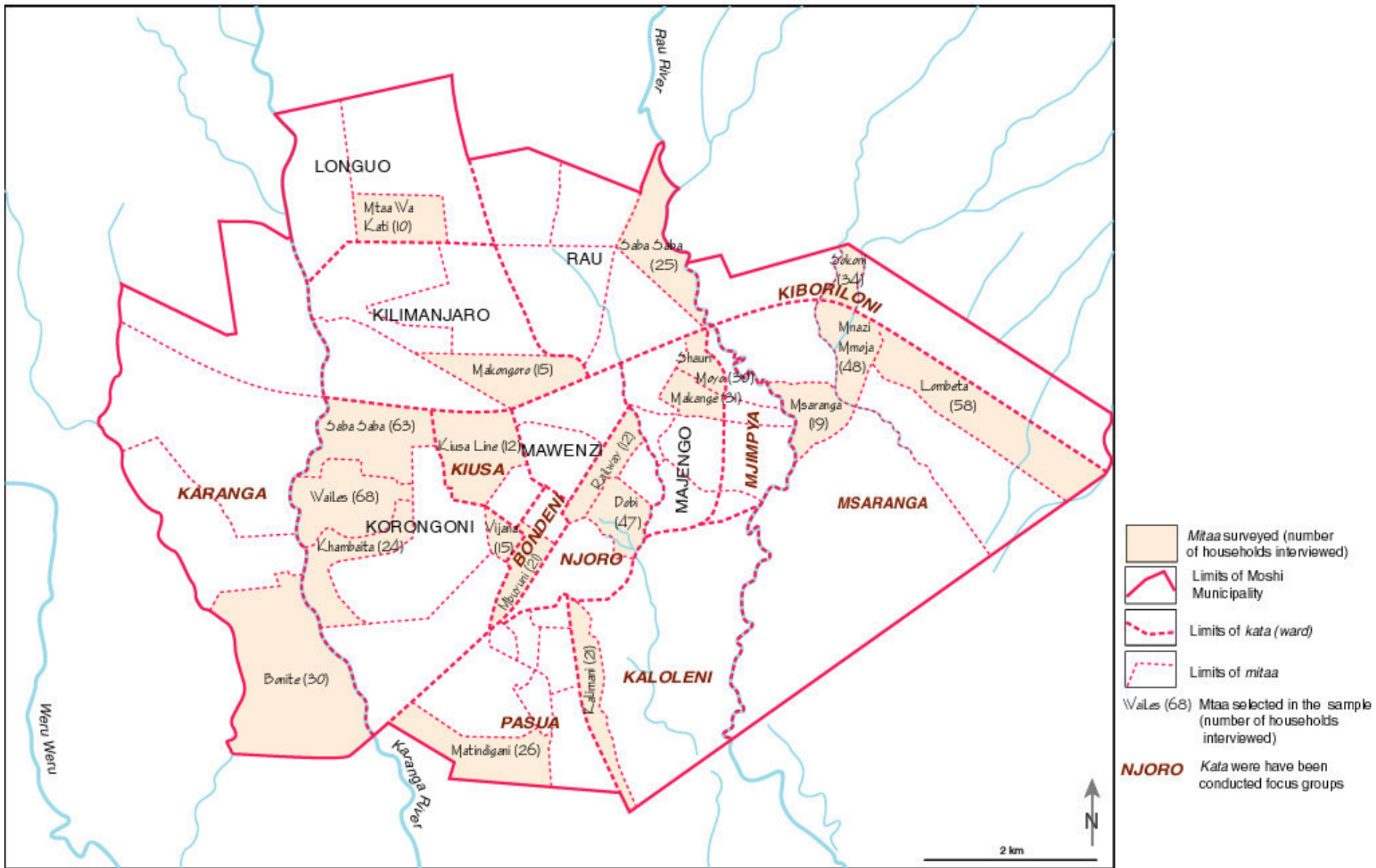
The other 18 interviewers were receiving strict instructions every morning. They were receiving a personal map where the plots they had to survey were precisely mentioned. They had to interview someone living in every plot selected. If nobody was on the plot they had to go to a neighbouring one until they found someone who could answer their questions²⁹. At the end of the day they were reporting the plots where they had made interviews on a special map reserved for this use.

Every night two or three interviewers were checking the questionnaires filled out during the day and were correcting them with the interviewers the next morning. A global briefing was also done every morning.

693 questionnaires have been filled out between the 25th April and the 13th of May 2002 for the Household-survey, 609 for the sample and 84 for complementary analyses³⁰. During the same period, 97 questionnaires have been filled out for the Landlord-survey. After the first days of the survey an interviewer would fill out from 4 to 6 questionnaires per day.

²⁹ An adult living in the plot who could answer in the name of his or her household

³⁰ Particularly in the *kata* of Majengo which has been recently connected to the sewer.



Map 1 Mtaa selected in the sample

2. Sanitation Perceptions, Behaviours and Facilities³¹

2.1. Priorities, inconveniences and information related to waste water and excreta

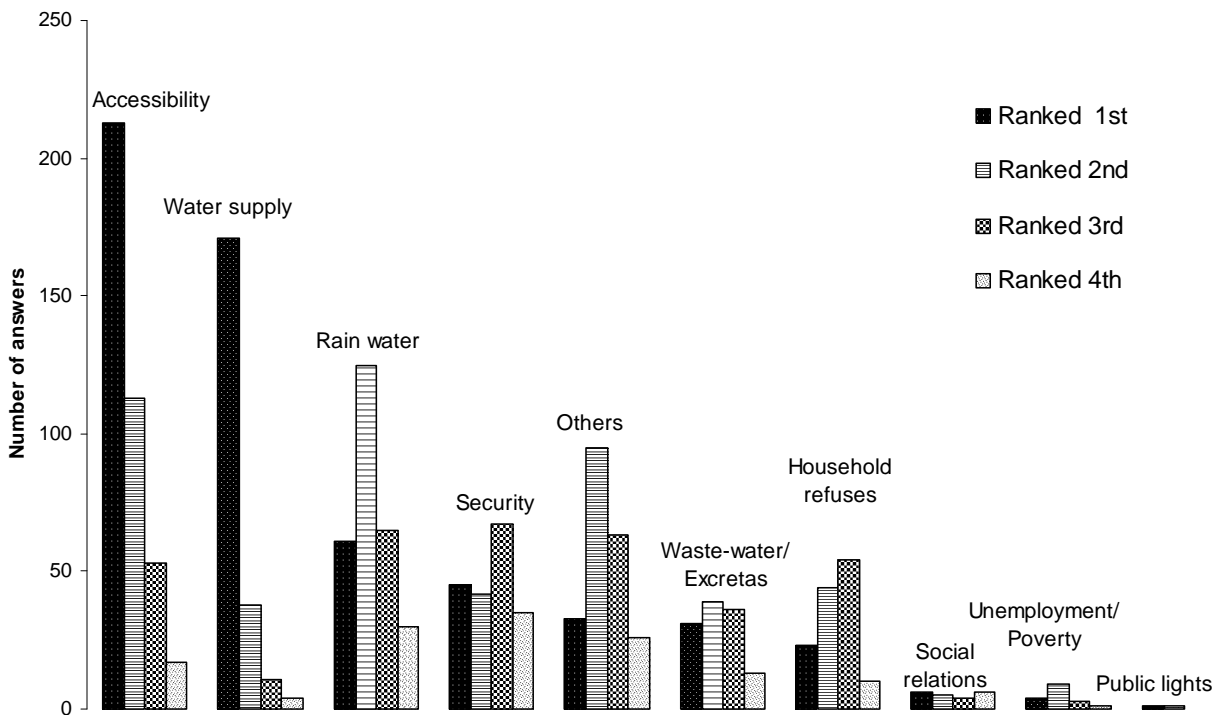
Before being interviewed about the inconveniences they had related to waste-water and excreta, the interviewees had to enumerate and rank the main problems they were facing inside their *kata* and their plot. Before answering more detailed questions concerning sanitation, these two questions allowed them to put these issues into a more general perspective³².

2.1.1. Environmental problems and priorities of households

The questions related to the problems of the households were open-ended; they were allowing them to give four answers and to rank them.

2.1.1.1. Problems inside the kata

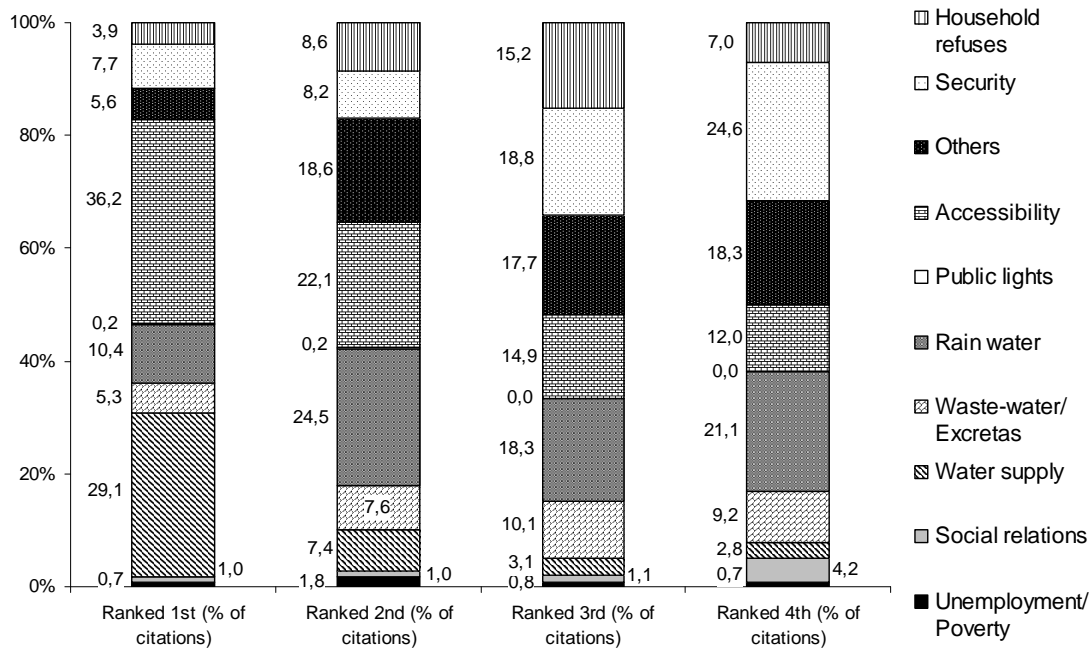
Only 3.4% of the households said that they did not face any problems in their kata. We ignore these answers in the following analysis. The distribution of the answers of the other household is the following:



Graph 1 : Problems in the *kata* (number of answers)

³¹ All the data presented here come from the household survey

³² see in owners and tenants questionnaires question II.1 and II.2

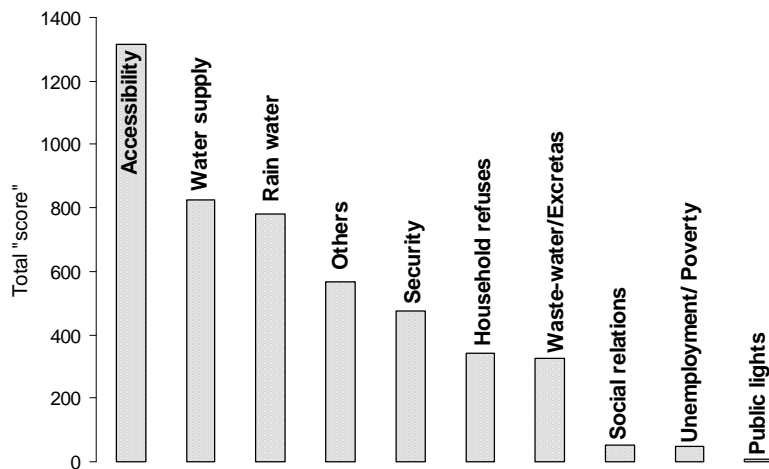


Graph 2 Problems in the *kata* (percentage of answers)

The problems of **accessibility**, which are expressed in a series of answers related to the state of the roads and the lack of collective transports, are the households' first source of concern: 36.2% mentioned this problem in the first place.

The problems of **water supply**, mentioned in the first place by 29.1% of the people, is second in the general ranking, but this number is actually hiding important differences between the *kata*. This problem was absent or almost absent from the answers of people living in areas covered by the MUWSA water supply network but **it was coming first for more than 50% of the people living in places not covered by the network.**

Problems of rain water and security are next in the line, while answers concerning **waste-water and excreta are only in the fifth place³³, with 5,3% of the answers.** Only 10.1% of interviewees mentioned this problem in the third place. The analysis of a ranking of weighted answers³⁴ does not show a stronger concern of the households about waste-waters and excreta. These problems are indeed in the sixth place after concerns about accessibility, water supply, rain water, security and household refuse:



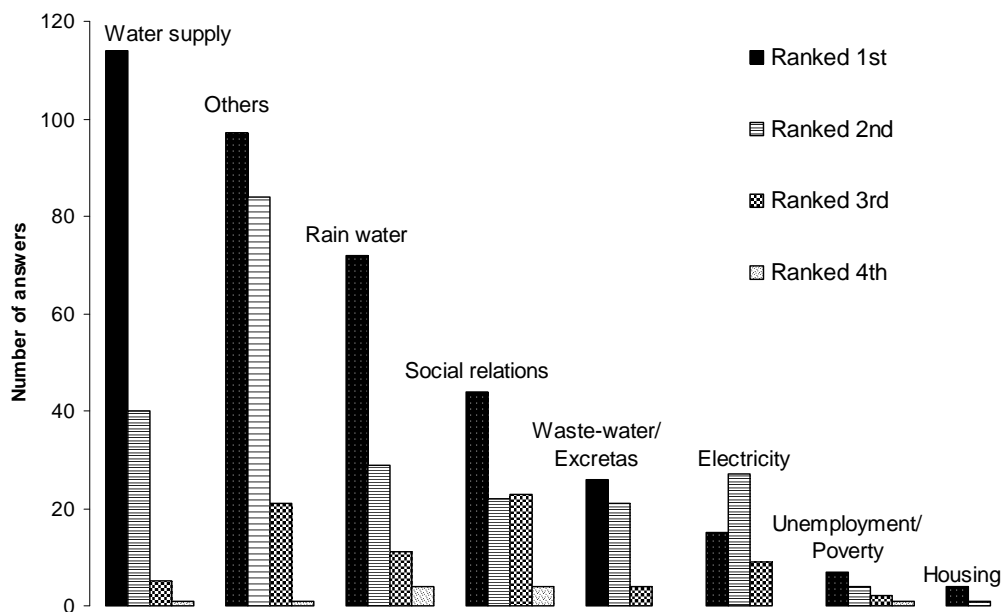
³³ A part from the "others" answers which are including different types of problems.

³⁴ The weighting is done by giving points to the problems depending on the priority they get in the answers. : 4 points if the problem is mentioned in the first place, 3 points if the problem is mentioned second, etc.

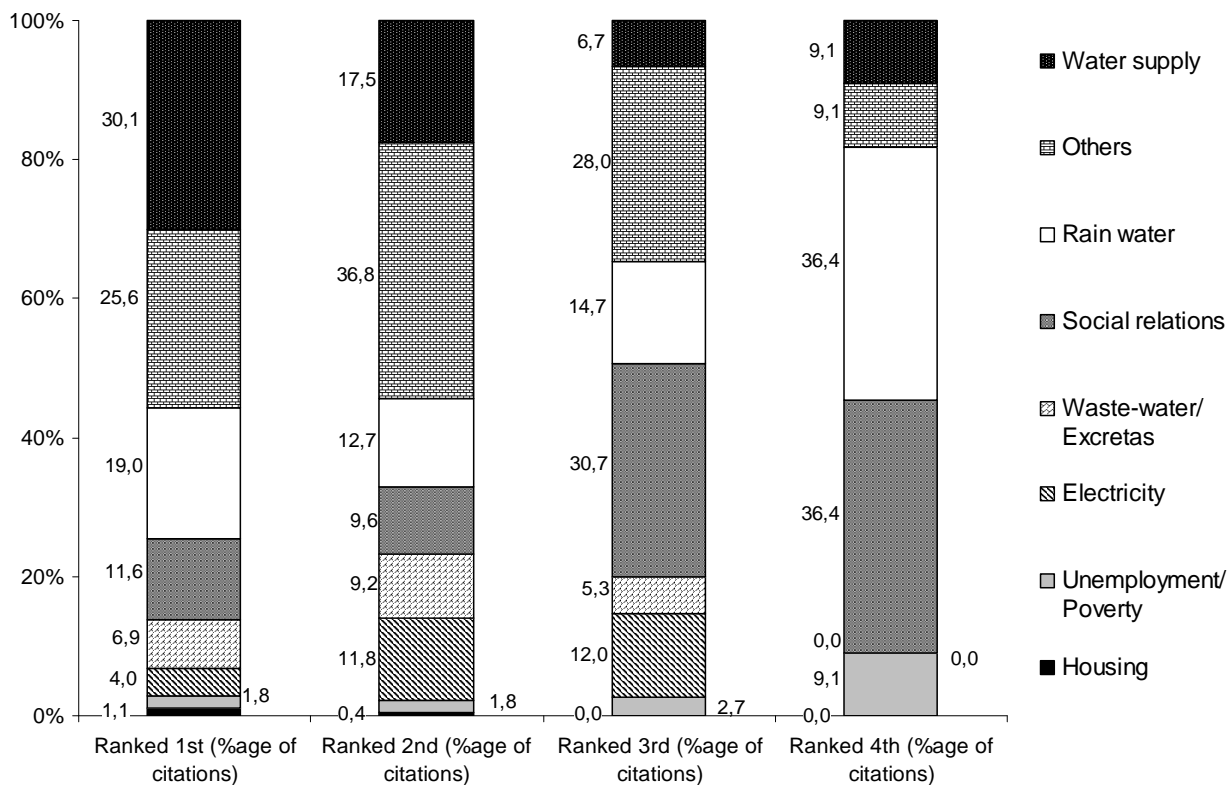
Graph 3 Problems in the kata (weighted answers)

2.1.1.2. Problems inside the plot

There are many more people (37.8%) who answered that they don't face any problems in their plots. If we look only at the ones who gave one or more sources of concerns in their plot, the distribution of the answers is the following:

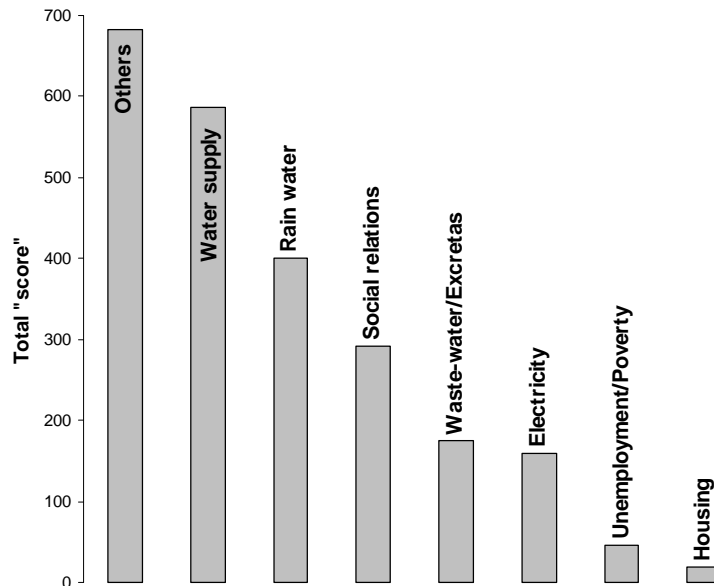


Graph 4 : Problems inside the plot (number of answers)



Graph 5 Problems inside the plot (percentage of answers)

For 31,1% of the people **the water supply is the first source of concern on their plot**. As we could see at the *kata* level, **waste water and excreta are not a major source of concern** for the households of Moshi at plot level either. These problems are only in the fourth place (leaving out “others”) of the most important problems (the ones mentioned first), with 6,9% of the answers. The ranking of weighted answers is not giving a different result, as we can see below: waste-waters and excreta are coming after water supply, rain water, social relations and electricity:



Graph 6 Problems on the plot (weighted answers)

2.1.1.3. Environmental problems and living area

The overview of the different environmental problems faced by the people is not enough to give us a clear picture of the sets of problems people face. An analysis of their answers with special statistical tools³⁵ allows to find three types of environmental problems and therefore three groups of people with the same type of environmental problems: the people with no problems, the people with problems linked to densely populated areas, and the people with problems specific to rural areas. This kind of analysis allows to establish a typology of the environmental problems mentioned by the people at ward-level.

Typology of environmental problems

Before describing the characteristics of these groups we can notice the importance of three problems which we can find in every group of people: accessibility, rain water and security. The problems of accessibility are indeed cited by at least 50% of the people in each group, problems of rain water are cited by at least 28% of them and security by at least 25%. These three problems apart, the groups have important specificities:

Before describing the characteristics of these groups we can note the importance of three problems which we can find in every group of people: accessibility, rain water and security. The problems of accessibility are indeed mentioned by at least 50% of the people in each group, problems of rain water are mentioned by at least 28% of them and security by at least 25%. These three problems apart, the groups have important specificities:

- **“Problems specific to rural areas”**: This type of environmental problem is faced by 24.1% of the people of the sample. The people of this group mainly complain

³⁵ Principal components analysis and Typological analysis

about **water and electricity services**. 29.2% of them (against 8.4% in average) indeed mentioned the electricity as a problem in their plot and above all, they were 85.7% (against 36.8%) to complain about the water supply at their area level and 83.0% (against 26.3%) at their plot level. Almost no other problem was particular to this type and it confirms the results found in other contexts of the survey: the water supply is such an important problem for the people who have no easy access to it that when they are asked about their daily problems it often prevails.

We called this type “Problems specific to rural areas” because such lack of public services is mainly found in rural areas.

- **“Problems of densely populated areas”** (36.4% of the sample): this group is made up of people who face problems which seem to be linked to a very dense organisation of the settlements. The members of this group don’t have problems with the basic public services like the ones from the last group: 88.8% of them did not complain about water supply and 96.4% didn’t mention electricity as a problem on their plot. These results confirm the idea that these people are living inside or near the town centre where these services are available.

On the contrary, typical environmental problems are often mentioned in this group. 63.5% of the people (against 45.5% in average) were complaining about the **rain water** at their *kata* level and 37.8% (against 19.0%) at their plot level. They were 35.1% (against 19.5%) to mention the problems of **waste water and excreta** at their *kata* level and 20.7% (against 8.4%) at their plot level. Moreover, 35.6% of them (against 21.5%) were complaining about **domestic waste** in their area.

The density of the settlement makes social **relationships** more difficult too: 23.4% (against 15.3% in average) of the people of this group indeed mention this kind of problem at their plot level and 35.6% (against 31.0%) complain about the **security** in the area.

The last problem shared by the people in this group is the **accessibility**. We saw that it is a global problem in the town but 74.3% of the people mention it against 64.9% in the entire sample. It may look surprising that people living in dense areas and therefore inside or near the town centre are complaining about it. Many roads in these areas in Moshi are however still made of mud or are in bad conditions and, combined with a high traffic of vehicles, this can certainly explain people’s complaints.

- **“No problem”** (39.4% of the sample): this group is mainly made up of people who answered that they had no problem in their *kata* or on their plot – to be precise, only 8.7% (against 3.7% in the whole sample) of the people from this group said that they didn’t have problems at the *kata*- level. The most frequently mentioned problems –by more than 10% of the people- are all located in the *kata*: they concern domestic waste (20%), water supply (30.4%) and the three common ones which are accessibility (64.6%), security (26.2%) and rain water (39.2%).

Environmental problems and mitaa randomly selected

Above we have sorted the interviewees according to the problems they face in their *kata* or on their plot. We could define three global types of concerns according to their answers and we could deduce for two of them that they were certainly related to the geographical situation. As we knew the location of the interviewees, we could compare it with this typology; we could therefore see if this analysis was pertinent and moreover we could define the *mtaa* selected in the sample according to the problems that are faced by the people living inside. The results are the following:

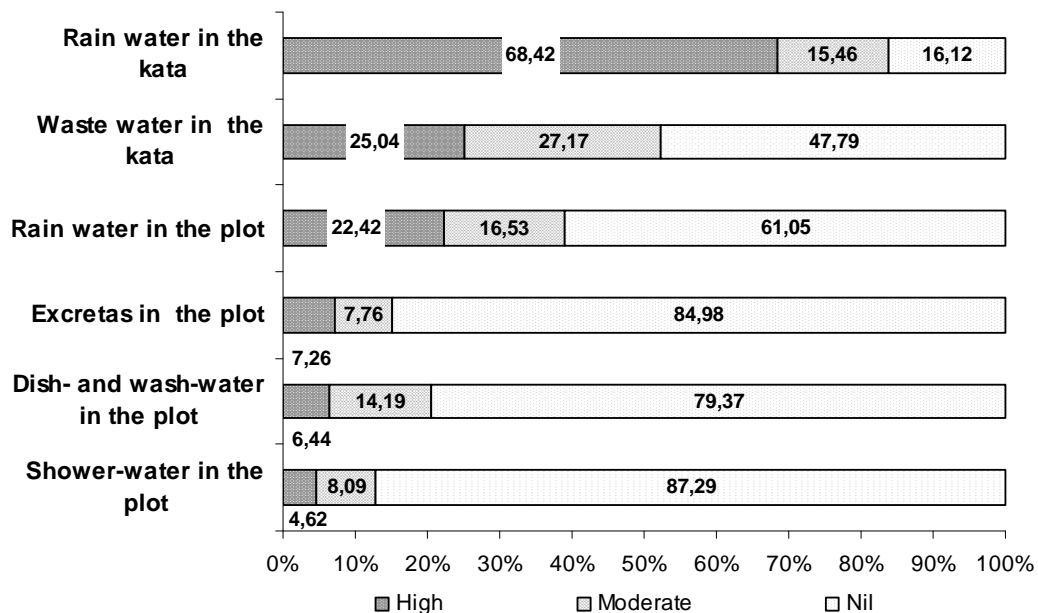
Problems of rural areas	Problems of dense areas	No problem
Mnazi mmoja (Msaranga)	Makange (Majengo)	Mtaa wa Kati (Longuo)

Kiboriloni Sokoni Msaranga (Msaranga) Lombeta (Msaranga) Bonite (Karanga) Matindigani (Pasua)	Kalimani (Kaloleni) Vijana (Korongoni) Railway (Njoro) Mbuyuni (Bondeni) Kiusa Line Dobi (Njoro) Shauri moyo (Majengo) Matindigani (Pasua) Makongoro (Kilimanjaro) Wailles (Korongoni)	Rau Saba-Saba Khambaita (Korongoni) Korongoni Saba Saba Makongoro (Kilimanjaro) Wailles (Korongoni)
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Table 6 Environmental problems and mitaa randomly selected

2.1.2. Inconveniences related to waste-water and excreta³⁶

As we are used to see in this kind of survey, we saw before that the households are not ranking the waste-water and excreta problems as major problems in their area or on their plot. They are more preoccupied by the lack of public services of water, transport and electricity or by the problems of rain water. It is therefore normal that this problem of rain water is appearing to be the more disturbing one for the people among the other problems of sanitation like waste-water or excreta:



Graph 7 Level of inconvenience from rain and waste water

The households are manifestly more preoccupied by the sanitation inside their area than inside their plot. More than half of them (52.2%) are indeed answering that they are facing high or moderate inconveniences from the waste-waters in their kata but this number is falling to 21% at the plot level. We therefore recognise here the traditional “NIMBY” (Not In My Back Yard) syndrome consisting in ejecting refuse and linked responsibilities out of the plot.

This type of answer, together with the minor importance that the people give to the sanitation problems in relation to other problems, could lead to conclude that there is an

³⁶ Analysis of the questions II.4 and II.5

ignorance on the part of the households of health issues linked to bad sanitation. Some questions were devised to highlight this issue.

2.1.3. Households' level of information on water-borne diseases³⁷ :

Thanks to a wide diffusion of educational programs on the media, the dispensaries and the schools, the inhabitants of Moshi are well informed about water-borne diseases. 98.3% of the households declared that they know at least one water-borne disease, 75% of them could cite at least three and half of the population know four or more. The most cited diseases were malaria (96.1%) and cholera (81.5%), six diseases were cited by more than 40% of the people interviewed:

Diseases	Percentage of people who mentioned the disease
Malaria	96,07%
Cholera	81,48%
Diarrhoea	57,87%
Typhoid	51,15%
Bilharzias	45,08%
Worms	43,77%
Dysentery	18,36%
Amoeba	10,98%
Skin infections	10,16%
Eyes infections	1,48%
Others	0,66%

Table 7 : Water-borne diseases cited by people interviewed

This knowledge could have come from personal or relatives' experiences of the diseases but apart from malaria the different diseases did not widely affect the population interviewed:

Diseases	Percentage of people directly or indirectly affected by the disease
Malaria	95,57%
Worms	27,05%
Typhoid	14,59%
Diarrhoea	14,59%
Skin infections	4,75%
Bilharzias	3,44%
Amoeba	2,79%
Cholera	1,80%
Dysentery	0,82%
Eyes infections	0,33%

Table 8 : Diseases having affected directly or indirectly the interviewee

The high level of awareness of the population of Moshi concerning water-borne diseases is actually due to wide information campaigns. Only 3.8% of the households said that they never received this kind of information and they are 75.7% to affirm that they often had access to such campaigns. There are various sources of information and in average the households said that they received information from three different sources.

³⁷ The informations of this part are coming from the answers of the questions II.6 to II.10 of the household-questionnaires.

The main vehicles for this kind of programme are media (radio and newspapers) but dispensaries and schools are also highly contributing to this global awareness:

Sources of information	Percentage of households who received information
Radio	87,36%
Newspapers	67,32%
Dispensaries	57,64%
School	47,45%
Other(s)	13,30%
TV	11,17%
Children	8,05%
Hearsay	7,88%
Municipality	3,12%
Adult education	1,97%

Table 9 : Sources of information about water-borne diseases

Even if the inhabitants of Moshi do not consider sanitation issues as priority problems and are not really disturbed by the waste-waters in their plot, they are well informed about the danger related to waste-waters and excreta. A detailed analysis of their practices and equipments is therefore necessary in order to understand better their sanitation behaviours. We begin now by an overview of the collective equipments and policies in Moshi.

2.2. Public policies on sanitation

Even if the sanitation problems are mainly coming from households we saw that most of them are seeing it as a problem only at the street or ward level. Contamination of water and soils and water-borne diseases are indeed collective problems and need collective solutions. There are in Moshi collective equipments for collection and treatment of waste water and excreta, the first have been built in the early 60's and the last have been finished in 2002.

2.2.1. Brief history of sanitation policies in Moshi

The first collective equipments for sanitation of waste water and excreta were built in Moshi between 1958 and 1962. This sewer network covered a part of the business centre of the town (*kata* of Bondeni and Kiusa), the administrative area (Mawenzi), the compounds of the policemen (Kiusa), the railway station and its employees' compounds (Njoro) and part of the rich area of the Kilimanjaro *kata*. The treatment of the waste water was made in the *kata* of Kaloleni with a treatment system using trickling filters; the effluents were discharged into the Njoro stream which is joining the Rau river.

In 1974, 30% of the households of Moshi were connected to the sewer network and the authors of the « Moshi Master Plan 1974-1994 » were writing that the town fulfilled all the necessary conditions to increase this rate to 100% before 1994... on the condition that the necessary funds were allocated to the extension of the network every year. If this should be impossible, they were advising to promote in some wards on-plot sanitation solutions like traditional pit latrines, soil pit and septic tank. They were also underlining that the waste water treatment plant won't be suitable for the needs of the population after 1976; they were therefore suggesting to build a new treatment plant functioning with oxidation ponds. These recommendations have been very partially listened to; the network has been extended in 1976 towards the north of the town to cover the needs of collective settlements: KCMC hospital, Cooperative College and Police school. Part of Longuo, Rau and Kilimanjaro *kata* have also be covered.

In 1980 a report commissioned by the « Ministry of Lands, Housing and Urban Development » set out some policies in order to increase the rate of connection to the sewer and to promote the use of ventilated improved pit latrines (VIP latrines). Certainly because of the harsh economic situation of Tanzania in the early 1980's and the cut on public expenses planned by the World Bank and the IMF from 1986 onwards, most of these measures have never been taken. In 1988, however, a programme of promotion of VIP latrines has been implemented in partnership by the « Low Cost Sanitation Unit » of the Ministry of Water, the municipality and the German cooperation (Kfw). The first –very ambitious- objective was to install this equipment in 50% of the households but was finally reduced in 1991 to a number of 50 to 70 constructions per year³⁸. By the year 1991 only 46 VIP latrines had indeed been built and only in administrative buildings or schools; the project was finally abandoned in 1993 and never succeeded to go ahead over and above these buildings of demonstration. Ms Kombe (sanitation engineer on the Municipal Health Department) explains today that this project has failed because of a poor packaging and the inability of the municipality to contribute its 40% to the financing of the programme. Poor knowledge of the household demand for this kind of equipment is certainly another explanation for the failure of the project. It indeed seems that no specific survey had been carried out on this issue and neither the subsidies nor the decreasing of the cost in 1991³⁹ succeeded to boost the households' demand.

During the same period (in 1992) a report called « Urban Sector Engineering Project »⁴⁰ commissioned by the office of the Prime Minister and the first Vice-President was concluding that there was a lack of “*trucks for emptying pits*”, “*global plan for sanitation management in town*”, “*laboratory for water analysis*”, “*system for treatment of waste water*”, “*spare parts for the sewer and the treatment plant*” and to “*an infra-utilisation of the sewer network due to a lack of houses connected*” (p38)... The assessment was therefore harsh and showed that the reality was far away from the prospects described by the writers of the 1974 “Master plan”. The situation became even harder from the early 90's when the waste-water treatment plant started to show malfunctions. Due to a lack of financial resources the maintenance of the treatment plant was stopped in 1997 and in 1999 a municipal report⁴¹ talked about a “minimal treatment” of the waste water before dumping it in the Rau river. As this stream is used for irrigation purposes the authors of the Urban Sector Engineering Project “second version”⁴² were warning the local authorities about the possible emergence of “major health problems”.

The situation has evolved in 1998: in parallel with the transfer of the sewerage network to the MUWSA, the two USEP reports became an « Urban Sector Rehabilitation Programme » which led, with the financial help from the International Development Agency, to a substantial improvement of the equipments.

This historical overview wouldn't be complete without talking about some initiatives of households living in plots located far from the sewerage who are determined to finance collectively a part of the costs of connection to the main pipe and develop in their area a simplified sewerage (or condominium sewerage). When the network was under its responsibility, the Municipality had supported such initiatives. A technical and logistical support had been provided to the inhabitants of the area (in Kiusa ward), who had agreed

³⁸ GTZ Document

³⁹ GTZ Document

⁴⁰ USEP 92, followed in 1995 by a report with the same name but written by different consultants.

⁴¹ Environmental Moshi Profile 1999; p25

⁴² USEP 95, 7/1

a cost sharing arrangement in proportion to their resources. Each household was contributing from 5 to 20% of the total cost.

The MUWSA, however, received and rejected, before 2002, three or four of these initiatives, because it did not want to change its pricing policy and feared possible conflicts which could emerge in these neighbourhoods. It seems that this reluctance has now changed.

Map 2 Sewage system evolution and coverage

2.2.2. The collective equipments today

Thanks to external funding the waste collection and treatment have been significantly improved but the households did not react to these improvements as it could have been expected.

2.2.2.1. New improved equipments

Thanks to a credit of the International Development Agency (2 178 millions Tsh⁴³) the sewerage network has been renovated and extended and a new sewage treatment plant made of treatment ponds is functioning since October 1999.

A renovated and extended sewer

The current situation of the pipes (in kilometres) is the following:

Former:	14,33
Renovated:	5
New:	8,411

total :	27,741

The network has therefore been extended by 44% and almost half of the pipes are as good as new. It covers now a surface of 4,06 km², that is 7,3% of the total surface of the town and 13,5% of the surface covered by the water network. The coverage rate of the population is however more uncertain:

In the annual report of the Ministry of Water 2000/2001 we can find on different pages the rates of 7% and 33%.

The last available report of the MUWSA (June 2001) was giving the number of 7%.

In 1995 the number of houses connected to the sewer was estimated at 5,24% by the « Socio-economic Survey ». As for the USEP project (1995, p7/1), it indicated a coverage rate of 100% in the town centre and 18% outside.

	Date	Nb Connections	Coverage
Ministry Report (1999)	June 1998	687	30%
Ministry Report (2001)			
p.13	June 2000	899	7%
p. 20	June 2000	843	33%
p.66	June 2000	950	33%
MUWSA Report (2001)	June 2001	1435	7%

Table 10 Number of connection and coverage rate of the sewerage system

Two reasons can explain these differences:

- a bad knowledge of the number of connections. The management of the network has indeed been very deficient before it came under the MUWSA responsibility
- a confusion between the population who could be potentially connected (population living in areas covered by the network) and the population actually connected. The rate of 33% certainly corresponds to the population covered by the network and the rate of connexion may be around 10%.

⁴³ Approximately 3 millions of Dollars US 1999

In March 2002, the number of plots connected was reaching 1576. Taking 10 people in average per plot ⁴⁴ it means that around 15 000 people are living on a connected plot. According to the census 2002 there are approximately 150 000 people in Moshi, the rate of connection was therefore approaching 10% in March 2002.

A new treatment plant made of oxidation ponds

It is estimated that 7000 m³ of liquid waste are daily produced in Moshi, 33% of which is collected and poured in the new waste-water treatment plant in Mabogeni⁴⁵. This plant can receive up to 4500 m³ of effluents per day, it operates a biological treatment of the waste water by using one anaerobic pond, two facultative ponds – which contain the same volume than the anaerobic ponds but are less deep with a higher surface- and six maturation ponds. After two weeks in these different successive ponds the treated water is poured into the Rau river which is mainly used for irrigation.

The building of wetlands for research uses is currently under progress in the Mabogeni site and this experimental type of treatment should be ready to use at the beginning of 2004. This research programme is implemented by the University of Dar es Salaam.

2.2.2.2. Little households reaction

In view of these recent changes, what could be the assessment of the public policies on sanitation in Moshi for these last years? Undeniably, progress has been made on the supply of services and in the treatment of wastes, but it seems that the population is not reacting to these improvements as it was planned.

According to the different data available, the number of connections to the sewage network grew from 687 to 1576 between 1998 and March 2002. However, in January 2000, 1520 connections were listed by the MUWSA and this would mean that all the new connections (around 900) have been made in 1999. It is actually very likely (and admitted by the MUWSA) that most of these “new” connections were existing connections not listed by the Municipality.

Concerning the new supply of services, after two years (at the beginning of the year 2002) the extension of the network to the area of Majengo and Kaloleni sparked off less than 30 connections. According to the data collected, this poor response of the people’s demand for this service can be explained, firstly, by a lack of information. 35% of the people of Majengo living in a covered area didn’t connect because they didn’t know that they were in this kind of area or because a lack of information concerning the conditions of connection. The MUWSA seems to have understood this problem because an information campaign has been carried out in 2003 in all the plots of this area.

The initial lack of an information campaign during the implementation of the extension of the network is symptomatic of a common habit of programme managers to take only into account the supply side of the project. The extension of the network to these areas could unquestionably be justified by demographical, topographical and technical matters and these parameters have certainly been taken into account. But, in opposition to this, the households’ demand for the service was certainly considered as an additional variable, automatically fitting into the new supply of services. This lack of demand analysis in the project design also explains the temporary failure of the programme; 46% of the households indeed answered that they did not connect because of reasons linked to the conditions of connection. The price of connection was too high for 18% of them and 28%

⁴⁴ according to the results of the household survey, there are 9,2 people per plo

⁴⁵ Environmental Moshi Profile 2001

said that it was the landlords' responsibility⁴⁶. The last change on the price policy of the MUWSA⁴⁷ could be a good answer to this problem. We however have doubts about the pertinence of "forcing" people to connect like it has been done with the help of Municipal by-laws since May 2003⁴⁸.

2.3. Practices and facilities for excreta disposal

Approximately 54% of the households interviewed have latrines (with different characteristics and standing) in their plot. The others are using systems which include a septic tank and/or a soil pit or a connection to the sewer.

2.3.1. The latrines

A statistic tool called "multiple correspondence analysis" allowed us to establish a typology of the latrines existing in Moshi. We will present below these different types before tackling the issue of the management of the emptying of these facilities and then looking at the level of satisfaction of the households concerning their facilities. We will finally detail the cost of improved facilities.

2.3.1.1. Latrines of various qualities

The quality and the cost of the latrines can vary a lot and we can even find these differences in the popular language. Thus, what we will call "unroofed flimsy latrines" in our analysis is commonly called "*passport size*" because like in the passport pictures you can only see the head of the user. The latrines considered as luxurious that we will call "high standing" are even sometimes called "*choo cha kulala*" which means "latrines where you can sleep".

The typological analysis of the latrines allows to classify the latrines found in Moshi in four types from a "high standing" one to an "unroofed flimsy" one including middle and low standing types:

The "**High standing**" type of latrines is found in 6,3% of the plots of our sample equipped with latrines. This type includes all the improvements found in Moshi: a double-pit for 26.1% of them (against 8.0% for all the latrines), one (or two) watertight pit(s) for 82.6% of them (against 43.5%), a ventilation pipe for 65.2% of them (against 11.1% for all the latrines of the sample) and a water-seal pan (59.1% against 4.6%). All the latrines of this type have walls made of bricks and cement, a roof and a cement slab; 72.7% of them (against 5%) also have a discharge pipe going out of the pit.

The second type, called "**Middle standing**" is by far the most frequent one (55.8%). It is made of latrines with the same superstructures than the high standing one but without the various improvements. Thus, only 10.8% of these latrines have a double pit, the pits are less frequently water-tight (61.9%), only 10.8% have a ventilation pipe, only one has a discharge pipe and almost all the slabs (made of concrete or cement for all of them) have only a single hole. These latrines tend to be older than the average: 57.8% of them are five years old or more (against 39.3%).

The third type, called "**Low standing**" (26,3% of the latrines of the sample), is made of facilities without almost any kind of improvement. None of them have a double-pit, a ventilation pipe or a water-seal pan, only 2.2% of them have a ventilation pipe and 13.2% of them have a water-tight pit (against 43.5% in average). Even if all these latrines

⁴⁶ see 1.1.1.2, p88

⁴⁷ see 2.4.4, p130

⁴⁸ This policy consists in threatening the people to expel them from their plot if they did not connect

have walls, their superstructure is often made of materials of poorer quality. 34,1% of the walls are indeed made of mud bricks, 28,2% of wood or planks, 8.2% of iron sheets and 6% of other materials. The diminution of standing is also illustrated by the absence of roof in 26.1% of these latrines (against 18.5%) and by the nature of the slab which is for 23.9% of them made of wood and mud (against 14.1%), for 5.4% made of wood and for 8.7% made of others materials. Due to their relative poor quality these equipments are quite a lot younger than the average, 57.8% are from one to five years old (against 46.1%) and 27.7% are less than one year old (against 14.64% in average).

The fourth type is the one with the lowest standing, it is called “**Unroofed flimsy**” and includes 11.6% of the latrines of the sample. This kind of latrines almost doesn't have any of the improvements that we saw above. More than half of them have no walls (58.3% against 6.2% in average) and none of them have a roof. When these latrines have walls they are mainly made of wood or planks (for 61.1% of them against 11.6% in average) or iron sheet (for 22.2% against 3.7%). The quality of the slab is also poor: 67.5% are made of wood and mud and 20% of wood only. This kind of equipment is not designed to last and they indeed have a low average age: 34.1% are less than one year old and none of them is older than 10 years.



Unroofed flimsy latrines
("passport size")



Low standing latrines



Middle standing latrines



High standing latrines (VIP)

Plate 1 Pictures of the different types of latrines found in Moshi
(pictures from Majengo kata)

2.3.1.2. Management of the emptying of the pit

Few pits of latrines have already filled up (17.9%) especially in the cases of the “high standing” (9.1%), “low standing” (10.1%) and “unroofed flimsy” (8.1%) types. These numbers can be explained by the relatively low age of the equipments which has not allowed the pit to fill up yet - the pits are in average filling up after 4.4 years. The “High level” latrines have a low age (2,4 years in average) because they have innovative improvements which were certainly not common in Moshi few years ago. Concerning the others, we saw that they are not designed to last and the people are therefore used to change them when the pit gets full.

On the other hand, 24.7% of the “middle standing” latrines have already filled up and they are significantly older than the others (3 years in average).

When the pits get full people behave in different ways: the most frequent behaviour is to empty the pit (for 52.4% of the latrines) and to shift to another pit dug elsewhere in the plot (43.9%).

The shift to another pit can be made by using the same superstructure but it is likely that for the poor type of equipments people will build a new one. This practice of shifting is of course mainly used by the people having poor quality equipments, it indeed concerns 62.5% of the people having “low standing” latrines and 90% of the one having an “unroofed flimsy” type.

The emptying of the pit is mainly done by people having high or middle standing latrines. 93.6% of these people are using the municipal trucks.

2.3.1.3. Level of satisfactions and reasons for complains⁴⁹

Approximately a quarter of the people were declaring that they were “very satisfied” with their latrines and another quarter that were “not satisfied at all”. Between these two groups, half of the people were saying that they were “moderately satisfied”. These results are however hiding strong differences between the households according to the type of latrines they use:

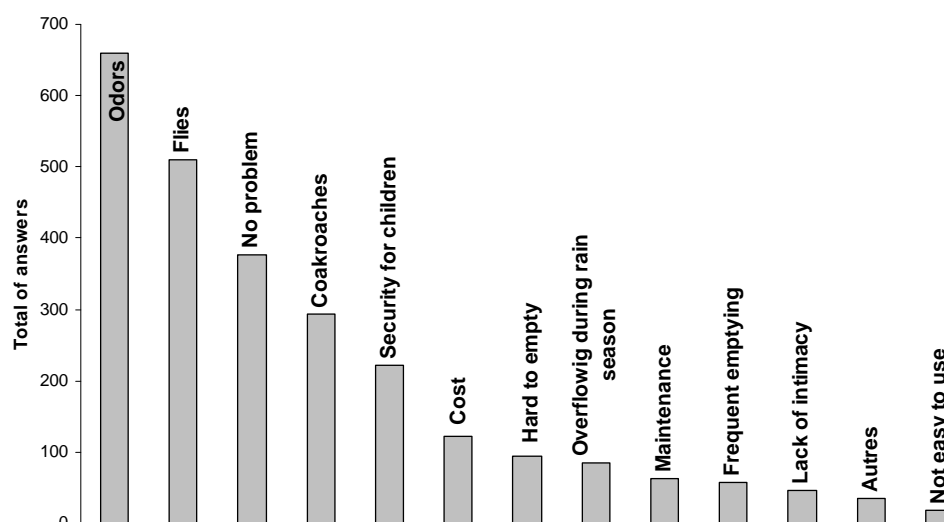
Level of satisfaction	Type of latrine				Total
	High standing	Middle standing	Low standing	Unroofed flimsy	
Very satisfied	45,45%	28,50%	18,68%	10,00%	24,86%
Moderately satisfied	50,00%	46,11%	58,24%	57,50%	50,87%
Not satisfied at all	4,55%	25,39%	23,08%	32,50%	24,28%
Total	100,00%	100,00% ^V	100,00%	100,00%	100,00%

Table 11 Type of latrines and level of satisfaction

We can indeed see in the table above that 45.4% of the people are very satisfied when they have “high standing” latrines but they are only 10% when they use an “unroofed flimsy” one. The level of dissatisfaction is also going from 4.5% to 32.5% according to the type of equipment.

⁴⁹ The results included in this part are coming from the analysis of the answers of the questions IV.18 to IV.20 of the owners-questionnaire and IV.19 to IV.21 of the tenants-questionnaire

People had also to answer about the reason of their dissatisfaction, the results are the followings:



Graph 8 Reasons of dissatisfactions for latrines

“Odours” are the problem n°1 for the interviewees, 37.1% of which are giving “odours” as their first answer⁵⁰. “Flies” are second, then comes the answer “no problem”, then cockroaches and then the danger for the children (risk of falling in the pit); other problems were less mentioned.

2.3.1.4. Cost of improved facilities

The tables presented here are a synthesis of the data collected during the craftsman-survey. They detail the costs of an improvement of simple pit latrines to VIP latrines and the costs of building new VIP latrines.

<i>Tsh or Numbers</i>	Mean	Median	Standard deviation	Maximum	Minimum	Coeff of variation
Pipe	14 081	13 500	3 227	20 000	9 000	0,23
Brackets	2 733	2 733	426	4 000	2 000	0,16
Number of days	1,15	1,00	0,36	2,00	1,00	0,32
Number of workers	1,67	2,00	0,55	3,00	1,00	0,33
Wage per worker	4 850	4 850	651	7 000	3 000	0,13
Labour cost	6 037	4 500	3 094	16 000	3 000	0,51
Total cost	22 852	21 733	4 621	34 733	17 233	0,20
Profit per day	5 496	5 000	1 929	10 000	2 000	0,35
Calculated price	28 348	26 733	5 645	44 733	22 233	0,20

Price given by the craftsman	28 706	25 000	11 794	52 000	15 000	0,41
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Table 12 Costs of improvement of simple pit latrines to VIP latrines

⁵⁰ The graph is showing the sum of the answers for every ground of insatisfaction, people could give up to four.

Tsh & numbers	Mean	Median	Minimum	Maximum	Standard deviation	Coefficient of variation
Total cost in materials	409 771	401 275	100 000	752 000	161 724	0,39
Days of work	12	12	5	21	5	0,38
Unskilled workers	3	3	2	6	1	0,39
Unskilled workers wage / day	1 929	1 500	1 500	4 500	858	0,44
Total cost of unskilled labour	67 536	51 000	15 000	252 000	53 502	0,79
Skilled worker	2	2	1	4	1	0,37
Skilled workers wage / day	3 750	3 750	3 000	6 000	855	0,23
Total cost of skilled labour	79 929	58 000	32 000	224 000	54 983	0,69
Total cost of labour	147 464	115 000	50 000	476 000	104 149	0,71
Total cost	557 235	524 015	150 000	1 228 000	247 841	0,44
Additional profit	65 413	50 000	0	296 800	58 162	0,89
Calculated price	622 648	560 250	180 000	1 416 800	286 512	0,46
Given price	611 621	500 000	250 000	1 416 800	314 827	0,51
Given price / Calculated price	0,98	0,89	1,39	1,00	1,10	

Table 13 Costs of building of VIP latrines with watertight pit

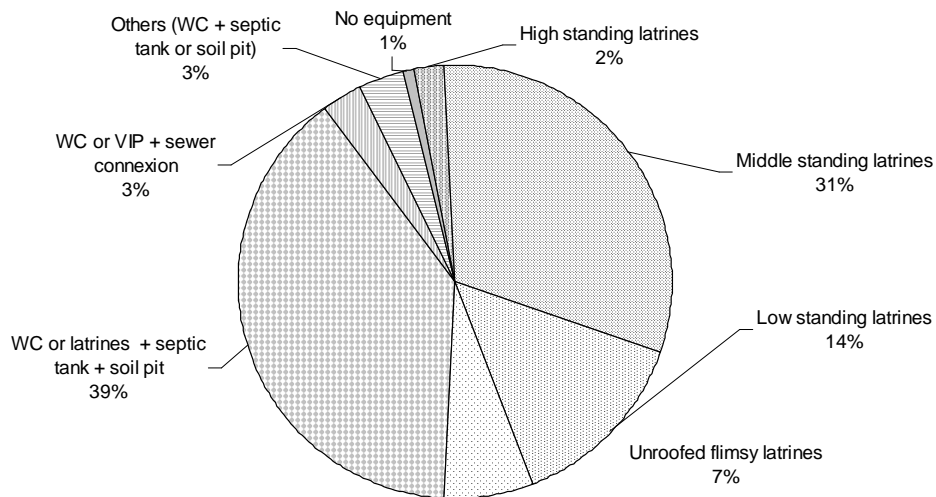
2.3.2. Sanitation disposals for excreta:

54% of the sanitation disposals of the people interviewed are only made of latrines. The next most common equipments are WC or latrines connected to a septic tank and a soil pit (38.7%) and 3.1% of the people have a WC connected to a septic tank or a soil pit. The systems functioning with a connexion to the sewer are few (3.2%) but under-represented due to the sampling procedure which excluded most of the town centre which is covered by the network, so the connection rate is certainly higher⁵¹. Almost no households (0.8%) have any equipment on their plot.

Type of equipment	Number of households	Percentage of the households
High standing latrines	15	2,46%
Middle standing latrines	188	30,87%
Low standing latrines	86	14,12%
Unroofed flimsy latrines	40	6,57%
WC or VIP + sewer connexion	20	3,28%
WC or latrines + septic tank + soil pit	236	38,75%
Others (WC + septic tank or soil pit)	19	3,12%
No equipment	5	0,82%
Total	609	100,00%

Table 14 Type of sanitation disposals for excreta

⁵¹ See 2.2.2



Graph 9 Type of sanitation disposals for excreta

2.4. Practices and equipments for waste-water disposals

There are different kinds of waste-water; we will consider in this part the waste-waters coming from showers, dish-washing, clothes-washing and bathing of children.

2.4.1. Destination of waste-water

If we look at the table below, which details the destination of the different kinds of waste-water, we first notice that there is approximately 40% of the population who pours all these types of waste water in their septic tank or their soil pit. As this number corresponds to the percentage of plots equipped with this kind of facility, we can conclude that the discharge of waste-water is uniform in these plots. The conclusion is the same for the plots equipped with a connection to the sewer; they were 3% of the sample and we can see that approximately 3% of the people pour all the types of waste-water in the sewer. For the other plots there are great differences according to the nature of the waste-water:

	Destination of shower water	Destination of washing water	Destination of dishwater	Destination of water of children's bath
Thrown in the street	4,1%	7,1%	5,9%	4,5%
Thrown in the courtyard of the plot	19,5%	43,9%	45,2%	32,9%
Thrown in the gutter	0,7%	2,6%	2,1%	1,0%
Sewer	3,1%	3,0%	3,1%	3,2%
Pit of the latrines	28,3%	4,3%	2,6%	15,8%
Soil pit	20,7%	16,8%	17,3%	20,1%
Septic tank	22,3%	19,1%	20,2%	21,3%
Others	1,3%	3,1%	3,5%	1,3%
Total	100,0%	100,0%	100,0%	100,0%

Table 15 Destination of waste-waters

Latrines are mainly collecting the water from the washing of bodies: 28.3% of the shower water and 15.8% of the water of children's baths. As these effluents can reach large volumes they can not be poured in the courtyard of the plot. Moreover most of the people

don't have a separate room to take their shower and they therefore have it inside the latrines where the water falls straight into the pit. The dishwater, on the other hand, is very rarely poured into the pit of the latrines (only 2.6%) and it can be explained by a refusal of the people to mix food wastes with faeces⁵².

The dishwater, produced in little quantity, is mainly thrown in the courtyard of the plot (for 45.2% of the households). With the washing water - which 43.9% of the people pour inside the plot too- this water is used to clean the courtyard or to fix the dust during the dry season. These answers also include the people from rural areas who throw these waste-waters in the cultivated area surrounding their house⁵³.

It is also interesting to notice that few people are throwing their waste-waters in the street (between 4 and 7% according to the type of waste). Quite rare in the town, the gutters are almost never used by the people

2.4.2. Existing equipments

Soil pits

The soil pit is an equipment which is quite widespread in Moshi: 45.6% of the people interviewed have one in their plot. Only 6.3% of these soil pits are located outside of the plot, 98.1% are covered and 61.3% are filled with stones. They have been built in average 13 years ago.

88.6% of these equipments are connected to a septic tank.

Septic-tanks

41.3% of the households have a septic tank on their plot; these equipments are in average 15 years old. When they get full, 98.5% of the people call the municipal trucks to empty them.

98.4% of the septic-tanks are connected to a soil pit.

Connection to the sewer

As we saw above, the data concerning the connection rate are biased by the sampling procedure. 13.6% of the households of our sample are living in an area where the sewer is available and among them 25% are connected, that is 3.28% of the sample.

According to the different data⁵⁴, around 10% of the population of Moshi is living on a plot connected to the sewer. The cost of use of the sewer makes up 50% of the water bill or 2000 Tsh per month if the people are not connected to the water-supply network.

2.4.3. Level of satisfaction

79.4% of the households are very or moderately satisfied with their sanitation system for waste-waters:

	Number of households	Percentage of the households
Very satisfied	285	46,95%
Moderately satisfied	197	32,45%
Not satisfied at all	125	20,59%
Total	607	100,00%

Table 16 : Level of satisfaction with sanitation facilities for waste water

⁵² Explanation heard during a plot interview.

⁵³ The "courtyard" (translated by "kiwanja") was understood in a broad sense and included in rural areas the near surroundings of the house.

⁵⁴ See 2.2.2.1 New improved equipments, p120

However this high level of satisfaction is highly dependant on the type of equipment and practices of the people. Thus for instance almost all the people having a connection to the sewer are very satisfied and more than 90% of the people using a septic tank or a soil pit are very or moderately satisfied.

2.4.4. Cost of equipments

Complete on-plot sanitation system

The costs presented here are the costs of a sanitation system made of one WC with its superstructure (that is a WC outside of the house), a septic-tank and a soil pit. As we did for the costs of the latrines every cost item is independently statistically detailed:

	Mean	Median	Minimum	Maximum	Standard deviation	Coef. of variation	
Costs in materials	Soil pit	229 400	281 600	100 000	582 000	141 964	0,50
	Septic-tank	348 200	363 544	146 000	740 000	149 599	0,41
	Superstructure	304 800	325 948	128 100	600 000	150 089	0,46
	Miscellaneous	78 100	84 526	49 600	118 900	21 993	0,26
	Total cost in materials	900 000	999 268	611 200	1 840 000	343 506	0,34
Costs in labour	Soil pit	168 000	230 525	42 000	1 176 000	240 020	1,04
	Septic-tank	105 000	163 350	56 000	578 000	135 317	0,83
	Superstructure	117 000	125 250	33 000	270 000	73 179	0,58
	Total cost in labour	320 000	429 241	108 000	1 852 000	364 637	0,85
Total cost	1 428 509	1 351 000	774 100	3 269 800	637 113	0,45	
Profit	156 645	100 000	0	736 000	171 472	1,09	
Calculated price (costs + profit)	1 579 352	1 420 000	821 100	3 829 800	770 368	0,49	
Price given by the craftsman	1 817 765	1 500 000	1 100 000	3 584 000	743 375	0,41	

Table 17 Details of costs for the building of a complete on-plot sanitation system (in Tsh)

	Mean	Median	Minimum	Maximum	Standard deviation	Coif. de variation
Total days of work	31	31	10	56	13	0,41
Total number of days of unskilled work	56	51	36	90	18	0,32
Wage of unskilled worker	1 611	1 500	1 500	2 000	220	0,14
Total cost of unskilled labour	204 333	139 500	54 000	1 104 000	208 419	1,02
Total number of days of skilled work	20	20	15	25	3	0,16
Wage of skilled worker	4 056	4 000	3 000	5 000	726	0,18
Total cost of skilled labour	224 907	210 000	54 000	748 000	166 294	0,74
Total cost of labour	429 241	320 000	108 000	1 852 000	364 637	0,85

Table 18 Details of the labour costs for the building of a complete on-plot sanitation system (in Tsh)

Connection to the sewer

The table 22 shows an estimate made by the MUWSA in 2002 for a connection of a house located 72 metres away from the main pipe:

	Quantity	Price (Tsh)	Total (Tsh)
Materials			247 000
Pipes PVC 4"	12	7 500	90 000
Bends PVC 4"	6	2 500	15 000
Blocks 5"	100	500	50 000
Cement (bags)	6	7 000	42 000
Sand (truck)	1	40 000	40 000
Miscellaneous			10 000
Labour			213 000
Trench			72 000
Building of the manhole			105 000
Laying of pipes			36 000
Connexion fee			15 000
Total			475 000

Source: MUWSA Technician, 2002.

Table 19 Example of cost of connexion to the sewer

Several comments can be made on this estimate:

- The total cost is 475 000 Tsh, a quite high amount.
- This amount of course varies according to the distance between the house and the main pipe. Decreasing this distance by half would allow to diminish the price by 25%, that is approximately 120 000 Tsh.
- The costs of materials have been calculated using high prices. The craftsman-survey showed that the prices of the materials can turn out to be twice as high. The savings can therefore reach 120 000 Tsh, that is 25% of the total cost.
- Part of the labour can be provided by the household.
- Even if its price can look prohibitive, the connexion is far more competitive than the building of a complete on-plot sanitation system.
- The running costs must be calculated taking into consideration the comparison between the monthly cost of the water bill and the cost of emptying the septic tanks.

Moreover this estimate has been made at the beginning of the year 2002 and since this time the price policy of the MUWSA has changed. Two decisions have been taken in order to decrease the price:

- the connexion fee of 15 000 Tsh has been cancelled
- the MUWSA is now selling the materials to the households who therefore don't pay the VAT.

According to M Kiula, the new sewerage engineer, **this new price policy should decrease all the connexion costs to less than 100 000Tsh.**

3. The demand for sanitation in Moshi

One of the main objectives of the survey was to measure the demand of the households of Moshi for improved sanitation equipments. By using bargaining games we have therefore collected data about the willingness to pay of the households for different sanitation systems. The owners of their plots were asked about their willingness to invest in their plot. Tenants were asked about their willingness to pay for rent increases and landlords about their willingness to invest in their rented plots⁵⁵.

As we also assessed the supply of sanitation systems through the craftsmen-survey, we are able to compare for every kind of equipment if the levels of demand of the people are reaching the prices of the market. We can see for instance if a real demand for connections to the sewer exists in uncovered areas.

This analysis is market-driven, considering only what people can afford according to the current prices of the market. It therefore gives us an appraisal of the possibilities of improvements in Moshi in the current situation and of course shows how the sanitation situation may stay without any public intervention.

The main interest of this kind of survey is certainly not to give “ready to use” solutions but to make a description of the situation of the market of sanitation equipments, which in turn allows us to find answers to some essential issues before planning public interventions: Who can pay what? How many people can not afford the different kinds of improved equipments? How much would it cost to subsidize the investments? Are there any incentives which could boost the demand of the people? Is the lack of investment only due to monetary problems? Does a demand exist for new or unknown equipments?

The willingness to pay (and/or to work) was measured for six different solutions:

Improvements and facilities	Tenants	Landlords		
		WTP 1	WTP 2.2	WTW1
Improvement of latrines to VIP	WTP1	WTP 1		
Building of VIP	WTP 2	WTP 2.1	WTP 2.2	WTW1
Building of soil pit	WTP 3	WTP 3.1	WTP 3.1	WTW 2
Building of soil pit and VIP	WTP 4	WTP 4.1	WTP 4.2	WTW 3
Building of soil pit and septic-tank	WTP 5	WTP 5.1	WTP 5.2	WTW 4
Connection to the sewer	WTP 6	WTP 6.1	WTP 6.2	WTW 5

Table 20 Sanitation facilities and WTP or WTW related questions

The unit of all the following numbers is the Tanzanian Shilling (Tsh).⁵⁶

3.1. Demand for sanitation and renting property market

Taking into consideration the original characteristics of the renting property market in Moshi we chose to make a specific analysis of its functioning by studying separately the behaviours and the demand of tenants and landlords before comparing them. It is from this comparison that we can deduce the potential improvements which could be made in the rented plots of Moshi.

⁵⁵ See for households 1.3.2-Part 6: Willingness To Pay, p93 and for landlords 1.4.3-Part 3: Willingness To Pay and rent increase, p102

⁵⁶ In April 2002 the exchange rate of the Tsh was one Euro for 900 Tsh.

3.1.1. No investment from the tenants

According to the different data available, 50% to 75% of the households of Moshi rent their house, numbers which are quite surprising for this kind of town. The main explanation can be found in the special organisation of the Chagga society, the tribe living on the slopes of the Kilimanjaro mountain: « *The commuting habit which the Moshi inhabitants have adopted, that is people moving in and out of the town for different socio economic activities during daytime and returning to rural areas (where their farms and residential premises are located) during the evening.* »⁵⁷ Thus all year long, people from the slopes are coming every day into town selling their production of fruits or vegetables or looking for a daily job in the informal sector. Among these villagers, some are going back home every evening – that is what is mentioned in the municipal document- but others are renting rooms in town and settle there for an indeterminate time⁵⁸. These people, however, do not forget their family house in the village and its surrounding *kihamba* where they grow coffee and common crops. Due to its high symbolic value for the Chaggas, this plot on the slope remains most of the time more important than the rented house in town.

We can deduce from these habits a strong reluctance of the households to invest in an improvement of their urban settlement. Being tenants and therefore living on a land they don't own -and having moreover a house on the slopes- the people even generally express a categorical refusal to invest in any equipment like new sanitation systems. They would even refuse to work without compensation for these improvements in their plots.

We first verified this idea during the focus-groups⁵⁹ and we definitively validated it during the household-survey. We indeed asked the tenants who, in their opinion, should pay for the sanitation improvements on their plot. The results from this question are the following:

	Number of answers	%age of the answers
Tenants	26	17,11%
Landlord	123	80,92%
Municipality	2	1,32%
Tenants and landlords	1	0,66%
Total	152	100,00%

Table 21 Who should pay for improved latrines in the plot?

	Number of answers	%age of the answers
Tenants	44	14,77%
Landlord	239	80,20%
Municipality	13	4,36%
Others	2	0,67%
Total	298	100,00%

Table 22 Who should pay for an improved sanitation system for waste-water in the plot?

The results of the survey are validating the data collected during the collective interviews: more than 80% of the tenants think that the improvement of the sanitation facilities is the landlords' responsibility. It was therefore pertinent to study the WTP of the tenants for rent increases and the willingness to invest of the landlords on their rented plots.

⁵⁷ Environmental Moshi Profile 1999

⁵⁸ 63.1% of Moshi residents are migrants from rural areas, Master Plan 1995

⁵⁹ Seen page 88: 1.1.1.2 Findings and Lessons

3.1.2. Demands of landlords and tenants

97 landlords and 339 tenants were interviewed during the field investigations in 2002. WTP questions were designed differently for the two groups but were about the same improved equipments.

3.1.2.1. Landlords' willingness to invest

The landlords were interviewed during the survey about their willingness to pay (or to invest) in new sanitation equipments on their rented plots. These questions were asked by using bargaining games with the intention of valuing as closely as possible the landlords' demands (cash or on credit) for the different facilities or to record their refusal to invest.

VIP latrines and "complete equipment" highly rejected by the landlords

The rate of refusal of the landlords for two kinds of equipment is quite surprising in this kind of survey. **48,7% of them would indeed refuse to invest any amount in the building of new VIP latrines on their rented plots and this number went up to 42,9% refusal for the building of a complete equipment including WC, soil pit and septic tank.** As a comparison, for the same equipments these rates only reach 7.3% and 5.6% for the owners. Landlords were even 18.7% to refuse to invest in a soil pit but only 2.4% to refuse the improvement of the latrines and 7% to refuse the connection to the sewer.

In case of refusal the landlords had to give an explanation. We can learn from their answers that the first rationale for not investing in VIP latrines or a complete equipment in their rented plots is that they think that the current facilities are good enough for the tenants.

Many of them therefore think that it is useless to invest in new latrines if you can improve the existing ones. Concerning the complete facilities, most of the landlords were arguing that there is not enough space or water on their rented plots but even if these explanations sounds acceptable it is somehow surprising that we almost never heard them while interviewing the owners... It is highly probable that some of the landlords gave this kind of artificial reasons in order to avoid saying what several of them said without hesitation: "tenants do not need these kinds of equipment".

Landlords' Willingness to invest

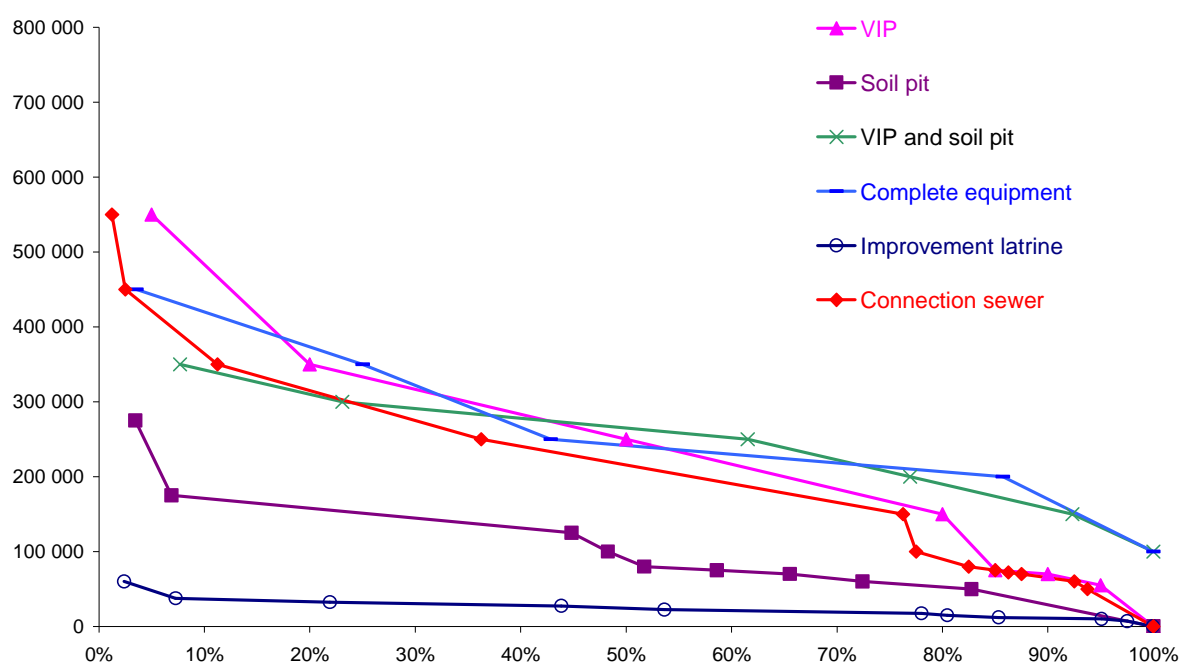
The table below presents the main statistic indicators (mean and median) of the owner's WTP:

		Mean	Median
Improvement of latrines		22 646	22 500
VIP	Cash	210 000	200 000
	Credit	179 474	150 000
Soil pit	Cash	88 448	80 000
	Credit	103 552	100 000
Soil pit and VIP	Cash	230 769	250 000
	Credit	222 083	250 000
Soil pit & septic-tank	Cash	235 714	200 000
	Credit	231 034	250 000
Sewer	Cash	178 150	150 000
	Credit	176 218	150 000

Table 23 : Mean and Median of Landlords' willingness to invest

Demand curves

The demand curves (with cash payment) of the landlords who did not refuse the idea of an investment are presented here. This kind of curve is not difficult to read; we can take as an example the curve of the demand for building VIP latrines: we see for instance on the graph below that 50% of the landlords who did not refuse the idea of an investment are willing to pay 250 000 Tsh or more to build VIP latrines on one of their rented plots.



Graph 10 Landlords demands (cash)

If we compare the demand curves we first notice that the one for the improvement of the latrines is relatively low and far below the others. This is normal because this improvement is very cheap compared to the others and the landlords naturally integrated this fact before giving their answers of WTP.

Apart from the demand curve for an improvement of latrines, the lowest curve is the one for the soil pit. It seems therefore that the landlords do not express a high interest in this solution.

The other curves are nearer and they intertwine, it is quite impossible to rank them. We can therefore see that the demands for all these facilities are quite similar but taking into account the rate of refusal for the two facilities mentioned above we can conclude that the **landlords really expressed interest in the improvement of the latrines and the connection to the sewer.**

The analysis of the WTP with credit solutions⁶⁰ does not give us any more interesting information on landlords' demand. The "cash" and "credit" demand curves are very close and for two equipments the "cash" demand curves are even higher than the "credit" demand curves. According to the data collected during the collective interviews **we were**

⁶⁰ See for details of WTP questions for landlords: 1.4.3 p102

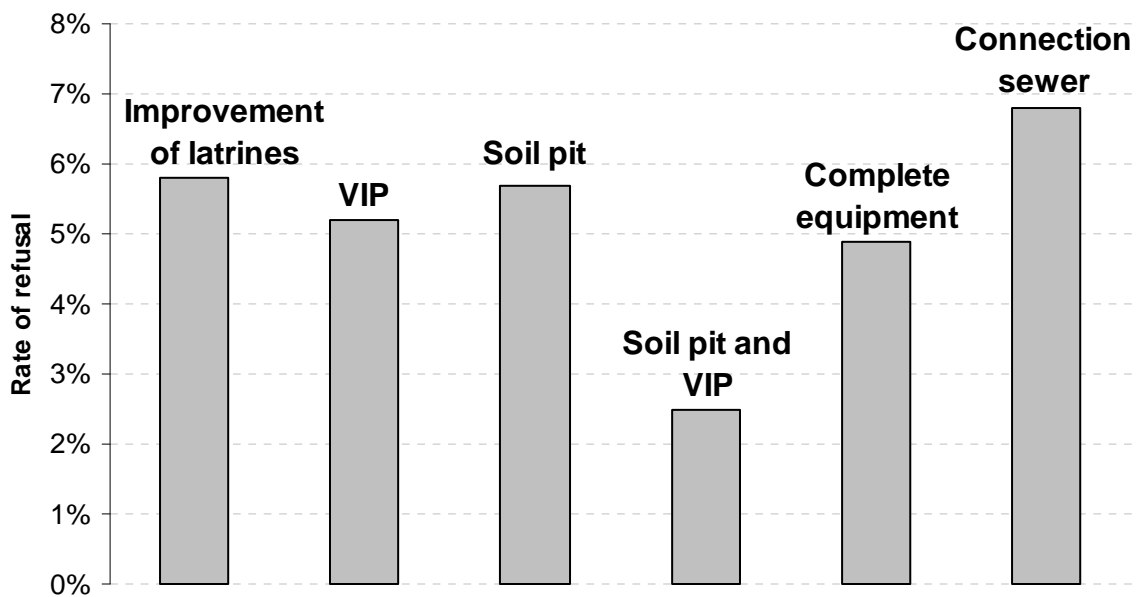
expecting that available credit solutions would boost the landlords' demand for improved equipments but this is not the case. We could try to explain this surprising result by methodological issues concerning the design of the questions of WTP but there is also another more simple explanation: the landlords don't want to be in debt for building facilities on a plot where they do not live. This last assumption sounds acceptable but still contradicts the results of the focus-groups where the landlords were complaining about the lack of credit institutions for housing improvements in Moshi⁶¹.

3.1.2.2. High tenants' WTP for rent increases

Landlords used to say during the interviews that even if they would accept to invest in new sanitation facilities in their rented plots tenants would never accept to pay rent increases. The results of the household-survey however proved that these statements were wrong. Very few tenants refused to pay any rent increase and they even expressed a willingness to pay a high percentage of their current monthly rent.

A massive support for the solutions submitted

The graph below is presenting the tenants' rate of refusal for the different facilities submitted:



Graph 11 : Tenants refusals to pay for an increase of the monthly rent

Very few tenants were refusing to give any amount of WTP and would so refuse to share the cost of new sanitation facilities with the landlord.

High amounts of WTP in percentage of the rent, in particular for the poorest:

We are comparing here the WTP of tenants in rent increases with their monthly rent. This comparison is not made at the room level but at the habitation one:

	Mean	1st quartile	Median	3 rd quartile
WTP1 / Monthly rent	23,4%	11,6%	20,0%	28,6%
WTP2 / Monthly rent	33,5%	17,7%	27,5%	40,0%

⁶¹ See 1.1.1.2, p88

WTP3 / Monthly rent	35,0%	20,0%	29,2%	40,6%
WTP4 / Monthly rent	57,2%	30,0%	50,0%	75,0%
WTP5 / Monthly rent	40,4%	21,0%	34,4%	50,0%
WTP6 / Monthly rent	34,2%	16,7%	25,0%	45,4%

Table 24 : Tenants' WTP in proportion to their monthly rent

Tenants will to pay an important increase of their rent: this increase is going from 23.4% to 57.2% of their current monthly rent. Half of the people are willing to pay an amount equivalent or superior to 20% of their monthly rent for an improvement of their latrines (WTP1) and approximately equivalent to 30% or more for the other facilities.

The high values for WTP4 are certainly due to the different methodology used for these questions (open-ended questions against bargaining game)

It is moreover very interesting to point out that an in-depth analysis shows that the people with the lower rents –certainly the poorest- are willing to pay the higher increases in percentage of current rent.

3.1.2.3. High amounts of tenants' WTP which are globally superior to the landlords' rent increases

The analysis of the results of the landlords-survey shows that 99.72 % of the accommodations are rented per room, households then decide if they rent one or several. The WTP of the tenants for rent increases has been measured at this level (per room) and we present here, at this level, the main statistical results of the tenants' WTP and of the landlords' willingness to increase rent after investing:

		Mean	1 st quartile	Median	3 rd quartile	Standard deviation
WTP1	Improvement of latrines					
	Tenants WTP	891,6	500	625	1000	683,5
	Landlords' Rent increases	480	500	500	500	312
WTP2	VIP					
	Tenants WTP	1178	625	1000	1500	867,6
	Landlords' Rent increases	854	500	500	1000	848
WTP3	Soil pit					
	Tenants WTP	1294,9	681,2	1125	1500	1138,8
	Landlords' Rent increases	521	500	500	500	350
WTP4	Soil pit and VIP					
	Tenants WTP	2141,2	1000	2000	2500	2049
	Landlords' Rent increases	1221	1000	1000	1000	654
WTP5	Soil pit & septic-tank					
	Tenants WTP	1475,2	750	1250	1750	961,8
	Landlords' Rent increases	860	1000	1000	1000	407
WTP6	Sewer					
	Tenants WTP	1756,1	875	1125	2000	3515,4
	Landlords' Rent increases	811	500	1000	1000	391

Table 25 : Statistics of the WTP of the tenants and the rent increases of the landlord (at the room level)

According to the contents of the table above, the willingness of the tenants to pay rent increases for sanitation improvements are globally superior to the rent increases that the landlords would make after investing in new equipments on their rented plots.

Another analysis moreover shows that the tenants' WTP is globally superior to the landlords rent increases at all levels of rent and therefore at all levels of standing of the accommodations.

We can then deduce from these interesting results that tenants and landlords would be able to agree on rent increases after an investment of the landlord on the rented plot. Therefore, two obstacles could hinder the investment in the rented plots:

- problems of coordination between landlords and tenants coming from negative mutual perception,
- unwillingness or inability of landlords to invest in their rented plots.

3.1.2.4. The determinants factors of the tenants' WTP

A statistical analysis called Partial Least Squares regression allowed to identify the main factors that determine tenants' demand for improved sanitation services by using the data of the survey. We will summarize here the most interesting results of this analysis; we can group the determinants factors in three wide issues: economy, information and relationship with landlords:

- *Economy*: as we could imagine, the people having a permanent paid have a higher WTP than the others. We could expect this type of result because the questions of WTP were in term of rent increases and somebody who has a permanent paid can plan better his or her expenses in the future and then accept to pay a higher rent increase. In other words, a permanent paid is decreasing the "economic risk" for a household and therefore increases the willingness to pay in the future.

On the other hand there is no strong evidence about the influence of the income on tenants' WTP. The income is boosting the demand for the connexion to the sewer but that is almost everything. It therefore seems that the economic influence on WTP is more related to the stability of the income than to its amount.

- *Information and Perception*: there are several results that show the influence of the level of information of the tenants on their WTP. Basically we saw that the knowledge about ventilated improved pit latrines was increasing the tenants' WTP.

Along the same lines, the people who told that excreta in their plot were one of their main grounds of concern had a higher WTP.

The level of education is of course strongly related to the knowledge that the people have on different sanitary issues and as expected the WTP increases with the level of education achieved by the tenant.

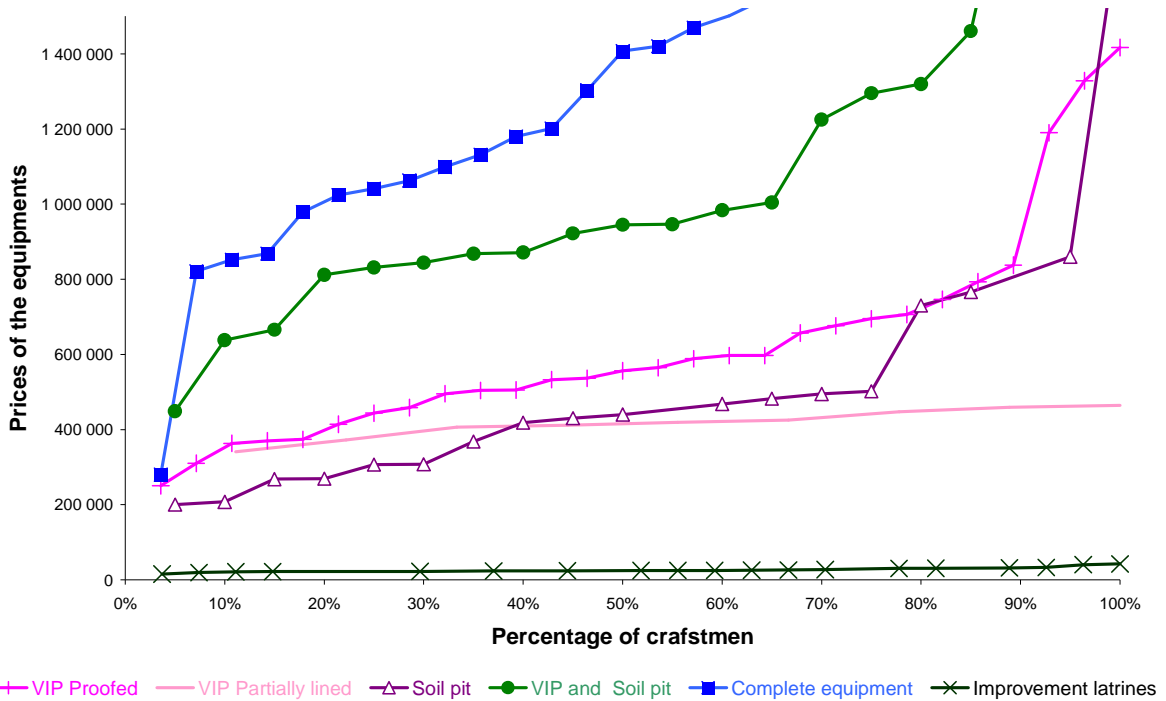
- *Relationship with landlords*: by using the answers to the questions about the relationships between landlords and tenants we could see that the tenants having a poor relationship with their landlords -because he or she is living out of Moshi- have a lower WTP.

3.1.3. Which facilities could be financed in rented plots?

We saw that in the current situation the only way to finance an improvement of the sanitation facilities in a rented plot would be an investment from the landlord followed by a rent increase. As the result of the WTP survey showed that tenants and landlords could agree on rent increases after an investment of the landlord in the rented plot, we now have to see if the landlords can invest in their rented plot in facilities purchased at the market price. We therefore have to compare the willingness to invest of the landlords with the prices given by the craftsmen.

3.1.3.1. Prices of the sanitation facilities

The prices given by the 29 craftsmen interviewed are represented in the graph below. The curves represent the prices for all the facilities and can be read as follows, for the price of the soil pit for instance: 5% of the craftsmen gave a price of 200 000 Tsh, 40% of them gave a price equal or inferior to 400 000 Tsh and all of them gave a price inferior or equal to 1 700 000 Tsh. We could also read it like this: 5% of the craftsmen can build it for 200 000 Tsh, for 400 000 Tsh there is 40% of the craftsmen who would build it and all of them would build it for 1 700 000 Tsh.



Graph 12 Prices of on-plot sanitation equipments (in Tsh)

The graph above shows that the prices of the facilities vary a lot from one craftsman to another. They vary because of differences of quality but certainly also according to the behaviours of the craftsmen during the interviews. Prices were not negotiated and some of the craftsmen, maybe thinking about making a good affair, have certainly given high prices.

We need however to choose a reference price to compare the craftsmen's supply with the demands of the landlords. We will actually study the situation of the market with two scenarios:

- the first quartile price, which is the price that 25% of the craftsmen would accept to build the facility and/or
- the median price, which is the price that 50% of the craftsmen would accept to build the facility.

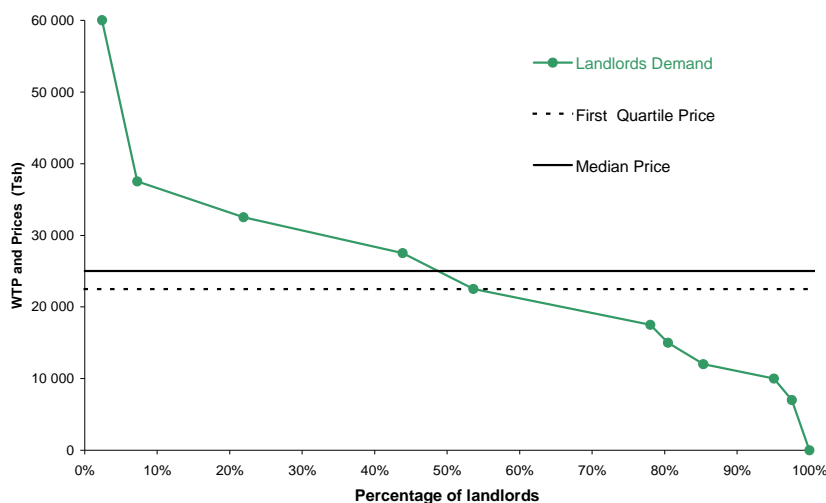
Using this kind of scenarios we will assume that at the price chosen the quality of the facility is satisfactory and there would be enough craftsmen to accept to provide the facility to the landlords which are in demand. The first quartile and the median prices have been chosen in accordance with these assumptions.

According to the price curves and the assumptions made above and of course, according to the demands of the landlords, two improvements or equipments could be purchased by some of the landlords: the improvement of the latrines and the connection to the sewer. The others facilities submitted have too high prices which are too high (VIP latrines, VIP latrines and soil pit, complete equipment) and/or do not interest the landlords (VIP latrines, Soil pit)

3.1.3.2. Prospects of improvements of latrines⁶²

This solution is by far the cheapest and only needs a day of skilled labour. The craftsman adds to the pit of the existing latrines a ventilation pipe which will eliminate most of odours and flies.

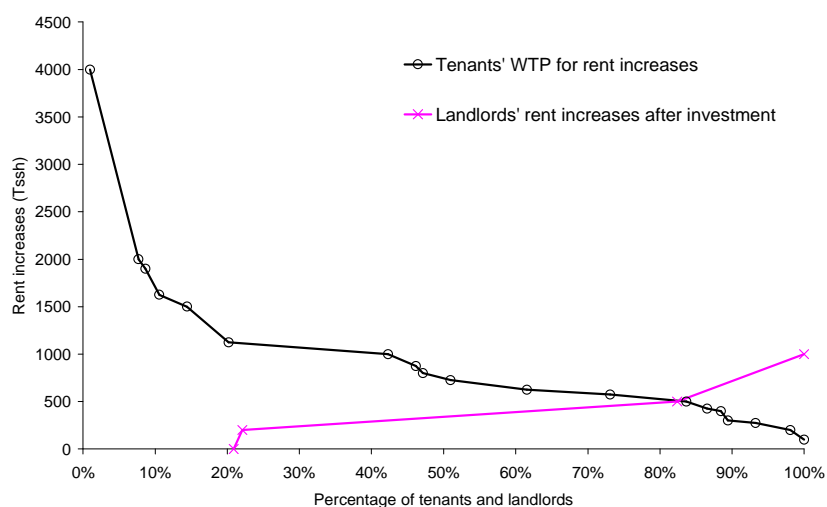
The price of this improvement varies from 15 000 to 42 000 Tsh, the first quartile price is 22 500 Tsh and the median price is 25 000 Tsh.



Graph 13 Landlords' demand and prices for latrines improvement

At the median price of 25 000 Tsh, 50% of the landlords would be willing to pay. Decreasing the price to the first quartile would not really increase the landlords' demand and the price should be under 20 000 Tsh to encourage more landlords to pay the improvement -at the minimum price of 15 000Tsh 80% of them would be willing to pay.

These results suggest that there is a high demand for latrine improvement on the rented plots in Moshi. At the median price of the craftsmen's prices, half of the landlords would indeed have the will to invest on their rented plots. They would however also increase the rents and we therefore have to see if the tenants would accept these increases.



Graph 14 Supply and demand of rent increases after latrines improvements

⁶² The demand curves presented here are made of the answers of the landlords who did not refuse the idea of an investment

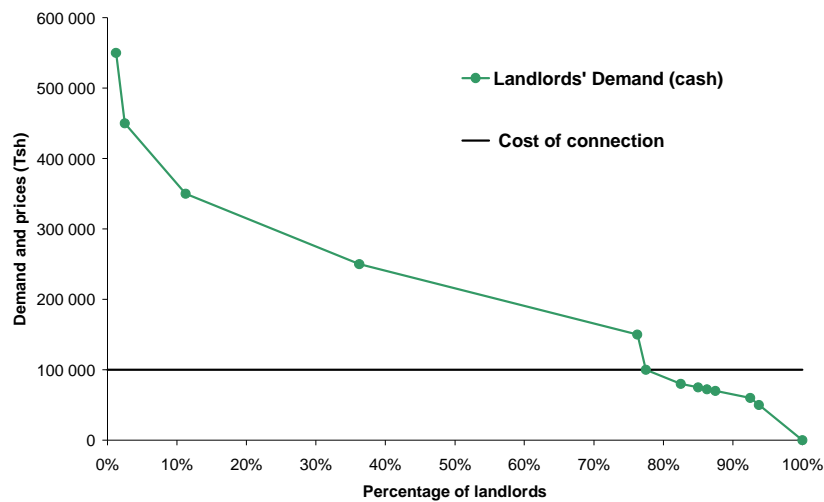
The graph above shows that most of the tenants could agree with their landlords on rent increases after an improvement of the latrines. 80% of the landlords and the tenants would indeed agree on an increase of 500 Tsh per month and per room.

It is moreover interesting to notice that 20% of the landlords would pay the improvement without asking any contribution to their tenants.

These results show that **a high potential for improvement of latrines in rented plots exists in Moshi.**

3.1.3.3. High demand for connection to the sewer⁶³

As we saw before⁶⁴ it is difficult to give a reference price of connection to the sewer because it varies according to the nature of the soil and the distance between the house and the main pipe. The estimate of 475 000 Tsh that we saw as an example of cost of connection⁶⁵ was made for a house located 72 meters from the main pipe of the network and can therefore be considered as a maximum. According to the new policies implemented in 2002 the MUWSA sewage engineer stated that all the costs of connexion were now under 100 000 Tsh and we can see that even with this cost of 100 000 Tsh a high percentage of the landlords would connect to the sewer:



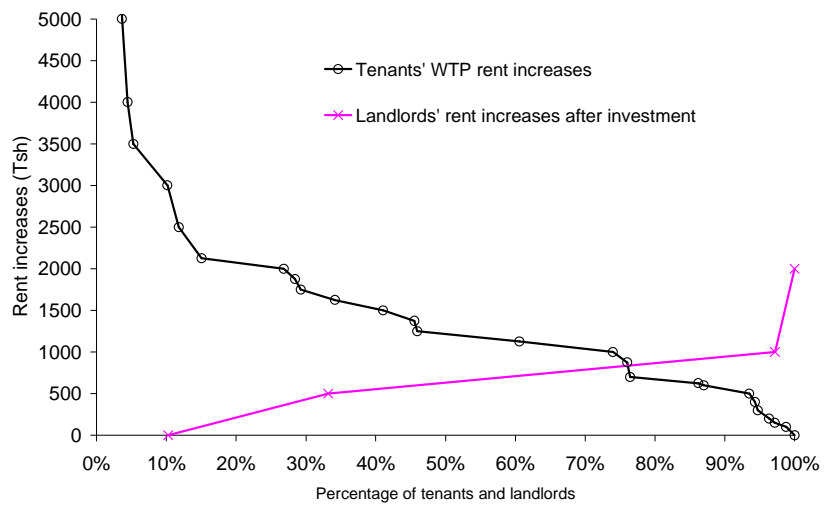
Graph 15 Landlords demand and one price-scenario for connection to the sewer

78% of the landlords would have the will to connect their rented plot if it would cost 100 000 Tsh. It shows that a strong potential for connection of the rented plots to the sewer exists in Moshi. The results of the tenants' survey moreover show that a real demand does exist:

⁶³ Same

⁶⁴ See 2.4.4, p130

⁶⁵ Same



Graph 16 Supply and demand of rent increases after connection to the sewer

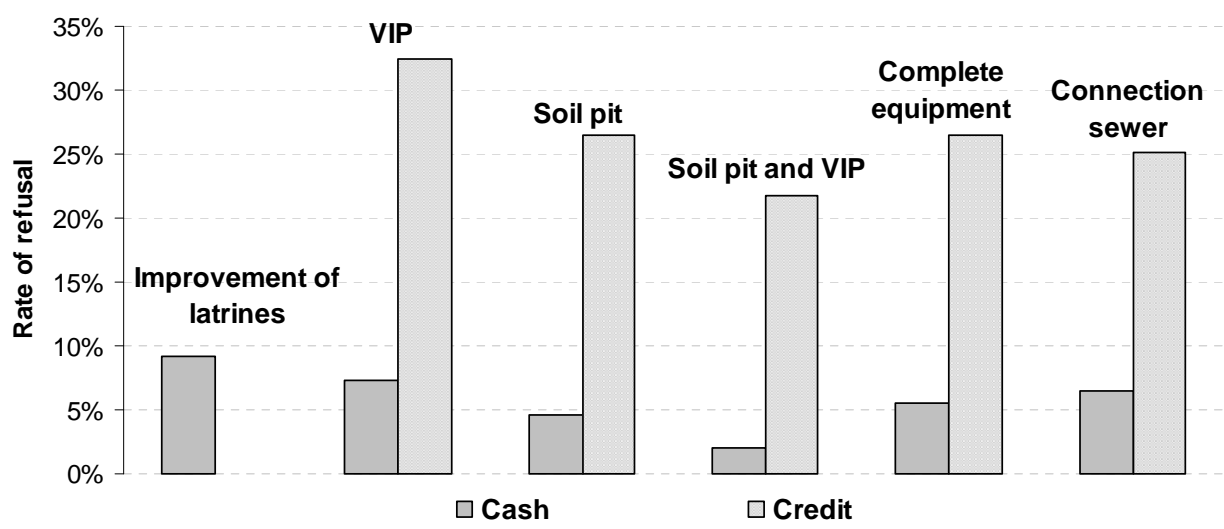
After the landlord’s investment, 75% of the landlords and the tenants would agree on a rent increase of 850Tsh per month and per room. It means that the connection to the sewer system would be possible for 60% of the rented plots if the cost was equal to 100 000Tsh. Under these price-conditions, these **results mean that there is in Moshi a high demand for sewer and this opens interesting prospects on network extension.**

3.2. Owner’s demand for sanitation facilities

Leaving aside the WTP questions for the improvement of the latrines all the WTP questions were asked with cash payment and with credit. The owners’ demands emerge from their answers to these questions and we will use here these demands to highlight some possible prospects of sanitation improvements in owned plots.

3.2.1. A real will to pay for new facilities but not on credit

Like tenants, owners are accepting to pay for new facilities but a lot of them are refusing to incur a debt for purchasing such facilities (see Graph 17 below).



Graph 17 : Owners’ refusals to pay for sanitation facilities

For every equipment and with a cash payment less than 10% of them refuse to pay. These rates of refusal are equivalent to the tenants’ ones and far less important than the landlords’ ones.

22% to 32% of them are refusing to pay with a credit and **they actually refuse the idea of the credit for these facilities**. The level of interest rate is indeed not changing the rate of refusal and most of the owners refusing were explaining their answer by the fact that they don't want to get in debt for this kind of equipments.

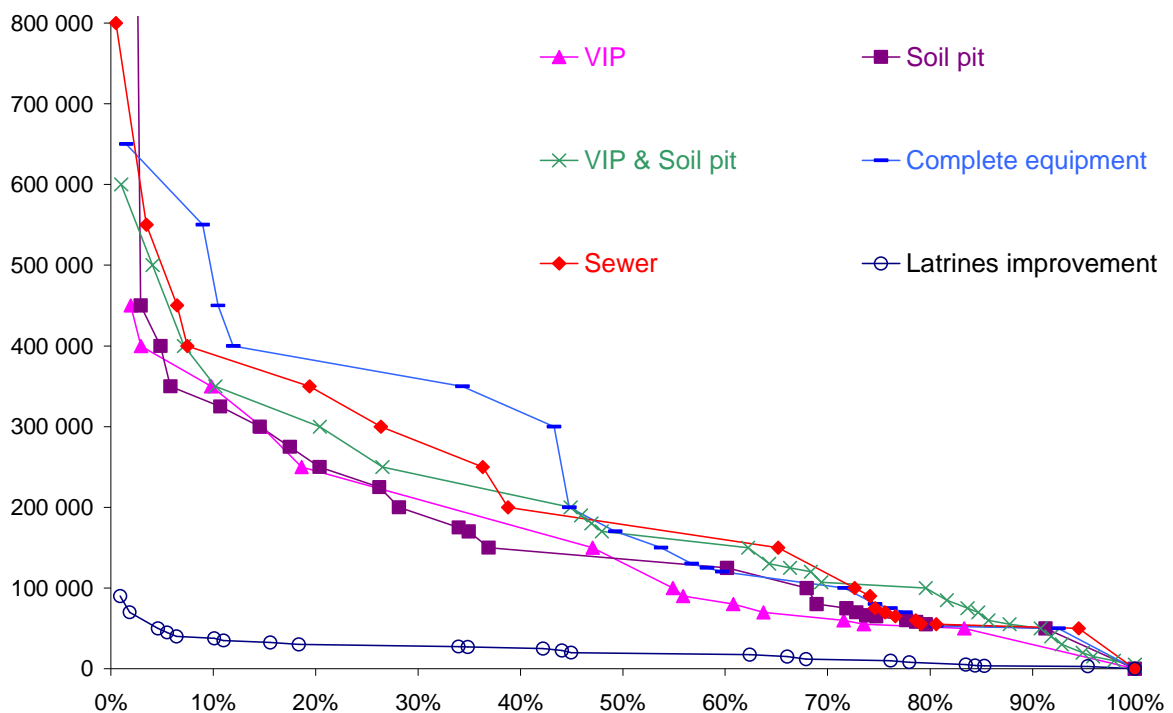
3.2.2. Owners' WTP and demand curves

The table below presents the main statistic indicators (mean and median) of the owner's WTP:

		Mean	Median
Improvement of latrines		19 446	17 500
VIP	Cash	130 811	100 000
	Credit	210 553	150 000
Soil pit	Cash	175 622	125 000
	Credit	190 217	175 000
Soil pit and VIP	Cash	186 846	160 000
	Credit	255 513	202 500
Soil pit & septic-tank	Cash	218 132	170 000
	Credit	287 632	300 000
Sewer	Cash	189 643	150 000
	Credit	266 015	250 000

Table 26 : Mean and Median of owners' WTP

These numbers are giving a first overview of the owners' demands, the complete demands can be represented with curves as in the graphs below. These curves are made of the answers to WTP questions of the owners who didn't refuse to pay. As the rate of refusal was different between cash and credit payment, the demand curves are not made of the same sample and we therefore present them in two different graphs:

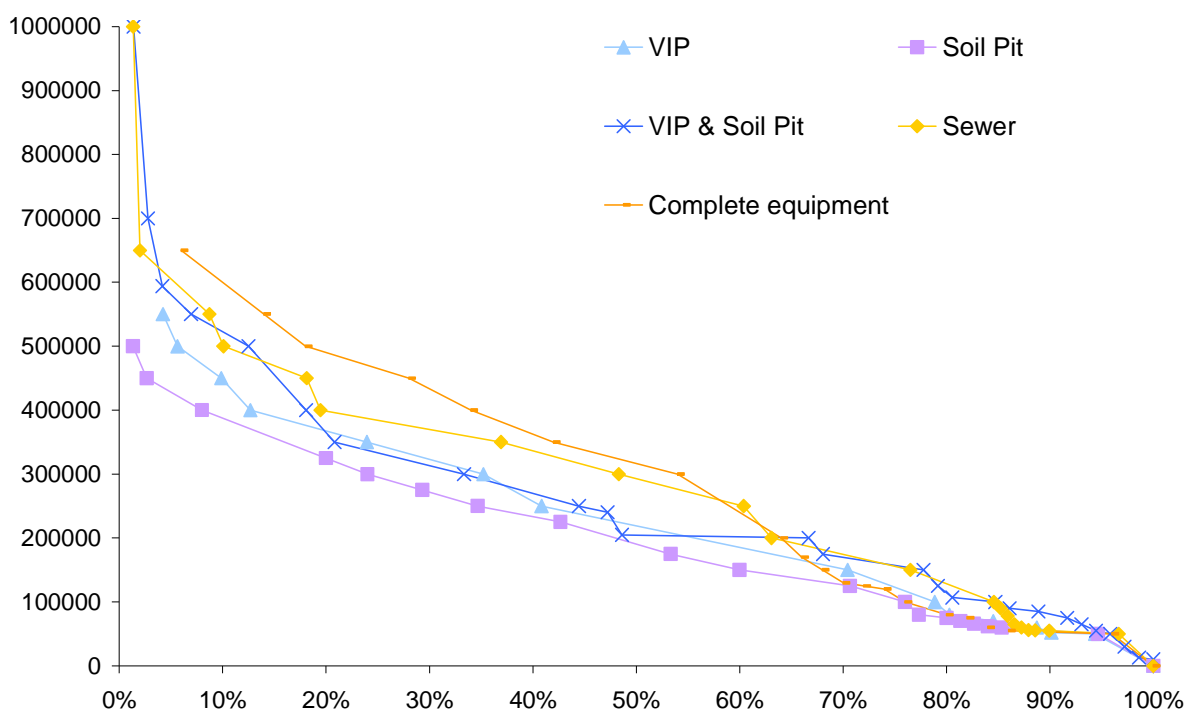


Graph 18 Owners' demand on cash payment (Tsh)

We can see in the graph above that below 200 000 Tsh the different curves are intertwining and we can not rank the demands. This situation is suggesting that the demands of the owners for the different facilities are quite equivalent under this level of 200 000 Tsh, certainly because of income restriction. Below this level the people are expressing a maximum of what they would be willing to pay in order to improve their sanitation facilities but are not able to mark any difference between the types of equipment. Approximately 50% of the owners interviewed were in this situation.

Concerning the other 50% of owners, who expressed a WTP equal or superior to 200 000 Tsh, the demands are more clearly distinct. The demand for the “complete equipment” (the most expensive one) is the highest, followed by the two other solutions combining sanitation of waste water and excreta: the connection to the sewer and the set “VIP & Soil pit”. Then, the demands for VIP latrines and for a Soil pit, both partial solutions, are the lowest. This ranking of the demands looks coherent.

The owners’ demands on credit are now represented here, with a lower sample because more owners refused to pay on credit than cash:



Graph 19 Owners’ demands with payment on credit (Tsh)

Like for the demand on cash payment, the curves are intertwined on the lowest amount. 40% of the owners who answered to these questions expressed a maximum amount of WTP for sanitation improvement without being able to differentiate between the facilities presented to them.

The remaining 60% are ranking their demands like the 50% of owners having the upper demands on cash payments.

3.2.3. Determinants factors of owners’ willingness to pay

A statistical analysis called Partial Least Squares regression allowed to identify the main determinants factors of the owners’ demand for improved sanitation services by using the data of the survey. We will summarize below the most interesting results of this analysis; we can group the determinants factors into different issues:

- *Economy*: the most important economic factor with a positive influence on owners' demands for sanitation facilities is their ability to save money. Purchasing this kind of equipment is indeed an investment for a household, so either it has to save money before it buys or it has to repay a monthly credit. In both cases, the household needs to be able to keep a part of its income every month.

The other economic factor increasing the owners' WTP is the wealth of the household.

- *Perception of sanitation problems and facilities*: The people who mentioned sanitation problems in their ward, as the ones who answered that they are not satisfied with their current sanitation system for excreta, expressed a higher WTP than the others. It is actually normal that the people who express more concerns about sanitation are willing to pay more for solving these problems.

- *Population density of the area*: the people living in densely populated areas have higher WTP than the average and people living in low-density areas express lower amounts. The denser the area, the more acute are the environmental and health problems caused by bad sanitation; it is therefore normal that people living in high-density areas express a higher WTP. On the other hand people living in rural-like areas don't have real problems to discharge their waste-water and therefore their demand for sanitation facilities is lower than the average.

- *Education*: The level of education has a strong influence on the WTP. The people without education are expressing a WTP inferior to the others. The education begins to have a positive effect on owners' demands when the people have reached secondary school and has a strong positive effect for people who attended university.

- *Septic tank on the plot*: the other determinants factors of WTP are somehow common but this one is related to the special situation of Moshi, with a sewer network limited to few areas. In the uncovered areas some people have built a complete on-plot sanitation system and they would now be reluctant to shift and pay again for a connection to the sewer. The people having a septic tank on their plot indeed have a lower WTP for sewer connection than the average.

3.2.4. Some possible improvements and a strong potential for sewer connection

For the same reason than before⁶⁶, we will use here the first quartile and the median prices coming from the craftsmen survey as reference prices. The first quartile price is moreover considered as a minimum price and we decided that prospects of improvements exists when at least 10% of the owners who accepted to pay gave a WTP superior to this minimum.

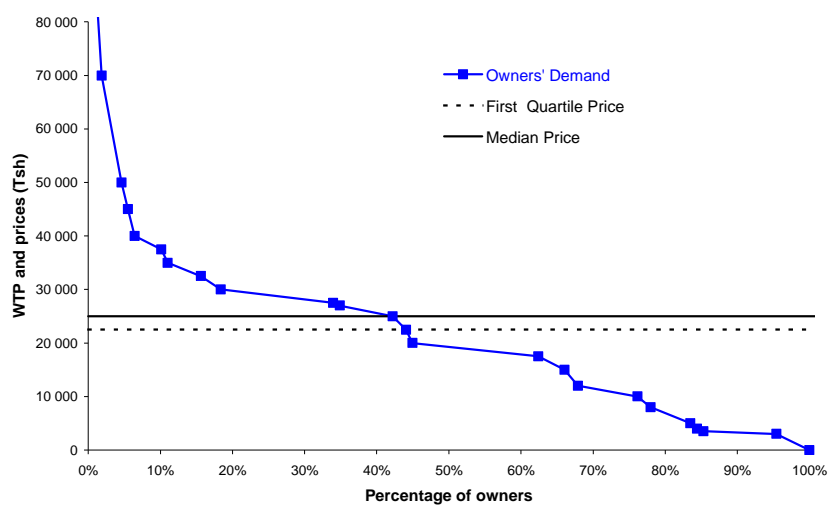
On credit, a little less than 10% of the owners could buy VIP latrines with a watertight pit, we won't therefore consider this solution. Because of low demands the "VIP & Soil pit" and "Complete equipment" solutions have also been excluded.

We will however see that approximately 40% of the owners would be able to improve their latrines, 20% of them could purchase a soil pit and 70% of them could connect to a sewer with a connexion price of 100 000tsh.

3.2.4.1. Forty percent of the owners could improve their latrines

The rate of refusal of owners for this improvement is below 10%, we can see here that, like for rented plots, on owned plots there exist good prospects of latrine improvement:

⁶⁶ See 3.1.3.1 Prices of the sanitation facilities, p139



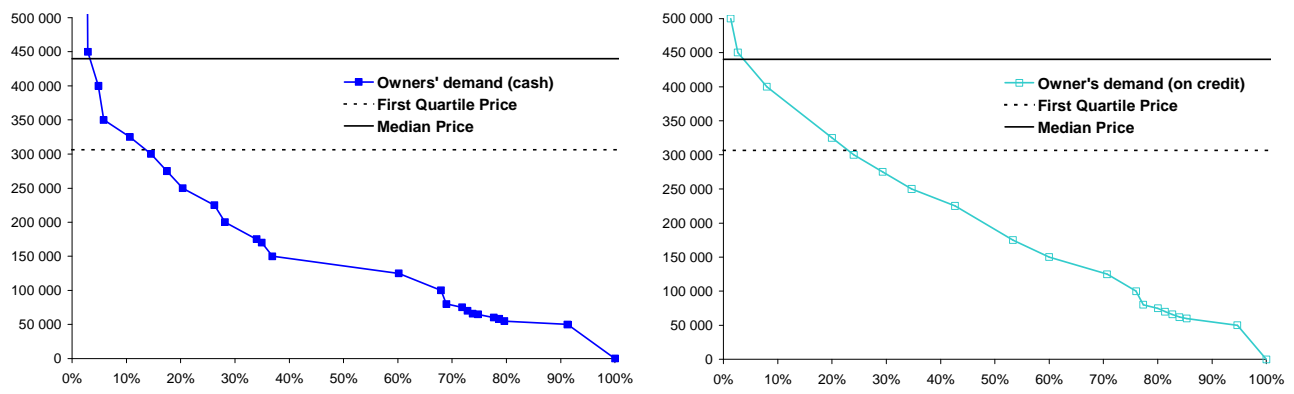
Graph 20 Owners' demand and prices for latrines improvement

At the median price of 25 000 Tsh, 40% of the owners could finance this improvement. It looks difficult to spread this improvement to more plots because the graph shows that with a decrease of the price to the first quartile the demand is not increasing by more than 2% or 3%.

We can however deduce from these numbers that in roughly **half of the owned plots latrines could be improved to VIP latrines.**

3.2.4.2. Some possibilities of soil pit building

We saw that landlords were showing very little interest for the investment in soil pits, we will see here that a little bit less than 20% of the owners could afford to buy this kind of facility.



Graph 21 – Prices of soil Pit and owners demands (cash and on credit)

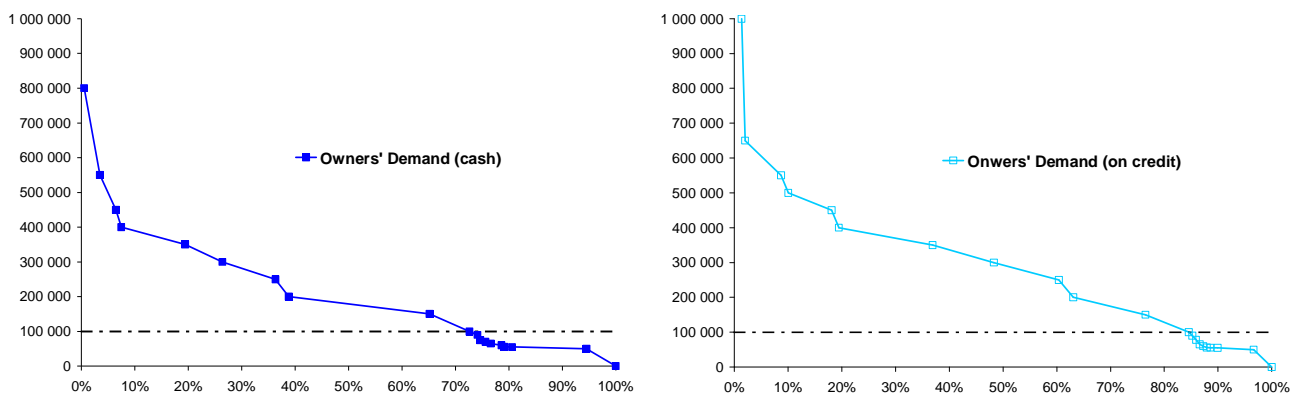
5% of the owners were refusing to pay cash for a soil pit at the price of approximately 310 000 Tsh (the first quartile price); among the others, 17% would be able to purchase this equipment.

They would however be more if they could pay on credit. Even with more than a quarter of the owners refusing to buy a soil pit on credit, the credit solutions are indeed increasing the percentage of owners who can get the equipment up to 19%. We can see on the graph above (on the right) that 25% of the owners gave WTP amounts superior to the first quartile price. As this graph is only representing the owners who accepted the idea of paying on credit we have to reduce this amount by one quarter to get the proportion of all the owners: we get almost 19%.

So, **17% to 19% of the owners could afford to get a soil pit**, these results moreover show that providing credit facilities to the owners has very little effect on their demand for this equipment.

3.2.4.3. A high demand for connection to the sewer

We have before seen the problems of giving a reference price for the connection to the sewer and according to the latest price policy of the MUWSA we finally decided to keep the amount of 100 000 Tsh as a reference. The graphs below show the prospects of connexion to the sewer in case of extension of the network at this price. Even if this analysis is not detailed by town areas it gives an interesting global picture of the situation and shows that a high demand for connection to a sewer exists in owned plots. The first graph on the left shows the demand of the owners who accepted to pay cash to get this facility (they were 6.5% to refuse) and the other graph shows the demand of the 75% of the owners who accepted to pay on credit.



Graph 22 Owners' demands on cash and on credit for a connection to the sewer (Tsh)

At a price of 100 000 Tsh, approximately 70% of the owners would be willing to pay cash for the connection to the sewer. At the same price, 85% of those who accepted to pay on credit would be willing to get connected, that is to say, less than 65% of all the owners.

We can therefore conclude that a very high demand for sewer connection exists in owned plots in Moshi but this demand does not increase if owners can pay on credit.

3.2.5. A possible participation of the owners by their work

For every solution submitted (except for the latrine improvement), the owners could choose three types of participation: paying only, paying and working or only working⁶⁷.

Most of the owners preferred to pay only, from 52% to 56% of them for all the solutions and 69% of them for the connection to the sewer. Around a quarter of the owners chose to work only and from 13% to 18 % of them chose the solution of working and paying.

These results show that an important part (from 48% to 31%) of the households which own their plot could participate in an improvement of their sanitation facilities on their plot by working on this improvement. In average these households would moreover accept to work from 4 to 5 days.

⁶⁷ See 1.3.2.2 Willingness to pay of Owners, p95

A participation of the households by their work is therefore possible in Moshi and could facilitate the improvement of the sanitation situation in the town.

Conclusion

Our main findings and recommendations are the following:

Information and perception of sanitation

The findings on the issue of information available to the interviewees looked quite contradictory at first sight. We indeed saw that, thanks to the media, dispensaries and schools, the people are well informed about the problems they can face because of bad sanitation but they don't express a high level of concern about their current sanitation system and when they do, it is about the sanitation in their street. These results are actually common in this kind of survey, people rarely express that sanitation is a major issue and the "Not In My Backyard" syndrome is now well known.

Distribution of the sanitation facilities

As the sample of the household-survey partially covered the town centre, we don't have a precise picture of the percentage of households living on a plot connected to the sewage system. According to different data available this rate is around 10%.

The main types of equipment owned by the people are latrines which can be found in approximately 50% of the plots. Forty percent of these latrines are in bad or very bad conditions.

The other kinds of facilities used by the people in Moshi are WCs or latrines connected to a septic tank and a soil pit. Around 40% of the plots are equipped with this kind of facility.

Less than 1% of the people do not have any equipment.

A need for information on latrine improvement

The first improvement presented to the interviewees was the improvement of the existing latrines to ventilated ones. This cheap operation allows to avoid odours and flies in the latrines and it seems that few people in Moshi are aware of this. This improvement could indeed be implemented in 40% of the rented and owned plots at the current market price and if it has not been done it is certainly due to lack of information. Many people told the interviewers that they did not know that this kind of improvement was possible and some even decided to implement it in their plot.

An **information campaign** on this issue would therefore certainly raise the standing of the latrines in Moshi.

A very low demand for on-plot sanitation facilities

Mainly because of high prices, very few of the people interviewed could afford to pay for new on-plot sanitation equipments like a VIP latrine, soil pit or complete equipment with WC, septic tank and soil pit. In the current situation there are therefore no prospects for this kind of improvements in Moshi. As we can not imagine that the sewage network will cover the whole town in the coming years, a strong programme of promotion of these facilities should be implemented. This programme should focus on decreasing the price of these equipments by **providing or subsidizing materials**. The labour cost could also be decreased by a **labour contribution** of the household in the building process. The survey showed that 30 to 50% of the owners would be willing to make this kind of contribution.

Another way to help the people to invest in on-plot sanitation could be the providing of credits. The results of the survey concerning this issue are however not clear.

The problem of lack of credit for housing improvement seemed at first to be a major issue according to the answers of the people during the collective interviews, but the results of the household and landlord survey showed that people wouldn't pay more (and sometimes even less) if they could get credit facilities. According to these contradictory results we would suggest to implement ***a pilot project with micro-credit solutions*** and see what happens in a real situation.

High level of demand for connection to the sewage system

According to our results and thanks to the new pricing policy of the MUWSA, 70% of the rented and owned plots could connect to the sewerage system. This result gives of course ***good prospects for an extension of the network***.

Thirty percent of the plots would however remain excluded in case of extension because they wouldn't be able to afford to pay for the connection. This problem could be solved by designing special policies for them, which could be implemented by the MUWSA; it could be considered, for instance, to give them the possibility of building or connecting to ***simplified sewerage*** (or condominium sewerage), as it has already been done in the poorest areas of cities of developing countries and once in Moshi.

A need for coordination between landlords and tenants

This survey showed that in order to study the demand for sanitation services in rented plots one needs to investigate the tenants' and landlords' behaviours on the renting property market. The first finding of these investigations was that tenants would never agree to invest in their rented plots and that is therefore essential that they find an agreement with their landlords who would pay the investment and then increase the monthly rent. We also saw, and it is a second finding, that this kind of agreement is not easy to reach because there are often problems of communication and therefore of coordination between them.

As proposed in the report on financial regulation, the Municipal project of a Sanitation Centre could include in its activities ***the promotion of agreements between the different stakeholders of the sector***, and therefore between landlords and tenants.

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