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Manual Pit latrine Emptying Technology in Dar es Salaam, Tanzania : Service and Equipment

by

Maria Muller* and Jasper Kirango**

Background

Dar es Salaam, the largest city of Tanzania, has a population of about two million people. Eighty per cent of this population relies on on-site sanitation, in particular on pit latrines. The majority of them belong to the low-income group.

The areas where the project has been implemented are unplanned, therefore, title deeds are not issued. But these areas have existed for a long time, so there is no eviction threat whatsoever. A World Bank sample survey of Dar es Salaam of June 1991 indicated that 32% of the houses in unplanned areas are owner-occupied and the remaining 68% have tenants.

Between 1988 and 1992 the Netherlands Ministry of Development Cooperation financed a project to develop a low cost technology for latrine emptying. Activities were implemented by WASTE Consultants of the Netherlands and the Dar es Salaam Sewerage and Sanitation Department. The project became known as MAPET, an acronym for Manual Pit Latrine Emptying Technology.

Existing services

At the beginning of the pilot project in 1988, two types of services for the emptying of pit latrines existed. They were the traditional method and the service with vacuum tankers provided by the Dar es Salaam Sewerage and Sanitation Department.

* WASTE
Crabethstraat 38 F
2801 AN Gouda
The Netherlands
Phone +31 (182) 522 625
Fax: +31 (182) 584 885
e-mail: Internet: waste@tool.nl

** DSSD
Head of Department
P.O. Box 61261
Dar es Salaam
Tanzania
Phone: +255 (51) 75603

343 96 MA. 19353

The traditional method consists of scooping out (sometimes flushing out) the latrine sludge, and burying it in a new hole on the residential plot. The method necessitates breaking down the superstructure of the latrine and the cement squatting slab. Private entrepreneurs are available in Dar es Salaam who practise traditional pit emptying on a casual basis. The advantages of the traditional method are:

- customers and pit emptiers agree personally on the details of the service without bureaucratic regulations.
- Sludge disposal takes place on the residential plot itself by burying the sludge, which makes the operation independent from a centralised agency.

There are disadvantages as well. The method involves a high lump sum expenditure for the customers (between US\$ 30 to US\$ 70). The method is unhygienic for the emptiers who empty the pits manually with buckets. And the emptying takes several days to complete.

The Dar es Salaam Sewerage and Sanitation Department (DSSD) (a City Council Department) has the main responsibility for latrine pit emptying. It operates a fleet of vacuum tankers to this effect. This service has great advantages. The modern technical equipment makes a service possible that is hygienic to both the emptying crews and the customers, and that disposes of the sludge in a controlled manner in the central sewerage treatment plant.

The tanker service also has its drawbacks in the conditions of Dar es Salaam:

- The tankers cannot provide service to many parts of the city, mainly because of inaccessibility of the roads (narrow, steep, muddy) inside the low-income areas.
- Tankers are out of service for long periods due to maintenance and repair
- The unit price of the service is the emptying load of one tanker i.e. 5000 litres. Although this price is subsidised, poor people cannot afford the lump sum of US\$ 10.-
- At the start of the pilot project (in the 1980's) DSSD had reached a limit in employment creation for pit emptying labourers, and is at present even laying off staff.

More generally, due to the structural adjustment programme the demand for employment in the informal and formal private sector is growing. Consequently, a steep rise in informal micro-enterprises has been observed by the ILO. These informal micro enterprises provide employment and respond to a demand for service that the public sector cannot satisfy. The MAPET service is an example of this trend.

Summarizing the characteristics of the situation in Dar es Salaam existing in 1995 as well as at the beginning of the project in 1988:

- a demand for more pit emptying services, especially in areas that are inaccessible to large vacuum tankers
- a demand for a level and type of service which is consistent with the income and

expenditure patterns of low-income households

- a demand for more informal employment opportunities

Consultations on improved services

As a first step of the project, the people most directly concerned with the development of the new equipment --traditional pit emptiers, the DSSD mechanics and the informal sector manufacturers-- were asked to give their suggestions and comments. The project team also decided to visit the political party Chama Chai Mapinduzi-CCM (the most important organizational unit in Dar es Salaam) branch leaders and to talk with groups of women.

During these meetings, people made suggestions about how to introduce the services and attract more customers. They suggested activities that were familiar to them, such as holding a series of branch meetings, providing written information, identification cards for the emptiers, and a financial bonus per customer identified by a local official or women's group. To publicize the service the project team also distributed a MAPET Newsletter with information on the equipment, its use and pictures. These promotional activities stimulated the residents to pressure the DSSD to extend the MAPET services when these started in some areas.

Developing the improved equipment and service

To ensure sustainability, the pilot project relied on the expertise available in the DSSD and an external technician and assistant were posted in Dar es Salaam during the first four months of development and testing of the equipment. Thereafter, the technician came only for short missions for monitoring and to support further developments. National women were also assigned to the project implementation.

During the first period (the test phase) the focus was on technology development. A prototype diaphragm handpump was developed and tested in the Netherlands by consultants and shipped to Dar es Salaam. A second diaphragm handpump was constructed in Dar es Salaam as well as a prototype piston pump. This was done together with three DSSD mechanics, with continuous feedback from the pit emptiers who were using the equipment for earning their daily income.

At the same time, a socio-technical survey was conducted in Manzese, a densely populated, unplanned area in Dar es Salaam. Interviews were held with residents about sanitation practices, the construction and operation of pit latrines, their views on the traditional emptying methods and the DSSD services, and on the cost of traditional pit emptying. Extensive interviews were also held with traditional emptiers, community leaders and women's groups.

The decision to involve traditional pit emptiers in field testing the equipment necessitated the early introduction of enabling support to the pit emptier. This support comprised MAPET demonstrations in the residential areas, and experiments with a system of leases and loans

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operated by the DSSD.

The need for sludge transfer stations was also identified during investigations. These would enable sludge to be deposited in special sites when households were located on inappropriate sites for final disposal, especially in waterlogged areas, where the MAPET technology was demanded mostly. Dar es Salaam being built on flat land, some parts of the unplanned areas have a high ground water table. In those areas MAPET service cannot be operated, as burial of sludge cannot take place where the ground water is high. This is traditional knowledge of the pit emptiers.

The remaining project period focused on the development of several components of the MAPET services. Technology development resulted in essential improvements of the equipment.

At the end of the project period, a second social survey was executed (1991/1992). Residents were specifically asked about their experiences with all available emptying services in Dar es Salaam, such as MAPET, the DSSD services by large and mini vacuum tankers and the traditional.

Service and equipment in operation

The MAPET equipment has two main components: a handpump and a 200-litre vacuum tank, both mounted on pushcarts. Two flexible hose-pipes belong to the equipment, i.e. a 3/4 inch hose-pipe as air connection between the pump and the tank, and a 4-inch hose-pipe of 4 metres to drain the sludge from the pit. A mixing rod to agitate the sludge before pumping is also part of the equipment.

The emptying routine starts with contacting the customer, negotiating over the price, picking up the MAPET equipment from its parking place in the neighbourhood and taking it to the customer's house. The MAPET team digs a hole for sludge disposal in the compound and the latrine sludge is prepared for pumping. After the hose-pipes have been connected the sludge pumping can start. Depending on the sludge's viscosity and the pumping head, it can take five to twenty minutes to fill up on 200-tank with sludge. When a tank is full, the hose-pipes are disconnected and the tank is manoeuvred next to the dug hole, and topped over in discharge position. A pressure relieve valve is opened and the sludge flows into the hole. After putting the tank back in its original position, pumping can start anew and the vacuum tank is filled again. This routine is repeated until the required amount of sludge has been taken out. The equipment is then cleaned and returned to the neighbourhood parking place.

At present only on-site disposal can be practised, implying burying the sludge and covering it with a good layer of soil. Conditions are that the water table is low and there is sufficient space on the plot.

Service providers and the institutional setting

The MAPET service is provided by a team of three emptiers, each of whom is self-employed. The team leader selects his own team members. Together they decide on how to cooperate in the work and how to share the income they earn as a team. They depend on their own efforts to find work. Each team has its own MAPET equipment and its own service territory. The boundaries of each territory correspond to one or more neighbourhood based 'branches', or administrative/territorial units. A branch has on average 110 households (about 500 people).

One team services on average one customer household per day, provided there are good business conditions. The first factor determining good business conditions is a steady demand for service from customers. Customers are defined as people who have a full latrine pit and who have ready cash available. The second factor in good business conditions is to have easy access to repair facilities for the MAPET equipment.

To achieve these conditions, the MAPET teams depend on cooperation with two other parties, i.e. the leaders of the branch or neighbourhood, and the DSSD. The neighbourhood branch office is the central place in the neighbourhood which everybody knows. This place is easily accessible for neighbourhood residents to book the pit emptying service with the MAPET team. And it is here that the MAPET equipment is guarded overnight. Approval of the neighbourhood leaders is therefore essential. The leaders assist with identifying customers.

DSSD gives direct enabling support to the MAPET teams in leasing or lending the equipment to them, and in carrying out major repairs. For minor repairs, the MAPET teams return to the informal mechanical workshops in their neighbourhoods for which they pay themselves. Replacement of major components, such as a wheel, is, however, beyond the capacity of any MAPET team.

In addition DSSD supports MAPET in the following ways:

- training and licensing of the MAPET emptiers
- promotion of MAPET in selected areas and public health education
- monitoring the pit emptying performance of the MAPET teams.

Advantages of MAPET

Residents in low-income areas mention several advantages of MAPET over the DSSD taker service. First, the booking office is at easy walking distance in the neighbourhood, in contrast to the central DSSD offices. Secondly, customers can have direct influence on service performance, through their own negotiations with the MAPET team, through supervision, and through involving the neighbourhood leaders in case of disagreement. Finally, the payment modality is consistent with the income and expenditure pattern of low-income households.

The cost of the service is related to the 200-litre tank as unit of service. Customers and pit emptiers negotiate about the number of tank loads of sludge to be taken out. The price charged per 200-litre tank load is circa US\$ 1.-. A survey in 1992 showed that 27% of the MAPET customers requested up to three tank loads of service, while another 27% of customers requested between three and five tank loads.

Using the number of tanks as a unit of service fits into the buying behaviour of low-income customers, who buy other commodities in the same way (e.g. sugar by the cup). A household that has small amounts of cash available at any one time may prefer to pay removing only one tank of sludge in order to have its latrine functioning again.

Low-income households may be compelled to spend more on emptying of their pit latrines (compared with other households), in the following situation. The households may not have the cash amount available to purchase a large 'amount' of tanker service. And the tanker service may not reach that particular low-income area at all.

To the MAPET teams themselves the great advantage is that the equipment enables them to earn an income that is, on average, larger than they would earn as unskilled labourers in the formal private or public sector. The MAPET equipment is also a sturdy source of income which they can, in daily practice, maintain from their own earning. The major repairs are beyond their capacity. Three years after the end of foreign project support, all the seven MAPET teams are still operating.

Gender and MAPET service

Questionnaire surveys, analyzed by gender, and discussions with women's groups confirmed that women held themselves responsible for keeping the latrine in a clean conditions. This concerns the surroundings in the first place: the latrine slab, the floor, and the yard outside. Latrine pit emptying was not considered women's work.

The MAPET service enables women to carry out their household task more fully by having a booking office in the neighbourhood. As the booking office is on walking distance and is often located in the same building as the local clinic, it is easy for women to make a booking for pit emptying. To go to the centrally located DSSD offices proves to be constraint.

Household decision making on whether to book the MAPET service and to pay, varies. In some households decision-making appears to be taken jointly by husband and wife, while in others the wives are not even allowed to hand over the payment to the pit emptiers.

Women as community members and as businesswomen have indicated their willingness and ability to organise people and manage a businesslike operation. Both these capacities are required if the MAPET service is to expand and acquire a sound footing in the neighbourhoods.

Problems to be solved

First, the sludge disposal method of MAPET is only feasible in location with low housing density, and with a low water table. In order to expand MAPET services to areas with different planning and hydrological conditions, it is necessary to implement a system of transferring the latrine sludge out of the neighbourhood. The pilot project identified the technical, operational and management parameters of such a sludge transfer system and tested sludge transfer stations.

Organizing a regular demand for service from customers is a second issue to be confronted. This is necessary in order to ensure that latrines are emptied before they overflow, and to ensure that the MAPET teams spend less unproductive (unpaid) time in identifying customers. Promotion of MAPET, health education and community mobilization must be increased to create an organisational basis for this.

Public hygiene standards regarding the handling and disposal of sludge must be determined to suit the socio-economic and planning conditions in low-income neighbourhoods. This requires training, supervision, and a legal framework to give DSSD the means to enforce hygiene standards.

A major issue to be confronted is cost recovery for the depreciation of equipment. Currently, the labour costs of the MAPET teams are fully recovered as the fees negotiated with customers are paying for that. However, cost recovery regarding the equipment itself is still not feasible, as DSSD does not have the means to set up an efficient system of revenue collection for the lease of equipment. Moreover, the buying power in low-income areas is too low to cover depreciation of equipment as well.

Finally, an intermediary organisation must be established for scaling up the MAPET service. Such an organization will handle the issues of ownership/leasing of equipment to the MAPET teams; strengthen the organizational capacity of neighbourhood communities in relation to public hygiene; and provide professional expertise to DSSD for improving its regulatory and monitoring capacities.

Scope and impact

The operations of each MAPET team are limited to one neighbourhood, as the non-motorised equipment allows an action radius of about 2 kms. It is essential for the MAPET teams to be supported by the leadership of the neighbourhood where they find their customers. It is in this social environment that the MAPET teams can build up their reputation as reliable service providers, and create their network of clientele. The pilot project has enabled nine MAPET teams to have a continuous service operation providing an income for 27 males and serving neighbourhoods with 4500 people.

The MAPET pilot project has made demonstrations with the new equipment, and supported DSSD staff who organized a series of meetings in each neighbourhood to promote the

MAPET pit emptying service. The project supported the DSSD staff and the MAPET pit emptying teams with knowledge, ideas about promotion strategy, transport, and with solving technical problems. In each of these neighbourhoods, the basis was laid for an accessible, low-cost and reliable service.

The MAPET pilot project has contributed to a lasting relationship between the MAPET emptying teams on the one hand and selected neighbourhoods on the other. In the Dar es Salaam context a neighbourhood is the territory of one political branch.

The project has contributed to the improvement of environmental sanitation by facilitating a pit emptying service in those areas where the conventional vacuum tankers cannot provide adequate services. Also the traditional emptying method has been improved by the development of equipment that makes pit emptying a more efficient and more hygienic occupation. The link with the DSSD contributed to the sustainability of the project, through training of pit emptier, mechanics and staff members, which can be considered a positive impact of the project.

The DSSD/MAPET coordinator is a woman. As one of the few professional women in the world of male engineers and technicians, she has gained the respect of both the pit emptiers and the DSSD management. In the next project phase - with opportunities to try out various forms of management - there will be a privately owned and managed MAPET service next to the public/private services.

The MAPET emptiers in Dar es Salaam are self-employed. They are not employees of DSSD. Thus, MAPET creates additional employment opportunities both for the pit emptiers and for the mechanics in the small neighbourhood workshops.

After the pilot project ended, the MAPET teams are continuing in these same neighbourhoods, relying on the same equipment and the partnership already built up.

The pilot project has enabled nine MAPET teams to have a continuous service operation.

Outlook on Sustainability

The MAPET pit emptying service is sustainable for several reasons. First, it thrives on the complementarity of needs. One of these is the need for earning an adequate income in the informal sector. The other is the need for reliable and affordable infrastructural services that the conventional public service with its conventional modern equipment and high costs is not able to deliver.

The MAPET teams do anything they can to keep their equipment operational. It is in their own interest. And the neighbourhood residents have often expressed ideas about how to organize a more effective, efficient and regular infrastructure service, which responds better to their own demand for a cleaner environment.

The second reason for sustainability is that the MAPET equipment is based on a combination of elements of two technologies familiar to small workshops in Tanzania. The modern technology has contributed the principles of vacuum operation and the techniques of the piston handpump which is utilized in drinking water supply programmes. Maintenance of the

equipment has been ensured by only using materials easily available in the country, and by applying construction techniques generally known and applicable in large and small scale workshops in Tanzania.

Sustainability of the MAPET service will also be enhanced when the method of sludge disposal is further developed. The present method is suitable for about 50% of the city with a low ground water table. A system to dispose of and treat sludge in the neighbourhood or transfer it out of the neighbourhood is required to widen the applicability of the service and its effects on a sanitary environment.

Finally, institutional support for MAPET is ensured through the City Council. MAPET, introducing a new technology, was submitted to the City Council for endorsement. The City Councillors as well as Ministry officials support MAPET in response to the demand for this service from residents. The City Health officials, from the Head of Department to the neighbourhood based Health Assistants, also approve of MAPET and even called in its service, having observed its efficiency, effectiveness and environmental impact.