DRAFT FORMULATION REPORT

MANUAL PIT EMPTYING PROJECT (MAPEP)

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CONTENT

FOREWORD

This formulation assignment was commissioned by the Royal Netherlands Embassy in Dar es Salaam. The activities of the formulation mission, as stipulated in the Terms of Reference are presented in annex 1. The mission was executed over the period 1 - 24 February 1996, by the following team:

- Mr. Leon B.M. Tomesen, consultant and team leader.
- Mrs. Madeleen H.A. Wegelin-Schuringa, consultant International Water and Sanitation Centre (IRC).
- Mrs. Shamsha S. Mwangunga, senior consultant Business Care Services.

The mission was facilitated by Mr. Mlongetcha L. Mkuku.

The mission spend considerable time to review the MAPET 1 project, and worked closely with the Dar es Salaam Sewerage and Sanitation Department (DSSD) for this purpose. All existing MAPET teams in Dar es Salaam were interviewed while a substantial number of households and private enterprises were visited. Related projects, such as the Sustainable Dar es Salaam Project of UNCHS/Habitat, and the Urban Sector Rehabilitation Project of the World Bank were consulted. Daily visit reports are included in annex 4 for specific reference.

At the end of the mission the findings were discussed in Dar es Salaam with the Royal Netherlands Embassy, the DSSD, and the Sustainable Dar es Salaam Project. However, any mistakes, omissions or other flaws in this report are the sole responsibility of the mission, which reached a consensus about its content.

The mission would like to express its gratitude for the cooperation extended by the Dar es Salaam Sewerage and Sanitation Department, the Sustainable Dar es Salaam Project (in particular Mr. Chris Radford and Mrs. Joyce Ndesamburo), and Population Services International (in particular Mr. Tim Manchester). Thanks are also due to H.E. the ambassador of the Royal Netherlands Embassy in Dar es Salaam, the second secretary (Mr. Bob Hensen) and the sector specialists health (Mr. Thomas van der Heijden and Mr. Ger Steenbergen), who have been assisting the assignment and provided helpful support and guidance. Last, but not least, all those who gave their valuable time and subjected themselves to the tenacious questioning of the mission deserve our gratitude.

EXECUTIVE SUMMARY

BACKGROUND

1. About 90% of the 3 million residents of Dar es Salaam use pit latrines and septic tanks, as only 10% is connected to a sewer system. There are approximately 270,000 pit latrines, that need to be emptied every five years. Half of the latrine pits can not be reached by the tankers of the Dar es Salaam City Council.

2. In the Manual Pit Emptying Technology (MAPET) project (implemented from 1988-1991) and a Comparative Study on Pit Emptying Technologies (COMPET) project (implemented from 1991-1993) a concept and technology were developed to empty these inaccessible pits.

REVIEW OF THE MAPET PROJECT

3. The most important and commendable achievement of the MAPET project has been that the concept of MAPET has proven to be valuable for solving latrine pit emptying problems for a large number of people living in Dar es Salaam. Also for other major cities in Tanzania the concept is in principle applicable.

4. The technical, organisational and institutional arrangements made in the project show a number of serious flaws. Out of the eight MAPET units manufactured in Dar es Salaam, only four still exist and of these only two are more or less operational. Contrary to earlier assumptions, the pit emptying technology developed during the project has proven to be not sufficiently appropriate and requires major adjustments and improvements.

5. The project could have had more impact on the development of indigenous technological capability.

6. The public - private partnership that should ideally have developed between the Dar es Salaam City Council, the private sector and local communities, did not emerge. The MAPET services are not known to many people, while there does not seem to be any public campaigns for environmental sanitation in the unplanned areas.

7. The Dar es Salaam City Council and the Municipal Council of Morogoro have shown to be not interested in running or monitoring the project or ensuring its sustainability whatsoever.

8. All reports pertaining to the project have been written by the Netherlands implementing consultant WASTE. No independent study or a formal evaluation of the project has been undertaken. Considering the pilot nature of the project, the mission found this rather surprising.

9. The available reports provide little information on methodologies followed for different research activities, surveys and technology development activities. There are reasons to seriously questions the validity of a number of statements made in the available reports.

10. Drawings of the equipment, a number of technical reports, financial data, and the results of several tests referred to in the available documentation are not freely available. The mission noted with concern that evidently WASTE Consultants tends to monopolise knowledge and experience that has been gained in the projects.

PROBLEM DEFINITION

11. Different choices of technology (e.g. piston pump over diaphragm pump, driving the hand pump by means of a very heavy (25kg.) flywheel, and the choice of the *Kibuyu* tank) need to be reassessed.

12. Local technology institutions and the private sector are capable and willing to take up the challenge to improve the design and efficiency of the MAPET equipment and to produce working prototypes.

13. The MAPET operation should and can be made more businesslike and sustainable. MAPET units should be managed by a person with an entrepreneurial attitude and be operated by competent operators. Proper management will ensure that funds are set aside for marketing, maintenance, repair, and new investments.

14. A workable new partnership between private pit emptying enterprises and the Dar es Salaam City Council needs to be shaped. In this new partnership the Dar es Salaam City Council, through its DSSD, should ensure that nobody is excluded from essential pit emptying services and that no or minimal negative environmental effects occur as a result of the privatisation of emptying services.

15. There is a large potential demand for MAPET services and potential customers are quite able and willing to pay the charges. If only 25% of the market would be served, about 170 pit emptying enterprises would be needed.

16. In Dar es Salaam there are very few community based organisations who have shown the ability to organize themselves for the improvement of neighbourhood services. Therefore, the mission sees no advantage in artificially creating community based organisations as a means to promote the application of MAPET.

17. Due to lack of space or a high water table, in half of the cases on-site disposal of sludge is not possible. Therefore, eventually a solution for the final disposal of sludge, through mobile transfer stations or otherwise, needs to be found.

18. The following institutional issues need to be addressed:
    - The Dar es Salaam Sewerage and Sanitation Department should not play any implementing role in the MAPEP project.
    - Equipment manufacturers, together with researchers and designers, need to redesign and improve the MAPET equipment. Approved designs may be manufactured by several metal enterprises, thus creating an atmosphere of healthy competition, adaptations and innovations.
    - A mechanism of certification of approved MAPET equipment is needed to

safeguard quality and safety.

- It is crucial for the success of the project that MAPET enterprises have to deal with one department only, notably the DSSD.
- A local NGO, to be selected through a tendering procedure, would be best placed to take responsibility for project management.
- In order to empower entrepreneurs and to stimulate a constructive dialogue with the Dar es Salaam City Council, the formation of associations of entrepreneurs should be encouraged.
- The Surface Waters and Liquid Waste Working Group of the Sustainable Dar es Salaam Project could become a forum of interaction of the proposed project with other players in the field of urban development.
- The project should focus clearly on the technical and entrepreneurial aspects of the activities. Through the project, the Sustainable Dar es Salaam Project will be supported to undertake activities that are related to policy matters, coordination and urban management.
- With current desluding fees, each MAPET enterprise could realise a yearly profit of Tsh. 420,000. Under such conditions the operation of MAPET is certainly a sustainable undertaking.
- The Dar es Salaam City Council and its departments should show the willingness to change the perception of their roles and to accept and facilitate the private sector to take over much of the implementation tasks.

19. The innovative and experimental nature of the proposed project necessitates the undertaking of complementary activities in the areas of monitoring, evaluation, and research. In the project systematic information will be collected through monitoring and evaluation activities on the following aspects of development:

- Changes in sanitary conditions in unplanned areas of Dar es Salaam: less environmental pollution and diseases.
- Economic changes in the pit emptying enterprises: increased profitability and sustainability of the enterprises.
- Economic changes in the manufacturing enterprises: increased profitability and sustainability of the enterprises.
- Technological changes: increased indigenous capability to choose, adapt and innovate.
- Economic change in the community: increased access to affordable pit emptying services and more jobs.
- Social changes: individuals and groups gaining more self-confidence and control over their lives.
- Effectiveness of the project on institutional change: the emerge of new and sustainable public-private partnerships.

PROJECT OBJECTIVES

20. The main long term objectives of the project are:

- To develop a solution for emptying of pit latrines and septic tanks.
- To create a city wide system of emptying services that are complementary and technologically integrated.

- To develop an organisational structure in which complementary services are delivered in a cost effective, sustainable way.
- To develop a system in which public-private partnerships are responsible for city wide desludging services.
- To improve indigenous technological capabilities in the area of liquid waste disposal.

21. The main short time objectives of the project are to :

- To improve the technical quality and performance of the MAPET.
- To stimulate the development of the local capacity to manufacture MAPETs.
- To create local enterprises to run a MAPET service on a commercially viable basis.
- To create a demand for MAPET services through social marketing.
- To improve environmental conditions in unplanned areas through MAPET services.
- To generate modest employment for manufacturers and pit emptiers.
- To open new channels of communication between the public and private sector.
- To undertake research and survey activities relevant for liquid waste disposal.

BENEFICIARIES AND PROJECT PARTNERS

22. The main project beneficiaries are:

- Dar es Salaam residents living in unplanned areas.
- Local technology institutions.
- Local equipment manufacturers.
- MAPET enterprises.
- MAPET operators (pit emptiers).
- The Dar es Salaam City Council.
- Local NGO.
- Local researchers.

23. The following partners are envisaged to play a role in project implementation:

- Equipment designers.
- Equipment manufacturers.
- Pit emptying enterprises.
- Local unskilled or semi-skilled workers.
- Dar es Salaam Sewerage and Sanitation Department.
- Health Department.
- Sustainable Dar es Salaam Project.
- Implementing NGO.

PROJECT ACTIVITIES AND PHASING

24. The following project activities will take place:

- o Project management.
- o Competition for designing and manufacturing a prototype.
- o Prototype testing.
- o Concept testing.
- o Mobilisation of entrepreneurs to buy, operate and maintain the equipment.
- o Training of entrepreneurs and pit emptiers.
- o Social marketing of pit emptying services and awareness raising campaigns.
- o Creating channels of communication and coordination between project partners.
- o Monitoring and evaluation.
- o Dissemination of knowledge and experiences acquired during project implementation.
- o Back-up missions.
- o Research.

25. The project shall have a duration of three years.

BUDGET

26. Since the project will, to a large extent, follow a process approach, it is not possible to give a detailed budget for the entire project over a period of three years. However, an indicative overall budget amounts to Dfl. 976,000.

APPRAISAL

27. The project is completely in line with policies and principles of the Tanzanian and the Netherlands Governments.

28. There is no reason to doubt the technical, financial/economic and socio-cultural feasibility of the project.

29. The major risk for the realisation of the long term objectives of the project is that the Dar es Salaam City Council (DCC) fails to develop and implement policies that are conducive to participatory urban improvement and development. Other risks are not a major threat to the successful implementation of the project.

1. BACKGROUND AND HISTORY OF MAPET AND COMPET

1.1 BACKGROUND

Dar es Salaam, the capital of Tanzania, is estimated to have a population of 2.5 to 3 million people. This population is growing at a rate of 6 - 8% annually. Of the population, 75% lives in unplanned areas. About 10% of the area of Dar es Salaam has a sewerage system, while the rest of the population uses pit latrines and septic tanks. Presently there are between 225,000 and 270,000 pit latrines in use in the city. Traditionally pit latrines in Dar es Salaam are constructed with a large volume. A typical pit measures 1.5 x 1.5 meters and is 3 meters deep. This implies a volume of approximately $10m^3$. Although initially filling may take more than 5 years, afterwards, most latrine pits fill up within 5 years due to clogging of the soil, and start overflowing, thus posing a threat to public health. The fresh leachate from the latrine pits causes the spreading of diseases like cholera, diarrhoea and infections like hookworm. The Township Ordinance, Rules and Building Rules (Cap 101) declares that officially a new pit must be dug when the contents of the pit have reached a level of 90 cm. under the subsoil. Most premises, however, lack the space for shifting the latrine to a new pit. Moreover, the construction costs of latrine pits, which in the coral sand of the East African coast have to be fully lined with blocks to prevent collapse, are very high. The Dar es Salaam Sewerage and Sanitation Department (DSSD) presently charges between Tsh. 130,000 and Tsh. 200,000 for a VIP latrine, while Plan International constructs VIP latrines at the cost of Tsh. 290,000.

Full latrine pits need to be emptied. Latrine pit emptying services are being provided to the public by vacuum tankers of the City Council of Dar es Salaam, through the Dar es Salaam Sewerage and Sanitation Department (DSSD) and the Health Department. There are also 12 other organisations in the public and private sector that operate one or more vacuum tankers. However, half of the pit latrines are not accessible for vacuum tanker trucks. Most of the unplanned areas and part of the planned areas are inaccessible for these trucks and emptying has to be done manually.

Traditionally residents in these unplanned areas hired casual labourers, called *vyura* or *frogmen*, to empty their pits. These men break open the squatting slab and scoop out the pit manually from the inside. The sludge is then buried in a large hole dug on the customers' compound. However, many residents are not willing or able to engage the services of the *frogmen* and allow their pits to overflow and contaminate the environment. In order to address this problem the idea of a new manual pit emptying technology (MAPET) was developed. A MAPET project, and a comparative study on pit emptying technologies (COMPET) were financed by the Netherlands Government. The MAPET project was implemented from 1988 - 1991, while the COMPET project was executed from 1991 - 1993. The present report is meant to formulate a second MAPET project. Table 1 below presents the main events for these projects in a time frame.

Table 1: Time frame MAPET & COMPET project activities

	1988	1989	1990	1991	1992	1993	1994	1995	1996
Implementation MAPET	xxxx	xxxx	xxxx	xxxx					
Final Report MAPET-1							xxxx		
Implementation COMPET				xxx	xxxx	x			
Project proposal MAPET-2						x			
Formulation MAPEP									x

1.2 THE MANUAL PIT EMPTYING TECHNOLOGY (MAPET) PROJECT

The MAPET project was established to: (i) improve the public health conditions in unplanned squatter areas of Dar es Salaam; and (ii) upgrade the traditional emptying practice. The project was implemented by the Dar es Salaam Sewerage and Sanitation Department and WASTE Consultants from the Netherlands. The first phase of the project included the development and field testing of a small scale and manually operated pit emptying technology to suit the requirements of low-income squatter areas that are not accessible to the conventional pit emptying tanker service.

The concept of the project was to develop a technology based on the informal business and practices of traditional pit emptying, but making it more efficient and hygienic for the operators and more affordable for the customers. WASTE Consultants developed equipment that was to fulfill the following conditions:

- It could be manoeuvred through narrow lanes.
- Manually operated.
- Locally constructed and maintained.
- Using locally available materials and components.
- Requiring skills and techniques commonly available in micro enterprises.

The intention of the project was to create employment for unskilled men working in the informal sector. DSSD is the owner of the equipment and was supposed to lease this equipment to the MAPET emptiers. The emptiers can earn an income by charging a fee to the customers for emptying their latrines. DSSD was responsible for major repairs, while the emptiers were supposed to use local workshops for small repairs. Thus, MAPET intended to stimulate informal sector growth. Another major feature was that MAPET was to result in a community based service, since the emptying teams were supposed to work in one particular neighbourhood. It was expected that an informal network would be built up between the emptiers, the residents, local leaders, health officials and DSSD. This would allow the business to thrive and would serve as an instrument for public health control.

It has always been realised that the MAPET system, as applied in the pilot stage, had the limitation of not addressing the issue of final sludge disposal. The present system relies on the traditional practice of burying the sludge on the plot of the customers. In an estimated 50% of

the unplanned areas the on-site disposal of sludge is adequate and hygienically safe. However, in another 50%, the high ground water table or the lack of space to dig a hole are fundamental constraints. In such cases a solution for final sludge disposal has to be found.

WASTE and DSSD have experimented with fixed transfer stations from where a vacuum tanker could collect the sludge and haul it into sewage treatment ponds. The large number of fixed stations needed and the scarcity of land renders this solution unpractical.

The main other option would be the development of mobile sludge transfer stations (MSTS), consisting of a sludge transfer tank towed by a tractor that can be stationed where and when desired. The flexibility thus realised implies that less transfer stations are needed and that planning procedures would not form an obstacle.

The achievements of the MAPET project, as perceived by WASTE Consultants have been laid down in a Final Report, dated 18 March 1994. The mission has verified these achievements and re-assessed the situation in 1996. Chapter 3 of this report presents the findings of the mission.

1.3 COMPARATIVE STUDY ON PIT EMPTYING TECHNOLOGIES (COMPET)

The Netherlands government, together with the British Overseas Development Agency (ODA) and the International Reference Centre for Wastes Disposal (IRCWD) financed a study to compare the performance and effectiveness of three pit emptying technologies: large vacuum tankers; mini vacuum tankers and MAPET. The findings of this study were discussed at a seminar in 1993 and have been laid down in a report "Comparative Study on Pit Emptying Technologies", published by WASTE Consultants, dated December 30, 1993. This report presents the following classification of areas where either one of the three technologies has comparative advantages:

- **Regular MAPET services** are suitable for areas that are inaccessible for large and mini tankers and where on-site disposal is possible.
- **Conditional MAPET services**, with mobile sludge transfer stations, are suitable for areas that are inaccessible for large and mini tankers and where on-site disposal is not possible.
- **Regular mini tanker services** are suitable for areas that are inaccessible for large tankers and where the hauling distances between pit and dumping station is less than 5 km.
- **Conditional mini tanker services** are suitable for areas that are inaccessible for large tankers and where the hauling distances between pit and dumping station is more than 5 km. Large capacity hauling equipment may be necessary for such areas. In areas like this, the MAPET could also be applied, provided that the ground water table and the burying space are no limitations.
- **Regular large tanker services** are suitable for areas that are accessible for large tankers.

From this classification it is evident that the concept of the technology of MAPET is complementary to other desludging technologies and an efficient and practical method for emptying latrine pits in unplanned areas.

1.4 PROPOSAL MAPET-2

On the basis of the results of MAPET-1 and COMPET, WASTE Consultants and DSSD submitted a proposal for a MAPET-2 project entitled: "Expansion of Manual Pit Emptying Services and further Development of Sludge Transfer Technology for Low-Income Squatter Areas in Dar es Salaam, Tanzania." dated 24 June, 1993. In this proposal it was assumed that the pilot phase had resulted in an acceptable technology and mode of operation. The proposal was aimed at introducing the MAPET technology at a much larger scale and to develop new technologies, such as mobile sludge transfer stations, for final sludge disposal. This proposal was appraised by the Royal Netherlands Embassy as unsatisfactory with respect to the institutional setting, financial feasibility and sustainability, manufacturing and operation of equipment, and the overall approach to community participation.

1.5 Formulation of Manual Pit Emptying Project (MAPEP)

The Royal Netherlands Embassy has commissioned the present mission to formulate a Manual Pit Emptying Project (MAPEP) on the basis of the following principles:

- The project should have a facilitating nature, matching supply and demand for pit emptying services.
- The government and the City Council should play a limited role
- The private sector will play a major role in the manufacturing and operation of MAPET units.
- The MAPET services should eventually be available at affordable costs on a commercially viable basis.
- Sludge disposal should be environmentally sound, observing the importance of public health aspects.
- Social marketing techniques should be used for the widespread dissemination of MAPET services.

These principles were moreover based on the following assumptions:

- The MAPET technology and equipment have been proven and do not need major adjustments and improvements; minor refinements will remain possible.
- Consumer demand (amongst communities in unplanned areas) for the MAPET services exists and is sufficient to sustain the commercial approach.
- The private sector is interested in becoming involved in delivery of MAPET services.
- The Dar es Salaam City Council creates an enabling environment for MAPET services.

The terms of reference for the formulation (see annex 1) rightly assumed that the demand for the MAPET services exists and that the private sector is interested in becoming involved in the delivery of MAPET services. However, this report will provide evidence that the assumption that the technology and equipment have been proven and do not need major adjustments was incorrect.

2. REVIEW OF MAPET

In the following a number of statements presented in the Final Report of the MAPET project have been included in boxes. After these boxes the observations and findings of the mission are reported.

2.1 TECHNOLOGY DEVELOPMENT

Hand pump

> Since drinking water technologies are applied on a much larger scale in Tanzania than vacuum or pneumatic technologies, the MAPET handpump technology uses parts, e.g. valves, piping, that are also used in the regular local drinking water technology.

Final Report, page 28.

> Eventually a piston pump with a leather piston in a 6-inch PVC cylinder became the standard MAPET pump. The PVC cylinder is made out of sewage piping, readily available at the DSSD. .... The leather piston is not as vulnerable as the diaphragm however. It only needs to be replaced once a year.

Final Report, page 29.

Both pump cylinder and piston valves differ from the standardised equipment used in hand pump technology in Tanzania. The pump cylinder is made of 6" PVC pipe (see annex 5, drawing nr. 1) of which DSSD happened to have a small stock at the time of the implementation of he MAPET project, which is now exhausted. If more pumps would have to be made, this part would have to be imported. Also the leather cup in the piston valve is an imported part which cannot be manufactured locally (see annex 5, drawing nr. 2). The maintenance records of DSSD show that the leather cup needs to be replaced two times per year.

> The diaphragm-pump proved to be less suited to the local situation than the piston pump. The most vulnerable part in the diaphragm pump is the rubber diaphragm. Even imported heavy duty diaphragms started cracking and leaking after a few months.

Final Report, page 28.

Although heavier, the reliability and durability of the diaphragm pump have shown to exceed that of the piston pump considerably. One diaphragm pump has been brought for the first time to the DSSD workshop for major repair (worn bearing) only recently, while of the 7 piston pumps only two are still in an operational but dilapidated condition. The locally manufactured version of the imported diaphragm pump in Morogoro is still operational. Engineers of DSSD believe that the diaphragm pump is more expensive than the piston pump, but since WASTE Consultants did not share financial data with the DSSD staff, this could not be verified. The engineers considered it absolutely feasible that a modified (lighter) version of this pump could be locally manufactured. This would have the advantage that parts could be standardised and all spare parts would be

locally available. The operators/emptiers stated that they preferred working with the diaphragm pump because it is much more effective, even if it is heavier to push around.

Vacuum tank

> The tank was enabled to be fitted in between the wheels of the tank cart, without exceeding the maximum width of 80 cm.

Final Report, page 29.

> The current design is known as the *Kibuyu*, which is the Kiswahili name for gourd, reflecting the shape of the tank. The *Kibuyu* tank has many advantages.

Final Report, page 29.

The mission was informed that all emptying teams discontinued the use of *Kibuyu* tank carts. On-site verification confirmed this. There were major problems with the seals where the shaft penetrates the wall of the *Kibuyu* tank, while both customers and operating crew rejected the use of this alternative because they do not believe the content is the same as that of the cylindrical tank (drum-type).

> In order to reduce dependency on expensive imported fossil fuel human powered equipment was adopted: a handpump for emptying and pushcart transport with an operating base close to the customers.

Final report, page 27.

The flywheel of the hand pump is considered too heavy, while the relative position of the handle on the flywheel with respect to the lever driving the piston rod could be improved to allow a smoother start of the operation.

> A gauge to control sludge level (looking glass) is provided with each pump.

Of the four units inspected by the mission, one unit had no gauge at all any more, while the other gauges consisted of a plastic pipe with insufficient transparency for inspection. Operators knock on the wall of the tank with a metal piece to estimate how full the tank is. None of the gauges was properly mounted.

Carts and wheels

> Initially, used car wheels were used for the carts. As there is a great demand for used wheels in Tanzania, they are hard to come by. A disadvantage of using car wheels for the tank cart is that they are too wide and heavy. As the width of the cart should ideally not exceed 80 centimetres the use of car wheels implies that the tank is placed above the wheels which raises the centre of gravity. The smaller diameter of the car wheels also makes it harder to push the carts over unpaved roads.

Final Report, page 30.

> There are some problems with the tricycle wheels: for example, they are too light for the loaded tank cart. Especially the bearings wear out quickly. ..... Although fat caps have been introduced, the ball bearings remain a vulnerable part. The final disadvantage of the tricycle wheels is, that the only tires fitting them, are those supplied by a Chinese company. The quality of these tires leaves much to be desired. Despite these disadvantages tricycle wheels are still used, mainly due to the lack of an alternative option.

Final Report, page 30.

Both the engineers at DSSD as well as the emptying teams expressed a strong preference for used car wheels. On two of the three remaining piston pump carts the tricycle wheels have been replaced by used car wheels and tires. A quick market survey undertaken by the mission revealed that used car wheels are now readily available at a cost of Tsh. 15,000 (US$ 28) per wheel, including tire and inner tube. The fixing of used car tires evidently increased the width of the carts. In the now adopted design, the shaft welded onto the wheel hub rotates directly in a bush made of a piece of pipe. Both 'bush' and shaft are made of mild steel. Naturally this wears out very quickly, especially since the wheels are frequently removed when the cart has to be carried. There are no protective caps, no greasing media are used and thus, sand and other damaging particles can easy come in between the shaft and the 'bush'. The one unit still using tricycle wheels presented a rather pathetic picture of a cart without tires and completely worn out bearings with substantial play between shaft and bearings and the absence of fat caps and greasing media. The wheels could be moved through an angle of 10° - 15°.

> A reduction of the load on the wheels could also be achieved by exchanging one tank cart of 200 litres by two tank carts of 100 litres. The lower payload could enable the application of standards bicycle wheels and tires.

Final report, page 30.

No tank carts of 100 litre have been design, manufactured or tested.

> Current MAPET units consist of a tank cart and a pump cart. They are lighter, easier to steer and to tip than the combined cart. This is especially relevant in situations where on-site disposal of the sludge is not possible and a full tank has to be moved to a transfer station.

Final report, page 30.

The separation of tank cart and pump cart is essential in the narrow streets and paths that are typical in the areas where the MAPET is operating. The mission observed a significant number of situations where even the small carts could not pass and the equipment was actually carried by the operators after the wheels had been removed.

Hose-pipe and couplings

> The air connection between the pump and the tank consists of a ¾" water hose pipe of the sort readily available in Tanzania.

Final report, page 31.

The mission observed that the proper connection of the water hose pipe to the tank was not used any more in any of the present tanks (see annex 5, drawing nr. 3). The hose-pipe is simply pushed into a hole which is too wide and then mud is used to 'seal' the hose pipe. This enables sand to get in between the moving parts of the piston, increasing wear and tear.

> The hose-pipe that drains the sludge from the latrines has a diameter of four inches and a minimum length of 4 metres. It should be flexible enough to be manoeuvred into the squatting hole of the latrine. .... The hose-pipes are connected to the tanks with *Bauer* clamp-couplings.

Final report, page 31.

All hoses in use by the operational teams are punctured or kinked and have been patched up with wooden pieces, rags and ropes. While pumping, mud is applied to leaking spots. The teams do not invest in the replacement of broken hoses, which reduces the efficiently of the pumping operation.

> Since the sludge is excavated through the squatting hole by means of a hose pipe, no demolition of squatting slab and superstructure will occur.

The mission observed one team that used a hose with a *Bauer* coupling on both ends. Consequently, a rather wide hole had to be chiselled in the wall of the latrine, while the squatting hole also had to be widened and damaged.

Maintenance

> Local maintenance capabilities were built up through the participation of DSSD mechanics in all development phases of the MAPET technology.

Final report, page 31.

> MAPET has proved that it can survive under the prevailing local maintenance conditions. The applied pump technology is such that worn out parts lead to pump failure before much harm is done to other parts of the equipment. ... The bicycle wheels on the other hand, are more vulnerable. Riding without mending a puncture ruins the tires, riding with dry or worn out bearing balls damages the cups, leading to major repairs.

Final report, page 32.

Although maintenance capabilities have been built within the workshop of DSSD, the personnel is only mildly interested in MAPET which is just one of other, sometimes more profitable, undertakings of the workshop. The emptying teams do not observe basic small maintenance routines whatsoever. The mission found the "Checklist for Periodical Technical Check Up" rather elaborate (see annex 6) and probably impractical.

All four remaining MAPET units presently look rather dilapidated and patched up. Only two are still operational. Nearly all tyres are flat, or no tyres are present at all. Bearings are damaged and shafts are completely worn out.

Miscellaneous issues

> Prior to the start of the project in Dar es Salaam, prototype sludge handpumps had been constructed in the Netherlands where several tests had been done on two types of pumps: a piston pump and a diaphragm-pump.

Final report, page 28.

In order to promote local development of technology and built indigenous technological capability, it is generally considered desirable to undertake prototype development and testing in the country concerned and by local personnel. Foreign expertise should be used to guide the process and train local personnel in technology assessment, adaptation, and testing. The mission could not find any records of the results of the several tests referred to in the available documentation on MAPET.

> The MAPET equipment can be assembled completely in Tanzania with local supplies, except for the leather piston ring. Despite efforts to interest a local manufacturer, this part has to be imported from the Netherlands.

Final report page 28.

The leather piston ring has to be replaced two times per year. The costs for replacement of this simple part would be Tsh. 15,000 (US$ 44). However, the non-availability of this part is presently the main reason that one piston pump is standing idle, while the other two piston pumps operate inefficiently due to wear and tear of the leather piston ring which is not replaced in time. It is very likely that this part could also be obtained at a lower costs and with less logistical problems from neighbouring Kenya.

Other parts are also not so readily available as the final report suggests (see e.g. the section "Hand pump" above).

> The costs for single construction of a complete MAPET unit proved to be the equivalent of $ 3,000.

Final report, page 28.

The mission could not trace any detailed financial specifications for the MAPET equipment in the available documentation. The DSSD staff reported that such records were kept by WASTE Consultants who took it to the Netherlands after project completion. A recent calculation of the price of a complete unit made by DSSD shows a price of US$ 1,733, excluding labour and overhead costs. The breakdown of the costs is as follows:

Piston pump	:	Tsh. 508,200
Pump cart	:	Tsh. 83,600
Tank cart	:	Tsh. 308,000
Control gauge	:	Tsh. 36,410
Total	:	Tsh. 936,210

This amount to the equivalent of US$ 1,733.--

Appropriateness of the approach and design
On the basis its own observations and interviews with local and international experts the mission identified the following areas in which it considers the MAPET technology not entirely appropriate:

Market: The needs and preferences of consumers and pit emptiers has not been taken into account adequately.

- The quality of the equipment and the technology adopted is generally considered to be of a too low standard.
- Consumer taste eventually resulted in a rejection of the choice for the *Kibuyu* tank.
- On several grounds pit emptiers and engineers prefer the diaphragm pump over the chosen piston pump.
- The design has not taken into account that it could sometimes be desirable to take of the wheels and carry the equipment over short distances.
- Product durability (useful life) proves to be very limited under the prevailing conditions.
- The 'product' has not been marketed.
- The availability of service and repair facilities may not have been reflected sufficiently in the product design and operating requirements.

Too much emphasis appears to have been placed on adaptations which have resulted in relaxation or lowering of standards. Taken into consideration that the pit emptiers have little knowledge or motivation to properly maintain 'their' equipment, a choice for higher quality standards may have been better. The experience with the diaphragm pump seems to confirm this. Another example is the case of diesel engines in India, where the combination of low quality of maintenance service for air and fuel filters and limited operating skills of operators led to higher standards of quality of these diesel engines in India than in industrialised countries.

Raw materials: The technology is based on the use of non-standardised and, to a limited extent, imported materials, with little application of technologies locally developed for drinking water supply.

- Little or no efforts were made to redesign the diaphragm pump to adapt it to the specific characteristics of locally available materials.
- Little evidence emerges about explicit attempts to replace the imported leather piston cup and the 16" PVC pipe with local alternatives, while complete local availability of parts was an explicit objective..
- The mission assumes that the wants and needs of Tanzania do not necessarily always require "simplicity" over the entire range of technical activities. With a liberalised economy there seems to be no valid reason not to consider the application of new pumps and raw materials, particularly considering the relatively small markets involved.
- Bearing the previous point in mind, it may be attractive to copy and adapt more sophisticated equipment through reverse engineering. Reverse engineering may initially be inefficient, but through a learning process and a growing domestic market, the scale of operation and efficiency may eventually increase.
- In spite of the huge demand, there is a gross under-utilisation of the available and

operational MAPET equipment. This under-utilisation of capacity will be eliminated gradually with the expansion of markets, more aggressive marketing or the introduction of improved MAPET equipment.

Labour: One of the basic project idea was to improve the hygienic conditions under which frogmen were working. It was insufficiently realised that these frogmen cannot work properly without supervision.

- o Former 'frogmen' do not have the education and attitude to operate MAPET equipment as a commercial enterprising undertaking.
- o There is an abundance of entrepreneurial people who are eager and have the capability and capacity to buy, operate with employed labour, and maintain MAPET equipment in Dar es Salaam.

Costs and restrictions in the transfer of technology: The technology has been transferred at a high cost.

- o Restrictions were imposed on the dissemination of knowledge and experiences gained in the project.
- o The use of other technologies has been rejected on insufficient grounds.
- o No transparency with respect to prices of services and equipment provided by WASTE Consultants.

The above restrictions imply that it is necessary for the governments of Tanzania and the Netherlands to exercise control over the procedures for acquiring technology in order to minimise the social cost of these distortions.

Role of engineers

The engineer(s) and other personnel of WASTE Consultants have been too engaged in 'getting the job done" rather than building engineering capability in the DSSD or elsewhere. Moreover, the engineers at DSSD only show limited interest in the MAPET activities. More emphasis could have been placed on inculcating in local engineers the notion that they play a role in *interpreting* technical information, *modifying* that information to meet local needs and conditions, and *creating* new technical information by way of new or improved methods of producing new materials, etc. In the MAPET case, more local engineers also from outside DSSD, should have been fully engaged in product design, maintenance and repair, manufacturing or production engineering, research and development, and quality control.

This is particularly important for Tanzania, which, like most developing countries in Africa, is best characterised as "non-innovating" and the country is only now beginning to realise the problems resulting from their technological dependency.

Technological capability

The mission is of the opinion that somewhat more advantage could have been taken to improve local technological capabilities by the project.

Increasingly economists and other scientists assign a central role to indigenous technological

effort in mastering new technologies, adapting them to local conditions, improving upon them, and diffusing them within the economy. For the MAPET project this implies that the process to absorb or create technical knowledge could have been more in the foreground. In the present case this is particularly important because the project directly relates to metal manufacturing. Metal industries are of key importance to the modernisation of the manufacturing industry and to the national economy of Tanzania. They have the potential to supply a wide range of intermediate products and consumer durables, and above all, essential capital goods which have an important bearing on technology and productivity. There can be no national technological capability unless basic metal industries are developed.

2.2 INFORMAL MAPET BUSINESS

MAPET emptiers are self-employed workers belonging to a low income group. Each team is responsible for continuity of activities and income. Per team there are three operators. Most teams work on a full-time basis, income is used as a personal income: there is no room for substantial savings. Elements of the informal MAPET business are:

- the equipment is not owned by the emptiers, they pay a lease fee
- the lease fee covers the cost of large repair and overhaul of the equipment
- the business is not registered
- the team and equipment is monitored by the DSSD/MAPET staff, who act as liaison with the CCM office and DSSD and arranges for maintenance
- the monitoring/liaison staff are paid for by DSSD.

The emptying fee is negotiated by the operators and the customers, but has come to a standard price per tank load ($2.5). Average per day is five tank loads. Estimated average income per month was Tsh 87. Loans given were not repaid due to low earnings and difficulty to collect the repayments.

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At present, there are three teams operational in Dar es Salaam, using the two remaining and more or less functional units of MAPET equipment.

Team 1

One team operates in Mwananyamala, near the head office of the DSSD. This team tries to get its own customers, but when there is no demand, they go to DSSD office to try and get jobs through them. When DSSD gets customers for emptying pits that cannot be served by a tanker, they engage the service of the MAPET crew. If the customer lives too far away for the MAPET team, the equipment is transported by a DSSD pick-up to the customer, who pays a fee for transport (usually between Tsh. 5,000 and Tsh. 15,000). The emptying fee is agreed between the customer and the operators and is, on average, Tsh. 1,300 per load. For digging of the pit they charge Tsh. 3,000.

Although the emptiers are fully dependent on MAPET for their income, they usually have only two or three customers per week. The first team does not do any marketing, and sometimes it does not have a job for weeks. The team is also not staying in one particular neighbourhood, but accepts jobs over a wide area, sometimes pushing the equipment for 6 hours. The demand for

emptying services increases in the rainy season. Depending on the number of customers incomes vary between Tsh. 20,000 and Tsh. 100,000 per month. The equipment is in a very poor condition (for detail see section 2.1 above) and regular maintenance is not carried out.

Team 2 and 3

The other two teams work more independent and are based in Mburahati. At present, they actually share one MAPET equipment as the diaphragm pump which belongs to one team, is out of order (see section 3.1). It has been brought for repair to DSSD, who want Tsh. 15,000 for the repair, which the team refuses to pay. Each team has one DSSD trained operator. In turn, they have trained about 15 others. The mission suspects that many emptying jobs are done by this group of other operators who are paid for their work by the trained operators who negotiate the fees. Last week, one team did three jobs, the other team four.

Small repairs are done by local technicians *(fundis)*, who charge amounts of Tsh. 10,000 to Tsh. 30,000 per month. For large repairs, the equipment is taken to the DSSD workshop. Officially, no payment is due for these repairs, but unofficially they have to pay. It also may take a long time.

Prospective customers can reach the MAPET teams through the CCM office in Mburahati or in a bar where the teams are usually sitting. Once they put an advertisement in the Uhuru newspaper. As it is, they have enough jobs and do not promote themselves at all. Both crews have a waiting list of 5 and 6 customers respectively. They say another five units of MAPET equipment would be needed to meet the demand. They cover quite a wide area, sometimes spending a day to reach a customer. While moving with the equipment they sometimes get other customers. Income per machine per month is stated to be about Tsh. 200,000. Old customers pay Tsh. 1,000 per load, new customers Tsh. 1,500. The number of loads vary from one to above 20. For digging of the pit they charge Tsh. 1,500, regardless of the size. After a job, the equipment is usually left with the customer and taken the following day after the sludge (then settled) has been covered in the pit.

There is no monitoring or regular maintenance done by DSSD. Actually, the crews work as if the equipment is theirs, making handsome profits. Not being entrepreneurs, they do not keep funds aside for repairs or reinvestment, but consume their income completely.

Team 4

A fourth unit of MAPET equipment is under management of the former DSSD/MAPET coordinator. The leather cup of the piston pump is broken since October last year. Her written request to WASTE to send her another valve has remained unanswered. This female entrepreneur is living outside Dar es Salaam (23 kilometres from the city centre) in a more or less rural area. She used to bring the equipment to customers with a pick-up truck, as distances are too far to walk. She used to have a crew of three trained operators, but only one is left. She has not been very active in running the MAPET service, mainly because she does not have a permit to do so, although the operator is licensed. She more or less assumes that complete private operation for a 'public' service is not allowed. Last year she had four customers. She expressed that she is very keen and able to manage a MAPET service if she has a permit to do so and clearly is aware of the business potential of such a service.

Team 5: Morogoro

Most pit emptying in Morogoro is done by *frogmen* who work only in the night because of the social-cultural inhibitions the population have against people handling sludge.

MAPET equipment was brought from Dar es Salaam and handed over to the Health Department of the Morogoro Municipal Council, where GTZ supported the introduction for about 3 months. After the German in-charge left, the municipality continued the service now and then for a period of 6 months and then abandoned the project completely. The reasons given by the Municipal Director for stopping the activity is that the introduction of the MAPET was not accompanied by awareness training of the population and the lack of cooperation of the municipal councillors for whom the MAPET equipment appears to be not prestigious enough. Another reason mentioned was lack of incentives for the emptiers and the lack of a full time responsible person within the Health Department. Health inspectors and a former frogman mentioned as reasons for failure the following:

- It is too heavy work to turn the flywheel for a long time.
- The operations of coupling and decoupling hoses and opening and closing valves was considered too cumbersome.
- The fact that two operators were needed for operating the equipment was considered a disadvantage.
- The vacuum tank developed a leak.

The booking for the MAPET service in Morogoro had to be done though the Municipal Council. Frequently health inspectors forced people to use the service on health grounds. The emptying fees in Morogoro were much lower than in Dar es Salaam. Considering the low income level of the people the Municipal Council considered subsidising justifiable. The charged per load were Tsh. 300 and, on average, 10 loads per latrine were emptied. Due to the high water table in most squatter areas in Morogoro, latrine pits need to be emptied twice a year.

The locally manufactured diaphragm pump was found to be in good condition. However, the whole unit has been laying idle because the tank started leaking. An attempt to stop the leaking by pouring tarmac in the tank failed.

A former frogmen of the Morogoro team declared that initially he was experiencing cultural or other inhibitions of the people against handling sludge. Probably because the MAPET uses equipment which resembles a machine, there were less reservations against the MAPET operators as there are against *frogmen*. The operator confirmed the high demand for MAPET services which apparently also exists in Morogoro.

2.3 CUSTOMERS AND THE COMMUNITY

The criteria for good pit emptying services from a customers point of view are the following:
- o the service should be of good quality.
- o the costs should be reasonable and affordable.
- o the social accessibility should be satisfactory.
- o the physical accessibility should be reasonable.

MAPET scored well on these criteria, the only disadvantages being the fact that the sludge has to be buried on the plot (not liked by all customers) and the price per volume of sludge (this being higher than tanker services). Because customers can decide on the number of loads taken out, they decide on the cost of the emptying. Demand for service is high as none of the teams has stopped working for lack of customers.

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A field survey carried out by the mission in a number of unplanned settlements (Buguruni, Mburahati, Kigogo, Manzese, and Mabibo) showed that there is a large potential demand for MAPET services. People who have been served by MAPET teams are quite satisfied with the service and willing to pay the charges, even if they are higher than the official DSSD tanker rates. A stated advantage of the MAPET concept is that the number of loads is adaptable and can be checked (in case of a tanker, nobody sees the amount of sludge actually collected). Although, the practice of on-plot burying is not much liked, people realise that there is not much alternative and usually there is enough space. In areas with a high water table, the sludge is buried in pits which are not as deep, but wider.

The process of negotiating over the price is resented by most customers. This shows that either there is no standard fee per load, or that this fee is not known. Yet, people did not seem to have much problem with the stated fees, as long as the work is carried out. Where possible (accessible), people prefer the services of a tanker as the sludge is taken away and less time is needed, while the fee for a full tanker load is less than emptying by a MAPET team. As many places are inaccessible or are not served by tankers (in case of the area of the ex-MAPET coordinator), MAPET is considered a very good option.

However, MAPET is not known to many people. This is understandable in areas where they do not regularly operate, but even in Mburahati, potential customers do not know much about the service. Although they know of the existence, they do not know how to contact the operators, nor do they know about the charges. Response in the community indicated that if the service is known and available, people would make use of it, rather than have the traditional method of scooping or channelling into an adjacent pit or letting the pit overflow.

In their project proposal of 1993, WASTE Consultants calculated the number of full pits in Dar es Salaam in 1996 to be 15,807, growing to 20,867 in the year 2000. This calculation is based on the assumption that 90% of the pits are emptied by large and mini tankers and 10% of all pits in Dar es Salaam would be emptied by MAPET. As it is, the mini tankers do not function and the present fleet of tankers is not serving 90% as they cannot physically reach such a large percentage of houses. A 1993 report of the SDP on accessibility and technologies indicated that in 65% of the areas, MAPET equipment is needed. Though projected customer demand is not given in the project proposal and calculations on service need are not clear, it is safe to assume that demand for MAPET services is very high.

Community ownership of a MAPET service, was discussed in some places, but was not deemed feasible, as most communities do not have the kind of organisation needed for this, nor do they appear willing to organise themselves. It was stated that, as soon as money is involved, community management becomes difficult, if not impossible. In 1994 an NGO, PLAN International, that is involved in upgrading an unplanned area through community participation, showed interest in obtaining a unit of the MAPET equipment for community operation and management. They hired a consultant to assess the feasibility of this venture. The consultant had difficulty in assessing the actual cost of the MAPET equipment as he could not get access to the drawings and also found that a mobile transfer system would be needed because of the high water table in the area. This was too expensive and consequently PLAN abandoned the idea altogether.

Specific gender aspects do not seem to apply to either the service or the demand. There is no problem for women to approach the operators and women are unlikely to be either wanting or able to act as operators as the work is quite heavy. However, it appears that business women are rather keen to buy and manage MAPET equipment when available.

2.4 URBAN SANITATION

MAPET is rooted in the traditional practice of burying latrine sludge on-site. The practice of burying does neither improve nor aggravate the problem of groundwater contamination as this is caused by the deep latrine pits and not by the shallow burying pits. Sludge cannot be buried when there is not sufficient space to dig a hole or where there is a high groundwater table. Then sludge transfer is needed. Fixed transfer stations were built, but never used because of land dispute and poor accessibility.

A study on the feasibility of a mobile transfer system was carried out in 1991 (study could not be obtained from WASTE consultants). It needs good communication between MAPET and DSSD (who operates the mobile system) to run such system. The MAPET tank cart cannot haul the sludge over a distance of more than one kilometre. A reliable service covering all unplanned areas in Dar es Salaam would require 50 MAPETs. MAPET operates independent of other public sewerage services, such as tankers and sewer infrastructure. Tankers and sewerage have been funded by donor aid, government pays for the salaries and administration, while fees finance the operation and maintenance costs. MAPET equipment has been funded by donor aid as well, but salaries and operation and maintenance are recovered from user fees. The population of planned areas benefit from donor aided capital investment and government subsidy of the tanker services and sewer system. People in unplanned areas receive little from those services and subsidies.

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About 90% of the residents of Dar es Salaam use pit latrines and septic tanks, as only 10% is connected to a sewer system. This figure was 15% in 1990, but has decreased since no extension has taken place. Servicing these on-site sanitation systems is a problem in both planned and unplanned areas due to inadequate emptying services, poor accessibility and high ground water tables.

The City Council has vacuum trucks with the DSSD and the Health Department. The official fee they charge per load is Tsh. 5,000. Records from dumping sites (see annex 7) show that during

1995, a total of 11,258 trips were made to the dumping sites (this implies 56,290 m^3 of sludge). There are 5 dumping sites, but only two (Mikocheni and Vingunguti) are use by tankers. A dumping fee of Tsh. 2,000 has to be paid for each load. However, these are only the official records, probably recording dumping for the official trips only. Besides these trips, a very large number of unofficial trips is made. In several places in Dar es Salaam, middlemen are operating an 'informal' desludging service. Customers approach these middlemen for tanker service, a price is agreed (varying from Tsh. 12,000 to Tsh. 18,000 per load of 5 m^3), a map to reach the house is given and the middleman arranges for a tanker. The tankers are the ones mentioned above, that make 'unofficial' trips in between their regular work. There is no direct contact between tanker operators and customers. The service is delivered on the same day, and the money is paid to the operators after the service. The tanker operators receive about Tsh. 5,000 per load, while the middleman keeps the rest and probably pays the staff at the dumping station not to record the 'unofficial' dumpings. DSSD tankers are obliged to do 7 or 8 official trips per day, in between they do the unofficial trips. The tankers of the other organisations can only do the unofficial service if they are called out for official service, otherwise they cannot leave their yards.

To obtain official pit emptying services from the City Council, a customer has to go to the DSSD or Health Department, register, pay the fee in advance and wait for the truck to come. This may take from 4 to 6 weeks, if ever. Because the price for this service is low, people still attempt to obtain these official services. However, those who can afford it and are aware of the unofficial circuit, rather go through the middlemen as service is quick and reliable.

During three months in 1995, a pit emptying pilot project was carried out by the Dar es Salaam City Council through its UNDP/UNCHS-Habitat funded Sustainable Dar es Salaam Project (SDP) in a planned area with a high water table. Objective of the project was to improve pit emptying services, promoting community awareness on environmental sanitation and establish appropriate management practices on the basis of the findings. A total of 295 trips with large tankers were made. The cost per trip was calculated to be Tsh. 7,952 (including maintenance cost, promotion cost and administrative costs, but excluding capital cost of the tanker).

The real cost per load would be Tsh. 13,520 based on the following assumptions:

- 2,800 loads are emptied per year.
- A truck life of five years.
- Interest on capital is 27.5%
- Purchase price of a tanker is US $ 60.000.
- Annual maintenance cost are 5% of purchase price.
- Labour and overheads are 10%.
- Dumping charges are paid.
- Profit margin is 15 %.

Interestingly enough the price many people are paying for the unofficial services is higher than the cost price of the tanker service. The DSSD has submitted a proposal to the City Council to establish new tanker fees at the rate of Tsh. 20,000 for residential use and Tsh. 25,000 for commercial use.

During the COMPET project (1991-1993), two mini tankers were purchased from the Irish company Manus Coffey Associates (MCA) and given to DSSD to supplement their tanker

service in areas where the tankers cannot reach. These two mini tankers have been out of order since '94 due to inability to obtain spare parts, but probably more to lack of maintenance and vandalising for spare parts.

A survey carried out by SDP in 1993 in the 22 wards of Dar es Salaam, subdivided in 71 smaller areas, indicated the type of technology feasible in each area, taking into account the type of land (including the incidence of high water tables) and kind of roads (see annex 8). Out of the 71 areas, 50 areas were identified that have no alternative but to be covered by MAPET, either exclusively or in combination with another technology (at that time the mini tankers were still operational). The mission agrees with the observation of WASTE Consultants that the practice of burying does neither improve nor aggravate the problem of ground water pollution. Moreover, there does not seem to be a short term viable alternative as any hauling of the sludge to a dumping station, would increase the cost significantly (and would render the service beyond the means of many people). Such an alternative would also require a degree of organisation which is at the moment not likely to be found in the government or with the operators. The disgust with sludge of most people also ensures that it is buried properly and that the compounds are cleaned after the desludging has taken place.

Public health conditions in the unplanned areas visited do not seem to be very bad. Solid waste is mainly buried or burned on the plots and no overflowing latrines were seen (this is the dry season). There do not seem to be any public campaigns for environmental sanitation in the unplanned areas, but awareness does exist. In Mabibo the mission was told that sewage and solid waste was dumped on an empty plot, but that the residents were able to stop that practice.

During the MAPET project, experiments were carried out with a fixed transfer station. It became very clear that this option does not work because a full tank load cannot be transported over a distance of much more than one kilometre. Even if this distance could be increased through either an easier movable cart, or even a motorised pushcart, there would be too many transfer stations needed.

2.5 INSTITUTIONAL ISSUES

The Government of Tanzania

The Government of Tanzania (GOT) is in the midst of introducing fundamental reforms in a bid to reverse a prolonged downturn in the economy. Nearly all social services, including health, water and sanitation, are affected by these reforms.

Till now, government efforts have been directed at making good sanitation systems available in urban areas and to provide clean and safe water to the majority of Tanzanians, especially in rural areas. Most of these services were free of charge. However, in 1991, the Ministry of Water, Energy and Minerals (MWEM) issued new guidelines, maintaining the idea of keeping these services accessible, but introducing the need for financial contributions by the end-users. In order to achieve this objective and also to lessen the administrative burden involved in running these services, MWEM advocates the setting up of independent entities by consumers to own and run public services in their respective areas. The MAPET project was earmarked as one of several schemes for more autonomous operation under these reforms.

Dar es Salaam City Council

The Dar es Salaam City Council is ultimately responsible for all health and sanitation matters in the capital. Three organisations are relevant for the present project: The Dar es Salaam Sewerage and Sanitation Department (DSSD), the Health Department, and the Sustainable Dar es Salaam Project (SDP).

Dar es Salaam Sewerage and Sanitation Department

The Dar-es-Salaam Sewage and Sanitation Department (DSSD) has the authority and mandate of controlling and monitoring all sewerage and sanitation activities in the Dar es Salaam region. To facilitate the implementation of the MAPET project, the DSSD has established a special unit, the Low-Cost Sanitation Division. The Low-Cost Sanitation Division has only two employees (one head of the division and one technician). The division has the following responsibilities:

- **Construction of pit latrines**
  DSSD builds three different types of pit latrines of the VIP type, ranging in price from Tsh. 130,000 to Tsh. 200,000, which only covers the material and labour costs. Other costs are subsidised. Mostly customers are schools and government buildings. Only a few individuals are being served. Previously, construction of pit latrines by DSSD was based on a loan scheme. Because of the high number of defaulters, this scheme was abandoned.
- **Health education**
  This section is supposed to promote health by conducting seminars and workshops to educate people about sanitation and hygiene matters.
- **Pit emptying services**
  Next to others, DSSD also operates tankers. However, the Health Department has the largest fleet of emptying trucks, obtained through a grant from the Japanese Government. The Health Department has 6 operational tankers, the harbour authorities 3 and DSSD has 3 operational tankers. Eleven other organisations have one tanker each. This brings the total number of vacuum tankers in Dar es Salaam to 23.
- **Management of treatment ponds**
  DSSD also controls five dumping sites, which consist of stabilisation ponds.

The MAPET project is but one of the many responsibilities of this division. No person in the DSSD has for a major part of his or her time worked for the MAPET project. The head of the division even reported that nearly all its operations, except the building of pit latrines, have come to a halt due to lack of funding.

In the framework of the MAPET project, the DSSD was, as owner of the MAPET equipment, supposed to issue licences and charge a lease fee. There are conflicting reports about the number of people that received a 'license' from DSSD. This license is in fact more a training certificate giving evidence that the person concerned is properly trained in the operation of a MAPET unit than a real licence. The DSSD management claims that only 6 such 'licences' were given to trained pit emptiers, while the former in-charge of project monitoring claimed that after training 21 emptiers received a 'licence'. DSSD is apparently not keeping a record of the licenses it issues and has not undertaken any monitoring activities of the MAPET teams. The DSSD management claims that lack of means (transport, drivers, etc.) is the reason for this. DSSD is not even aware of the location of the units.

Initially the project idea was to levy a 'lease' fee of Tsh. 12,500 for the MAPET units. After Waste Consultants insisted on making the equipment freely available during the first year of project implementation, it became very difficult to introduce this system later. For this reason the DSSD decided to waive the lease completely in 1992. However, the mission was consistently informed by the teams that lease fees were paid to the DSSD after that date.
For example, the Mwananyamala team paid the DSSD a lease for the equipment. They received receipts when they paid the cashier of the DSSD. The mission saw a bundle of receipts for '94 and '95 (last receipt for Tsh. 2,000 on 17-7-'95). The receipts inspected by the mission are mostly for Tsh. 1,000, but there were also some for Tsh. 2,000 and Tsh. 3,000 (all in the name of Steven Vincent). The DSSD, even when confronted with this evidence, categorically denied having charged and received lease fees from the teams.

According to the DSSD/MAPET coordinator, collection of lease fees from the operators was extremely difficult because WASTE Consultants had insisted that for the first year no lease fees should be charged. As could have been expected, after that, the crews were reluctant to pay.

Health Department

The Health Department, headed by the City Health Inspector, is a department of the Dar es Salaam City Council. The tasks of this department include the following:

- Health awareness campaigns for the public.
- Vaccination of children under 5 years old.
- City environment cleanliness including disposal of solid and liquid waste, roads, public latrines etc.
- Inspections of cleanliness of business premises.
- Food inspection.
- Vermin investation and fumigations.
- Health education for the public.
- Approval of business premises hygienical conditions before trading licences provided to an enterprise.

The role of the Health Department is now changing from solid waste collection to monitoring and conflict resolution. The Regional Medical Officer of Health for Dar es Salaam has been instrumental in changing regulations and making appropriate bye-laws to enable reform of collection charges.

It is the responsibility of the city health office to make sure that all liquid and solid wastes in the city are removed and disposed of. The Health Department has the authority to take any person to court in case of breaking the by-laws of the City Council. The Health Department has a waste disposal office at Mwananyamala, from where all liquid and solid waste disposals activities are controlled. The department had a total of 11 trucks which were bought 15 years ago. Of these 11 trucks 6 are operational. The remaining 5 are not functioning due to lack of spares. The Mwananyamala office is also responsible for all training concerning sanitation. The office in Mwananyamala is headed by an experienced trainer who is highly educated in the field of sanitation and sewage.

Besides the tankers, the health office also have a work force of "frogmen", mostly from retired and retrenched civil servants with experience in sanitation and sewage. This work force uses a

method called "*Kutapisha*" (which literary means "to vomit"). In this method a deep pit is dug next to the full latrine. Then a hole is made through the two pits so that the sludge is emptied (vomited) from the full latrine pit to the newly dug pit. After the 'vomiting' process is over, the new pit is covered and the latrine pit is empty again for use. The Health Department considers this workforce very vital due to the fact that they are doing a recommendable services where the health tankers cannot provide such services do to infrastructure constraints.

The Sustainable Dar es Salaam Project

The Sustainable Dar es Salaam Project (SDP), implemented through UNCHS/Habitat, is meant to stimulate sustainable development of the city of Dar es Salaam. Different actors are rethinking their roles and mandates and are forming new partnerships. Although the project has known its difficult moments, overall it has been rather successful in creating new private-public partnerships and in gaining experience how to operate a public service in the private sector on a cost-recovery basis. The project stressed the importance of establishing mechanisms (through workshops, seminars and otherwise) in which the private sector and local authorities communicate and appreciate each other's problems and constraints. A number of issue specific working groups, such as the Surface Water and Liquid Waste Working Group, and the Solid Waste Working Group, regularly meet for this purpose. When engaging the private sector in municipal services it is important to include in the contract a clause stipulating an obligation to establish and maintain a proper database and to issue regular reports to the authorities.

The SDP is in the process of applying the basic principles of the privatisation of solid waste collection services to liquid waste collection and disposal. Within the SDP a special on Surface Waters and Liquid Waste Working Group has been established for this purpose. An employee has been delegated by the DSSD to the SDP to coordinate this working group. The SDP is of the opinion that local communities have an important role to play in the monitoring of the provision of privatised services and will also allow for proper checks and balances. The working group has recommended that all matters pertaining to operating MAPET equipment would fall under the authority if the DSSD who would be responsible for licensing. MAPET teams do not need the regular trade licence required for other businesses.

MAPET teams as an enterprise

Between 1988 to 199I, 6 MAPET teams were trained and awarded licences to operate MAPET units. A total of 9 MAPET units were manufactured, of which 8 were allocated to Dar es Salaam and 1 to Morogoro.

At present, social and physical accessibility to the service is minimal because the operators are not really interested in marketing as they have sufficient customers as it is (Mburahati), or are not able to market themselves sufficiently (Mwananyamala).

As described above, there is a huge demand for pit emptying services. Therefore, the mission was surprised to observe that the MAPET teams are not regarding themselves as people running a business. They regard their work more as an income generating activity enabling them to live from day to day until the equipment is written off completely. Experienced business trainers in Tanzania clearly expressed that the employment of former frogman as MAPET entrepreneurs has not been a wise choice. Among others because of their educational background and attitude, they lack the entrepreneurial spirit needed to run a business.

Public - private partnership

The public - private partnership which should ideally have emerged does not exist. Apart from referring customers who come for tanker services to the DSSD to one MAPET team, the DSSD is presently completely detached from the MAPET teams. The interaction between the DSSD and the community and the emptiers and the community is minimal if not non-existent.

Neighbourhood offices

> MAPET reaches their customers through the cooperation of the CCM branch offices. A procedure has been established, but follow-up promotion is required. CCM leaders role is to mediate in difficulties and represent the community to the authorities. There is scope for strengthening community control over MAPET, through organisation by the leaders of systematic and regular services, or even ownership of the equipment.

Final Report, page 39.

The actual non-involvement of the CCM branch in Mburahati (it only tells the people where to find the operators, namely in the bar), suggests that this may not be the most appropriate solution. Mention was made that at the time of the project, the health inspector would come along with the MAPET team and would order people to get their (full) pit emptied. This form of coercion cannot be considered awareness raising about the health effects of overflowing latrines.

2.6 SUSTAINABILITY

Out of the eight MAPET unit manufactured in Dar es Salaam, only four still exist and of these only two are more or less operational. The other four are in the scrap yard of DSSD and the spare parts have been used for the other MAPET units. Maintenance of the equipment is not carried out on a regular basis, either by DSSD or the operators themselves. When the equipment breaks down, it is tried to make it servable again, by the operators or brought to the DSSD workshop. Renewal of parts or hoses is never done. Repair of the two broken down MAPET units is said not to be possible for lack of a leather valve of the piston (to be imported) or lack of funds (Tsh. 15,000 for the repair of the diaphragm pump).

The mission noticed with concern that this serious and accelerating degradation of the MAPET units supplied in 1991 is not accompanied by any visible efforts at arresting or reversing this trend from the side of the DSSD. In Morogoro the whole exercise has come to a complete standstill only because of minor technical problems and organisational problems which could have been solved by the Municipal Council with some good will.

Training of new MAPET operators is not taking place (there is no new equipment anyway) and supervision is also not carried out. There is no legal framework in existence pertaining to MAPET operations. No action has been undertaken with regard to transfer stations. Efficient scheduling of customers through close relationship of teams, customers and community leaders does not exist and is not seen to be important as there is sufficient demand (two teams, one MAPET unit) or total dependency on DSSD for customers (one team). There is no cost recovery except for labour costs as lease fees are hardly being paid or kept aside.

The project has improved the traditional emptying method by the development of equipment that makes pit emptying a more efficient and more hygienic occupation. The pit emptiers who have decided to take up this occupation consider working with MAPET equipment to be less dangerous and strenuous than the traditional method. At present there are seven teams working in Dar es Salaam earning a modest but steady income. The sustainability of achievements depend on four basic conditions:

1. the equipment has to be kept operational.
2. public hygiene standards have to be upheld.
3. there has to be an efficient scheduling of customers.
4. costs of MAPET services have to be recovered.

ad 1) Minor repairs are done through the MAPET operators; large repairs are carried out by DSSD mechanics. Only problem is the transport of the equipment to the DSSD yard.
ad 2) to make sure standards are adhered to training and supervision of MAPET emptiers by DSSD is carried out. It also needs a legal framework to enforce the standards - this does not exist. In areas where off-site disposal is necessary, transfer stations have to be used. This will require a solution to the technical, planning and financial problems regarding the use of transfer stations.
ad 3) close relationship between MAPET teams and customers and the involvement of community leaders ensure that efficient scheduling can be done. Enabling support is needed for hygiene education and community mobilization.
ad 4) labour costs are fully recovered, cost recovery for the equipment is still not feasible as DSSD does not have the means to set up an efficient revenue collection for the lease of equipment.

Final Report, pages 53-55.

2.6 MONITORING, EVALUATION AND RESEARCH

The Netherlands Government acknowledges the importance of research, monitoring and impact evaluation in projects and programmes in several of its policy documents. However, the mission was rather surprised to observe that over the total period of 5 years during which MAPET and COMPET were executed, no independent monitoring and evaluation of these two projects has taken place. Considering the pilot nature of the project, the mission found this rather surprising. All reports pertaining to the projects have been written by the executing consultant WASTE.

The DSSD/MAPET coordinator used to monitor the progress of the MAPET project, but she stopped after payment of her salary by WASTE Consultants ceased in March 1994. She continued to work till November 1994, but since DSSD did not pay her any salary she stopped. DSSD is not doing any monitoring at all.

The research which was done in the framework of the MAPET project was predominantly of a technical nature. To the mission's surprise the knowledge is being monopolised by WASTE Consultants and the DSSD. Only after substantial pressure could the mission get access to drawings of the MAPET equipment. WASTE Consultants refused to sell or make otherwise available the publications and technical reports mentioned on page 58 of the final report. None of these reports appear to be available in Tanzania.

The reports that are available provide little information on the methodologies applied for different research activities, surveys and technology development activities. The mission was not very impressed with the final results of the studies undertaken under MAPET and COMPET and seriously questions the validity of a number of statements made in these reports (as is further substantiated in different sections of this report).

3. PROBLEM DEFINITION

On the basis of the experiences gained in the first project and taking present realities into consideration, in the following a redefinition of issues and problems relevant for MAPEP are presented.

3.1 TECHNOLOGY DEVELOPMENT

The concept of MAPET is valuable for solving latrine pit emptying problems for a large number of people living in Dar es Salaam. Also for other major cities in Tanzania the technology is useful.

However, the pit emptying technology developed during the MAPET project has proven to be not sufficiently appropriate and requires major adjustments and improvements. Also the choice of partners and management structures require reconsideration.

Principles of appropriateness of design
In order to increase the appropriateness of the design, sufficient attention needs to be paid to the market, raw materials used, and labour aspects.

Market: The needs and preferences of consumers and pit emptiers have to be taken into account adequately. The final product needs to be of a good quality and the use of standardised raw materials and parts is preferred.

Raw materials: The design should be based on the use of standardised, or, to a limited extent, imported (but available) materials, with as much as possible the application of locally developed technologies.

Labour: Skills needed for the manufacturing, maintenance and repair of MAPET equipment should be readily available locally.

More precisely, on the basis of the experiences of operators and engineers that were involved in the MAPET project, the following major improvements need to be realised:

- Decrease the weight of both tank cart and pump cart
- Find a suitable solution for the wheels, shaft and bearing design of the cart, without increasing the total width of the carts beyond 80 cm.
- Use locally available materials, including readily available imported materials, exclusively.
- Take customers' preferences into consideration when designing the vacuum tank.
- Optimalise the content of the vacuum tank (100 - 200 litres).
- Improve the pump design (the appropriateness of different options of drinking water technologies, vacuum or pneumatic technologies needs to be assessed).
- Improve the operation of the pump (instead of a heavy flywheel a pedal system or may-be even an adapted foot tire pump may be used).
- Motorised pumps may be considered if this will not increase the profitability too much and if it poses no major maintenance and repair problems.
- A simplified and clear maintenance schedule has to be drafted.

- The whole design has to be in conformity with local manufacturing, repair, maintenance and management capabilities.
- A 'fool-proof" control sludge level gauge needs to be introduced.
- The cost of the unit should remain below Tsh. 1.5 million (or US$ 2,500).
- It should be possible to manufacture the units in the private sector.
- The connections between the hose pipe connecting the pump and the vacuum tank need to be improved.

Dissemination of technology
Technologies developed in the framework of this development project should be in the public domain and be easily accessible for everybody.

Technological capability
These desired technical changes represent an answer to bottlenecks and constraints that have to be bypassed, or removed. These constraints create a demand not for major innovations, but for technical adaptations and minor innovations to address the problems described above and to benefit from the availability of new materials, parts and machines in the market. It is, therefore, important that throughout the project, local engineers will be fully engaged in product design, maintenance and repair, manufacturing or production engineering, research and development, and quality control. This will ensure that local technological capabilities are improved. Local technology institutions and the private sector are capable and willing to take up this challenge. In the MAPEP, the first step will be to stimulate local engineers to improve the design of the MAPET equipment and to produce working prototypes.

3.2 PIT EMPTYING AS AN ENTREPRENEURIAL ACTIVITY

The mission feels that it is highly unlikely that the current actors would be able to operate a sustainable business. MAPET should not be owned or operated by the City Council or any other local or central government authority. The MAPET units can only be run as a profit making enterprise if people with entrepreneurial background or spirit own and manage the units. The former frogmen are very unlikely to answer this profile. At best, they can be employed to operate the MAPET units as wage earners. The MAPET units should be owned by entrepreneurs who are interested to buy and operate the equipment as a private enterprise. These enterprises may employ operators and pay monthly salaries. Private entrepreneurs, as owners (and buyers) of the equipment, will make sure that it is maintained, that customers are informed of the service and know where to obtain the service. The mission has sufficient confidence that the private sector in Tanzania is strong and competent enough to undertake this task.

Because women are usually taking care of the latrines, they have easier access to houses and women. It may be advantageous to especially engage women in social marketing activities.

Privatisation of essential services carries the risk that the service becomes very expensive and that this results in social injustice. Also, the free market tends to neglect environmental issues. Therefore, a clever and workable new partnership between private enterprises operating in the market and the government needs to be shaped. In this new partnership the government should cease to be the implementor, but increasingly try to be "director", "principal" and "catalyst". In this particular case, the Dar es Salaam City Council, through its DSSD, should and can ensure that nobody is excluded from essential pit emptying services and that no or minimal negative

environmental effects occur as a result of the privatisation of emptying services. Therefore, the following issues require attention:

- Geographical limitation of the area of operation of the MAPET teams may ensure that all customers are served, also people who can afford only to empty one or two loads. Also because the equipment is not very mobile (as it is) licenses should be issued for a delineated geographical area only.
- Health and environmental risks may be limited to require MAPET entrepreneurs to obtain a licence that has to be renewed every year. If on the basis of monitoring results an enterprise does not comply with minimum rules, no new license will be issued.
- To ensure safe and healthy working conditions and compliance with health and environmental standards, the emptiers have to be trained on handling the equipment, working methods and on proper disposal of the sludge.
- Social justice requires that the DSSD, in collaboration with MAPET enterprises, sets a maximum price for pit emptying services on the basis of a realistic cost-benefit analysis, and allowing reasonable profits.

The initial investment in a MAPET unit will not exceed the equivalent of US$ 2,500. Considering this relatively modest investment and the fact that there appears to be a sufficient large number of people who have access to this type of capital, the mission does not regard it relevant to consider the establishment of a loan scheme or other special financial services in the framework of the project.

3.3 CUSTOMERS AND THE COMMUNITY

Customer demand

One of the most crucial issues for the sustainability of MAPET operations is customers' demand for this service. In the following a preliminary calculation of the potential demand is presented.

Estimated population of Dar es Salaam	:	3.0 million.
Number of people covered by sewerage (10%)	:	0.3 million.
Number of people with pit latrines or septic tanks	:	2.7 million.
Number of latrine pits (based on an average of 10 people using one pit)	:	270,000.
Number of latrine pits serviceable by tankers (50%)	:	135,000.
Number of latrine pits not serviceable by tankers (50%)	:	135,000.
Total sludge capacity of potential MAPET pits (based on 10m³ per pit)	:	1.3m m³.
Average filling up period	:	5 years.
Annual demand for de-sludging	:	270.000 m³.
Number of loads of 200 litres (present capacity of MAPET tank)	:	1.35 million.
Annual capacity of one MAPET [10 (loads per day) x 5 (days per week) x 40 (working weeks)]	:	2000 loads.
Maximum number of MAPETs needed	:	675.
Realistic short-term need of MAPET units (25% of total market demand)	:	170.

Interviews undertaken by the mission in the unplanned areas confirm a high demand, provided proper marketing and accessibility of the servicing organisation or business is realised.

Role of the community

In a privatised service, communities are, like individuals, subject to basic market principles of demand and willingness to pay for the service. In Dar es Salaam there are very few community based organisations who have shown the ability to organize themselves for the improvement of neighbourhood services. A survey, carried out by SDP in 1995, showed only two such organisations (Tabata and Kijitonyama). The mission sees no advantage, rather the contrary, in artificially creating community based organisations as a means to promote the application of MAPET.

However, in the areas where the above mentioned organisations operate, a Community Infrastructure Programme (CIP) has been started. Because this programme is implemented under the Sustainable Dar es Salaam Trust Fund, established by the SDP, it may in these cases be relevant to experiment with running the MAPET service as a community based operation. For all other areas, the mission advises against this for the time being, because no community organisations exist and a basically individual service as pit emptying does not lend itself naturally for community mobilisation.

There may be a need to sensitise and educate the communities about environmental sanitation and the need for proper desludging of full pits. However, the environmental conditions in the unplanned areas are not bad at all (certainly not in the dry season). All houses have a latrine, solid waste is buried or burnt and overflowing or full pits is more a result of non-availability of services than of non-awareness. Yet, a pilot project recently carried out by SDP shows that in Sinza, a middle to high income area, many people have constructed outlets for their overflowing pits into the drains. This may be due to the frustration of the residents, living in an area with a high groundwater table, where desludged pits are full again with water in a very short time and the price and difficulty in obtaining desludging services. This area should not have septic tanks or pits in the first place, but sewerage. No awareness campaigns are likely to change the attitude and practices of the people there, as it is simply too costly to empty a pit monthly. A proper marketing campaign, however, should include hygiene education and raising awareness of the health risks of overflowing pits.

3.4 URBAN SANITATION

Sewerage

Eventually, the sewerage network should be extended to at least cover the areas which have such a high ground water table that on-site sanitation is not a viable alternative. However, there are no funds or plans to extend the sewer network, while in many (un)planned areas the availability of water is too low for sewerage.

Tanker services

A tanker system could service 50% of the septic tanks and pits, but as long as the capacity to maintain these trucks remains low, this figure will not be reached. Part of the problem with the maintenance is caused by the fact that the desludging fees are too low to recover capital cost and cover maintenance cost. The planned increase in official tanker fees to Tsh. 20,000 for residential plots may alter the competitive position of official tanker fees, unofficial tanker fees and MAPET services. Increasing fees could attract the private sector to start operating emptying services, as demand is existing and profits can be made.

Integrated pit emptying services

Ultimately, reliable and effective pit emptying services have to be realised for the whole of Dar es Salaam. Therefore, it is important to carry out some more pilot projects as was done by SDP in Sinza, to assess the effects of a reliable integrated pit emptying neighbourhood service, including sewerage, tankers and MAPET services.

Sludge disposal
Although in the long term, the option of mobile transfer systems may be useful, the mission feels that at present the level of interest and organisation in DSSD is such that the system is bound to fail. Priority should be given to improvement of the technical design and privatisation of the MAPET service. If a privatised service increases the demand for services and number of pits emptied and this service is well organised per area, it should be possible to assess the need and logistics for a mobile transfer system. This could also be done in conjunction with pilot projects to be carried out by SDP.

Dumping in sewer
In Nairobi, a motorised sort of MAPET is being tested at the moment. Sludge is dumped in the sewer system, manholes being not further than half an hour walk from anywhere in the large slum (500.000 people). In Dar es Salaam, however, dumping in the sewer is not an option because the sewer pipes are too small to accommodate the extra sludge and they are also not situated in areas where MAPET would be operational.

3.5 INSTITUTIONAL ISSUES

Dar es Salaam Sewerage and Sanitation Department
Considering the general policies of the Government of Tanzania, and based on the experiences in the first project, the DSSD should not play any implementing role in the MAPEP project. However, the DSSD, is ultimately responsible for all sewerage and sanitation activities in the Dar es Salaam region. They could facilitate and coordinate new MAPET enterprises, through licensing, including allocating specific geographic areas to MAPET teams. Another important role for the DSSD is to be involved in the monitoring of the MAPEP activities and to ensure that lessons learned are use for future policy formulation, especially with respect to an integrated service of sewerage, tankers and MAPET equipment.

One window approach
A situation should be avoided that entrepreneurs or emptying teams become subject to too much bureaucracy with all its known burdens. Therefore, it is crucial for the success of the project that MAPET enterprises have to deal with one department only, notably the DSSD. The SDP Surface Waters and Liquid Waste Working Group has already recommended the Dar es Salaam City Council to entrust the DSSD with the licensing, monitoring and control of all aspects of the MAPET operation. Adoption of this proposal would ensure a 'one-window' approach for MAPET enterprises.

MAPET Unit Manufacturers
Equipment manufacturers are key player in the project. Together with researchers and designers, they will set the first important step in redesigning and improving the performance of MAPET equipment. Approved designs may be manufactured by several metal enterprises, thus creating an atmosphere of healthy competition, adaptations and innovations. However, entrepreneurs may

try to market sub-standard, even dangerous equipment.

Technical Committee
A mechanism of certification of approved MAPET equipment is needed to safeguard quality and safety. A small technical committee may have to be established for this purpose.

MAPET entrepreneurs
Presently not enough potential investors know about the MAPET concept and technology. A promotion campaign is needed to inform entrepreneurs about the advantages of MAPET as an income generating entrepreneurial activity.

Implementing NGO
The private sector will play the most important role in the project. However, some organisation is needed to manage the project. The main tasks of this organisation should be to mobilise entrepreneurs, to coordinate and liaise, to undertake social marketing activities, to monitor the project, and to be responsible for financial and administrative control. A local NGO, to be selected through a tendering procedure, would be best placed to take responsibility for this project management. Since the proposed project does not need many full time employees, the implementing NGO should preferably already be undertaking a number of other activities. In that case, project management and administrative and financial control can benefit from economies of scale. For example, the project manager need only to be contracted for a limited period per week. Expensive overheads, such as cars and computers, can be avoided. In case of related activities in social services, synergetic effects may occur between the MAPEP and other activities of the NGO. The presence of the NGO in other developing countries would be an advantage for the wider dissemination of the technology once it is proven.

Association of entrepreneurs
The Dar es Salaam City Council tends to operate quite remote from its citizens, particularly entrepreneurs. In order to empower entrepreneurs to have constructive dialogues with the City Council, if may be beneficial that the new teams unite and form an association of MAPET entrepreneurs. This association could negotiate prices and wages and may play an important task in representing other interests of owners and operators.

The Sustainable Dar es Salaam Project
Till recently there has not been sufficient coordination and cooperation between public and private parties in Dar es Salaam. The SDP provides a unique forum to ensure and facilitate improved coordination between the Dar es Salaam City Council, the private sector and local communities. For the proposed project the Surface Waters and Liquid Waste Working Group of the SDP could become a forum of interaction with other players in the field of urban development.

Liaison with related urban development projects and activities
Since the SDP is most strategically placed within the Dar es Salaam City Council, it appears obvious that this project coordinates urban development projects for Dar es Salaam, including the MAPEP. Liaison with the Urban Sector Infrastructure Project of the World Bank should also

be channelled through SDP.

Coherence and specialisation
The MAPEP is relatively too small and has too little influence to be able to have a significant effect on policy matters and urban management in Dar es Salaam. The technical and entrepreneurial nature of the activities are probably also hardly compatible with a long-term involvement in institutional strengthening activities. Therefore, the project should focus clearly on the technical and entrepreneurial aspects of the proposed project. Through the project SDP will be supported to undertake activities that are closer related to policy matters, coordination and urban management.

3.6 SUSTAINABILITY

Conditions
To make the MAPET business sustainable, it is in the first place necessary that profits can be made with the manufacturing and operation of the equipment. A survey of design and manufacturing enterprises (see annex 9) revealed that the equipment may be manufactured at the affordable cost of less than US$ 2,500.

In order to assess if MAPET enterprises can make a sustainable profit the mission calculated the emptying fees.

Calculation of emptying fee
The calculation of the emptying fee is based on the following assumptions:

- Manufacturing cost of equipment is not more than Tsh. 1.5 million.
- The interest on capital is 27.5%.
- Depreciation over 4 years.
- Emptying capacity of one MAPET unit: 2000 loads per year.
- Annual maintenance cost is 5% of the purchase price.
- Labour cost for one unskilled worker is Tsh. 20,000 per month.

Annual costs for operation one MAPET unit:

1.	Interest on capital: 27.5% of Tsh. 1.5 million	412,500
2.	Depreciation: ¼ x Tsh. 1.5 million	375,000
3.	Maintenance: 5% x Tsh. 1.5 million	75,000
4.	Labour: 3 people x 12 months x Tsh. 20,000	
	720,000	
5.	Administration and other overheads: 12 months x Tsh. 50,000	600,000
Total costs:		2,182,500
Cost per load: Ths. 2,182,500 : 2000 loads		1,091

With current desluding fees, profit is Tsh. 210 per load. That implies a yearly profit of Tsh. 420,000 per MAPET unit. Under such conditions the operation of MAPET is certainly a sustainable undertaking.

Additional conditions

In addition to the commercial feasibility, the following conditions also have to be met to make the operation sustainable:

- Ownership of the equipment should be in the private sector.
- Operators need to be well trained in operation and maintenance.
- Regular maintenance and repair of the equipment has to be ensured.
- Social marketing of the service is required.
- Entrepreneurs should be issued a licence to operate, that has to be renewed annually.
- Licences to operate a MAPET unit should be tied to a geographically delineation area.
- Emptying fees should be based on capital cost, labour cost, number of loads, maintenance cost and reasonable profit.

Enabling environment

For the long term sustainability of the project a conducive enabling environment is crucial. The Dar es Salaam City Council and its departments should show the willingness to change the perception of their roles and to accept and facilitate the private sector to take over much of the implementation tasks.

3.7 MONITORING, EVALUATION AND RESEARCH

The innovative and experimental nature of the proposed project necessitates the undertaking of complementary activities in the areas of monitoring, evaluation, and research. Annex 11 provides some basic principles of monitoring and evaluation that the project will adhere to.

Monitoring and evaluation

In the project systematic information will be collected through monitoring and evaluation activities on the following aspects of development:

- Changes in sanitary conditions in unplanned areas of Dar es Salaam: less environmental pollution and diseases.
- Economic changes in the pit emptying enterprises: increased profitability and sustainability of the enterprises.
- Economic changes in the manufacturing enterprises: increased profitability and sustainability of the enterprises.
- Technological changes: increased indigenous capability to choose, adapt and innovate.
- Economic change in the community: increased access to affordable pit emptying services and more jobs.
- Market changes: increased demand for pit emptying services.
- Change in accessibility of services: increased availability of MAPET services.
- Change in environmental pollution: decrease in the number of overflowing of pits.
- Effectiveness of the project on institutional change: the emerge of new and sustainable public-private partnerships.

Research

There are a number of research topics that are important for the long term development of technological capabilities, for urban sanitation and for urban management, that are beyond the

direct interest of the project. Funds will have to be earmarked to commission research of this type to third parties.

For instance, a pilot could be done to assess the feasibility of serving one neighbourhood at the time for a certain period with both large tankers and MAPET services. In this period, not only completely full pits should be emptied, but also preventive emptying should take place (at a reduced price), accompanied by awareness raising and social marketing " dislodging campaign in area X, during weeks Y".

SDP should also be supported to undertake additional experiments with integrated sewerage services, involving partly settled and partly unsettled areas where the technological integration of tanker and MAPET services would provide the key to long term policy formulation as well as to the solution of final sludge disposal.

4. PROJECT OBJECTIVES

4.1 LONG TERM OBJECTIVES

The main long term objectives of the project are:

- To improve environmental conditions in Dar es Salaam.
- To develop a sustainable solution for emptying of pit latrines and septic tanks, that cannot be reached by tanker services.
- To create a city wide system of emptying services that are complementary and technologically integrated.
- To develop an organisational structure in which complementary services are delivered in a cost effective, sustainable way.
- To develop a system in which public-private partnerships are responsible for city wide desludging services.
- To improve indigenous technological capabilities in the area of liquid waste disposal.

4.2 SHORT TERM OBJECTIVES

Main short time objectives of the project are to :

- To improve the technical quality and performance of the MAPET.
- To stimulate at least three local metal workshops to manufacture MAPET equipment.
- To create a demand for MAPET services through social marketing.
- To create at least 100 local enterprises to run a MAPET service on a commercially viable basis.
- To generate at least 400 jobs for manufacturers and pit emptiers.
- To improve environmental conditions in unplanned areas through MAPET services.
- To open new channels of communication between the public and private sector.
- To undertake research and survey activities relevant for liquid waste disposal.

5. BENEFICIARIES AND PROJECT PARTNERS

5.1 INTENDED BENEFICIARIES

The main project beneficiaries are:

- **Dar es Salaam residents** living in unplanned areas who cannot be served by the vacuum tankers for emptying their latrine pits.
- **Technology institutions and local manufacturers** that increase their technological capacity and capability by competing in the MAPET design competition.
- **Local manufacturers** that can engage in the profitable manufacturing of MAPET equipment.
- **MAPET enterprises** that engage in running MAPET services on a profitable and sustainable basis.
- **MAPET operators** (pit emptiers) who find gainful and sustainable employment.
- The **Dar es Salaam City Council** that will be assisted to find a solution for the problem of hygienically emptying of pits that cannot be served by the vacuum tankers.
- **Local NGO** that will increase its capacity to assist in delivering public services to poor people on a sustainbale basis.
- **Local researchers** that will gain experience in carrying out policy relevant research in liquid waste disposal.

Primary target communities for MAPET are densely populated unplanned areas where tankers cannot reach. It is impossible to clearly delineate such areas in terms of socio-economic status, as many unplanned areas also have sections where people with a middle or higher income live and where tankers do have access. Similarly, in many planned areas, tankers cannot reach due to either the bad state of the roads or the location of the pits at the back of the house.

5.2 PROJECT PARTNERS

The following partners are envisaged to play a role in project implementation:

- **Equipment designers**: public and private technology organisations and enterprises will compete in the design for more appropriate MAPET equipment.
- **Equipment manufacturers**: local metal working enterprises will manufacture MAPET equipment and increase their profits.
- **Pit emptying enterprises**: local entrepreneurs will purchase MAPET equipment and operate a pit emptying service on a sustainable basis.
- **Local unskilled or semi-skilled workers**: will be gainfully employed in pit emptying enterprises.
- **Dar es Salaam Sewerage and Sanitation Department**: will facilitate pit emptying enterprises by issuing licenses and partipating in training and monitoring.
- **Sustainable Dar es Salaam Project**: will facilitate coordination between different project partners and undertake research relevant for long-term solutions for liquid waste disposal in Dar es Salaam.
- **Implementing NGO**: will be responsible for overall project management, social marketing, coordination, monitoring and dissemination of information.

7. BUDGET

Since the project will, to a large extent, follow a process approach, not all activities can be foreseen. It is therefore not possible to give a detailed budget for the entire project over a period of three years. However, an indication may be given of the magnitude of the expected costs of the project. Table 3 below gives a summary of the overall budget.

Table 3: Project budget

ACTIVITY	YEAR 1 [Dfl.]	YEAR 2 [Dfl.]	YEAR 3 [Dfl.]	TOTAL [Dfl.]
Project manager (expatriate, part time)	30,000	30,000	30,000	90,000
Programme Officer (local, full time)	30,000	30,000	30,000	90,000
Mechanic (local, full time)	10,000	10,000	10,000	30,000
Contest	85,000	-	-	85,000
Mapet units (10 x 4,000)	40,000	-	-	40,000
Social marketing	66,000	50,000	50,000	166,000
Overheads	15,000	15,000	15,000	45,000
Contribution to SDP Trust Fund	40,000	40,000	40,000	120,000
Back-up missions	60,000	60,000	60,000	180,000
Monitoring, evaluation and research	37,000	23,000	23,000	83,000
Sub-total	413,000	258,000	258,000	929,000
Contingencies	21,000	13,000	13,000	47,000
Grand total	**434,000**	**271,000**	**271,000**	**976,000**

8. POLICY RELEVANCE, FEASIBILITY AND SUSTAINABILITY

8.1 POLICY RELEVANCE

Policy of Tanzania

Like in a number of other social and economic areas, also in the area of urban sanitation the government of Tanzania (GOT) is introducing fundamental reforms. The guidelines issued by the Ministry of Water, Energy and Minerals (MWEM) in 1991 make the provision of accessible sanitation systems in urban areas one of the priorities of the GOT. The notion of users paying a fee for these services and the increased involvement of the private sector and communities in running these services remains an important principle in the policy documents. The present project is completely in line with these policies and principles, as was confirmed by relevant government officers interviewed during the mission.

The idea of privatising MAPET services fits very well in the policy of the Government of Tanzania. The following services are also being privatised under special partnership conditions between the public and private sector:

- Solid waste.
- Public toilets.
- Roads cleanliness.

Policy of the Netherlands

Poverty alleviation, including improvement of the quality of life of the poor, is one of the primary objectives of the Netherlands' development cooperation policy. Until a few years back, urban issues did not feature prominently on the development cooperation agenda. In 1991, the Netherlands' policy document "A World of Difference" clearly mentioned urban issues for the first time (DGIS, 1993). A special programme "Combating Urban Poverty" was established to develop relevant policies and strategies.

In 1994, a sectoral policy document on urban poverty alleviation was published in which the key concepts of sustainability and the enabling approach to development were defined. A development process for the urban poor was proposed that was to be ecologically and socially sustainable, in which the poor would actively participate, and in which the poor would exert control over it. Hence, decentralisation and enabling strategies are considered critical to this process. Moreover, great importance is attached to innovative methods of management and policy implementation, including the replication elsewhere of successful (integrated) interventions and the dissemination of relevant information.

Sustainability and enablement are key concepts of the special programme. A decent existence requires a level of economic growth (and distribution of growth) which will enable basic facilities to be created. National growth is mainly taking place in cities, creating more pollution. Urbanization therefore seems difficult to reconcile with ecological sustainability. Nevertheless, sustainable solutions using the specific resources of cities must be found. Decentralization and enablement strategies are conducive to this process. The strategies presuppose a new division of roles between the public and private sectors, explicit components of which are building up the capacity of cities and promoting the active involvement of the poor.

Habitat improvements are important in relation to production, distribution and consumption. Such improvements also determine general well-being to a large extent. Increasing decision-making and management powers at the grassroots, both in local government and private organisations in cities is essential for effective urban management that aims to alleviate poverty.

The proposed pit emptying project is completely in line with these policy principles of the Netherlands' Government. In particular, it addresses important policy themes of the Netherlands' development cooperation policy i.e. improving the quality of life of the poor and improving environmental conditions.

Active involvement of the private sector, the creation of awareness in the community, new methods of management, which nonetheless work within the existing institutional framework, and paying full attention to institutional and organisational development as well as the small-scale character of the planned interventions reflect the basic principles and guidelines of the Netherlands' policies. It is expected that the approach to be pursued in the Dar es Salaam can serve as an example which will benefit the development of urban improvement strategies of other cities in Tanzania as well.

8.2 FEASIBILITY

Technical feasibility
Regardless the generally poor quality of technical education in Tanzania and the relatively low level of education of entrepreneurs and workers, the mission observed sufficient, sometime impressive, evidence of technical know-how. A number of engineers working in the private and public sector are well aware of new technological developments in Tanzania, in countries in the African region, and in the rest of the world.

The common stage of technological development in Tanzania is adaptation, rather than full-scale innovation. However, the observed ability of people to absorb, adapt and innovate provides sufficient evidence and confidence that the improved MAPET equipment can be developed and manufactured in Tanzania.

Financial-economic feasibility
The financial-economic feasibility depends to a large extent on:

- The ability of manufacturers to produce pit emptying technology with a sales price below US$ 2,500. The MAPET project and the assessment of the mission indicates that this will be possible.
- The purchasing power and willingness of the people to engage pit emptying services. Field surveys by the mission confirm the existence of a substantial market for such services.
- The profitability of the pit emptying enterprises. Below a simplified calculation of emptying fees and potential profitability is presented.

On the basis of a number of explicit assumptions, in the previous chapter the emptying fee for one load was calculated to be Tsh. 1,091. That implies a yearly profit of Tsh. 420,000 per MAPET unit. Since the mission has no reason to seriously doubt the existence of a substantial market, the economic feasibility of the project appears to be ensured.

Institutional feasibility
The project will predominantly work with private sector entrepreneurs. Field visits and interviews with a wide range of entrepreneurs have given the mission sufficient confidence that there will be sufficient entrepreneurs who are willing to enter into the profitable business of pit emptying.

Among the NGOs active in related fields there will certainly be one NGO that will be strong and competent enough to undertake the task of project management, including social marketing.

The DSSD, the Health Department and the Sustainable Dar es Salaam Project have all expressed their unconditional support for the project in its present form.

The project will use existing institutions, organisations and enterprises only. Not one single new institution will be set-up for the project. The mission's assessment of potential project partners is positive, so there is no reason to seriously doubt the institutional feasibility of the project.

Socio-cultural feasibility
In urban Dar es Salaam the formation of community based organisations has proven to be very difficult. The concept that people take initiatives in improving social and environmental conditions rather than relying on the government is new. It is also questionable if the business-like approach adopted for project implementation gives communities an advantage over private entrepreneurs to run a business. Finally, pit emptying services is purely a private and individual affair which has little relevance for the community, except when people indiscriminately dispose of the sludge in the direct neighbourhood. The planned public awareness campaign will address this problem.

Although some segments of the population express a resistance against handling sludge, everybody is aware of the importance of pit emptying. If this is not done people will be even more confronted with substance they may detest. Interviews confirm that no major socio-cultural impediments may be expected for the implementation of the project.

8.3 SUSTAINABILITY

The project will work predominantly on the basis of commercial feasibility. This implies that most stakeholders, business people who are doing the major investments themselves, will have a high stake in the project's success. The sustainability will not be in the project, but in profit-making sustainable enterprises providing a service which is in high demand with the population.

Although not a primary objective, the project will contribute to the strengthening of a new institutional framework for the Dar es Salaam City Council, though the SDP, to effectively address urban management problems in a sustainable manner.

9. ASSUMPTIONS AND RISKS

The major risk for the realisation of the long term objectives of the project is that the Dar es Salaam City Council (DCC) fails to develop and implement policies that are conducive to participatory urban improvement and development. Although a number of policy statements are very encouraging indeed, much will depend on whether or not these policies will be actively implemented. Presently it is acknowledged by many that the DCC is facing complex political and administrative problems, that may reduce the effective support of the DSSD to the project. It will be essential that the DCC and its relevant departments continue to work closely with the SDP and understand and accept the principles of rational urban management in a liberalised economy.

The principal risks facing the implementation of the establishment of private enterprises include the following:

- The DCC may fail to issue or renew licenses for the operation of MAPET equipment.
- Entrepreneurs may have overstated their commitments to invest in MAPET equipment and will eventually back-out.
- A general deterioration of the economic situation in Tanzania will undermine the ability and willingness of residents to pay for emptying services and of local entrepreneurs to invest in MAPET equipment.

In a privatised operation, based on profit principles, there is always a risk that the poorer sections of society are left out. As the project is designed now, this is unlikely to happen. It is felt that the linkage of licences to geographical areas and a system of monitoring that is linked to the annual renewal of licences will ensure that all customers can obtain the service at an affordable cost.

Another risk with privatised operation is the lack of attention for environmental concern. This could be caused by inadequate burying of the sludge, or dumping of sludge on open plots or in surface water. However, looking at present environmental conditions in the potential project areas and the amount of 'social control', it is unlikely that the community or customer would allow this to happen. Furthermore, through training and public awareness campaigns and the involvement of the DSSD, effective control may be exerted in mutual understanding and harmony.

The assessment of locally developed technologies by a team of local and international experts further ensures the technical feasibility of the project. If need be, additional local or international expertise will be available to the project to solve technical bottlenecks.

Annex 1: TERMS OF REFERENCE FORMULATION MISSION MAPET PHASE II

Background

The population of Dar es Salaam experiences great problems with sanitation services, particularly in unplanned, low-income areas, where traditional pit latrines are the most common form of sanitation. In the present situation, the inadequate emptying of latrines leads to overflowing of pits and improper disposal of sludge, which causes adverse environmental conditions and public health hazards.

The Manual Pit Latrine Emptying Technology Project (MAPET) was carried out in Dar es Salaam between 1988 and 1993, funded by the Netherlands Ministry of Foreign Affairs (DGIS). The project was implemented jointly by the Dar es Salaam Sewerage and Sanitation Department (DSSD) and WASTE Consultants of the Netherlands.

The main objectives of MAPET were to improve on traditional pit emptying methods by ensuring environmental sanitation in unplanned urban areas, and to introduce (and test) an efficient and hygienic emptying technology. MAPET Phase I included a component to compare different pit emptying technologies under the prevailing conditions of unplanned areas in Dar es Salaam. This component was called "Comparative Study on Pit Emptying Technologies" (COMPET) and was concluded with a seminar in 1993. It was agreed that the technology of MAPET was a highly efficient and practical method for emptying pit latrines, and much better suited to service unplanned areas than other available technologies, such as the large and mini tankers.

On the basis of these results, DSSD and Waste Consultants submitted a proposal for a MAPET Phase II project, entitled:

"Expansion of Manual Pit Emptying Services and further Development of Sludge Transfer Technology for Low-Income Squatter Areas in Dar es Salaam, Tanzania"

This proposal was aimed at introducing the MAPET technology at a much larger scale, but was deemed unsatisfactory with respect to institutional setting, financial feasibility and sustainability, manufacturing and operation of equipment, and the overall approach to community participation. A practical and sustainable application of MAPET technology at a larger scale needs to be based on the following principles and assumptions:

principles:

- MAPET II will be a facilitating project aimed at matching supply of and demand for pit-emptying services
- government and city council will play a limited role
- the private sector will play the major role in manufacturing and operation of equipment, and in delivery of MAPET services
- although initially subsidized, the MAPET services ultimately must be financed wholly by the consumers on a commercial basis
- disposal of the sludge must be environmentally sound, with due regards for public health aspects

- the MAPET services needs widespread promotion among consumers through the approach of social marketing

assumptions:
- the MAPET technology and equipment have been proven and do not need major adjustments and improvements; minor refinements will remain possible
- consumer demand (amongst communities in unplanned areas) for the MAPET services exists and is sufficient to sustain the commercial approach
- the private sector is interested in becoming involved in delivery of MAPET services
- the Dar es Salaam City Council creates an enabling environment for MAPET services

The Mission will reformulate the abovementioned proposal for MAPET II to arrive at an Environmental project with strong components of small-scale enterprise (employment and income generation), social marketing, health and sanitation. The proposal needs to be accompanied by a budget. The Mission should address the following issues:

Institutional Arrangements

An organisation (preferably an existing NGO) needs to be identified to implement MAPET II and to house the MAPET Support Office (MSO). The role of the organisation centers around facilitating pit-emptying services in parts of Dar es Salaam by bringing together all the actors involved: private sector, communities and government. The respective roles and activities of the organisation, MSO and other actors need to be defined and described in detail.

Implementation of MAPET II needs to be linked with related existing programmes in Dar es Salaam such as the Sustainable Dar es Salaam Programme (SDP) and the Urban Health Programme (UHP).

Supply and the private sector

1. Manufacturing and maintenance

An existing enterprise (or group of enterpreneurs) need to be identified to locally manufacture and maintain the MAPET equipment according to the specifications developed in MAPET Phase I. Points of attention will be:

- manufacturing capacity and skills (quality and quantity)
- materials and parts must be locally available and import of parts must be avoided as much as possible
- the need for investments to enhance capacity
- competitiveness in relation to other companies
- a plan by the enterprise detailing costs and prices of manufacturing and maintaining of MAPET equipment
- possible adaptation of technology

2. Operation

An existing enterprise (or group of enterpreneurs) need to be identified to operate the equipment

to deliver the services. Points of attention will be:

- ownership of equipment
- selection and requirements of operators
- relationship of owners and operators: define roles (owners to hire out to operators?)
- the need for investments
- training needs for owners and operators in the use of equipment and proper disposal of sludge
- a business plan to outline finance, cost/benefits, price of services, operation schedules
- need for licensing and supervision
- disposal of sludge (see below)

Demand and communities

MAPET I has highlighted community perceptions, awareness and needs. Based on this information and further investigations, the mission should:

- identify a mechanism to establish the initial user fees for payment of MAPET services
- assess the needs for MAPET services per community (or number of households) in terms of volume of sludge and frequency of emptying (use and size of pits); also in terms of sludge characteristics
- define target communities with a clear focus on gender and socio-economic status
- define the role of communities and community participation in the project
- determine the needs for sensitizing, training and education of communities about MAPET technology
- assess the present use of pit emptying methods
- assess the potential for proper on-site sludge disposal
- pay particular attention to gender aspects

Matching demand and supply: Social Marketing

Social Marketing essentially promotes a product (or service) to lower income people, which are otherwise hard to reach. This system uses commercial marketing techniques to achieve a social objective and has been used succesfully in public health campaigns to promote family planning and AIDS prevention. The price of the product (or service) is an integral part of the promotional campaigns.

The mission should:

- assess the feasibility of the social marketing approach regarding MAPET services
- describe the necessary activities under the social marketing concept aimed at suppliers of the MAPET services (manufacturers, owners, operators)
- ditto, aimed at consumers of the MAPET services (individuals, groups, communities)
- define the roles of the various actors, with special attention to the role and needs of women

Disposal and transfer of sludge

In MAPET I the disposal of sludge was felt as a problem with a direct bearing on environmental and public health conditions. This problem was not addressed at the time, but does need attention during Phase II. It features in the original proposal as a complicated activity involving transfer stations, large trucks and tractors, which was deemed not feasible on organisational and financial grounds. If MAPET II becomes a succesful project, the volume of sludge to be disposed of, will increase enormously. Hence, the mission has to address this issue along two lines, short-term and long-term:

- suggest short-term solutions and activities to properly dispose of small volumes of sludge, preferably within easy reach of the operators; possibilities include on-site disposal within the compound or community, the use of existing dumping stations (operated by DSSD), the construction of new (temporary) dumping sites, the use of existing, operational sewer lines.
- suggest short-term arrangements and activities for control and supervision of sludge transfer and disposal mechanisms, define actors and roles; DSSD, MSO, communities themselves?
- suggest long-term solutions to properly dispose of large volumes of sludge, originating from various parts of the city; possibilities should not only be sought in terms of dumping, but also in terms of use: processing of the sludge for composting or biogas production.

Location of activities

In the long term, MAPET activities should be available in all parts of the city where demand exists. In the short-term, the mission should come up with suggestions for locations where MAPET II activities can be implemented. Points of attention will be:

- the physical location of MSO
- criteria for selection of communities and areas
- the need for facilities
- the need for proper disposal of sludge within easy reach of operators

Timing, Organisation and Team Composition

Period: three weeks, preferably in January 1996
Total inputs: 3 man-months

Preferably the mission will be organised and implemented under the responsibility of one organisation that hires the required experts.
The teamleadership should rest with the most experienced member of the mission.

Required expertise:
- small-scale enterprise/business development/engineering (3 weeks; expatriate?)
- social marketing/institutional (3 weeks)
- social marketing/community development/gender (3 weeks)
- sanitation/public health/community waste disposal (2-3 weeks; expatriate?)

Budget

Budget for the mission should be based on the following items:

- expert input (salary/honoraria, DSA if applicable)
- local transport and other local costs
- report writing
- overhead and administrative support
- contingencies 5%.

ANNEX 2: DOCUMENTATION

Development Cooperation Ministry of Foreign Affairs, The Netherlands

1991 *A World of Difference; A new framework for development cooperation in the 1990s.* Policy document of the Netherlands Ministry of Foreign Affairs, Development Cooperation Information Department, The Hague, SDU Publishers.

1994 Disappearing Boundaries, Smaller Margins, Larger Risks.

1994 "Urban Poverty Alleviation." Sectoral Policy Document of Development Cooperation. No.5.

Kirango, J., J. Ndesamburo and H. Kiwasila

n.d. "An analysis of Compet Seminar Recommendations (8th - 11th March 1993) for Application by DSSD." Occasional paper.

Macharia, L.

1992 "Sanitation Options for Kibera Low-Income Area in Nairobi" Unpublished Report, Tampere University of Technology, Institute of Water and Environmental Engineering, Finland.

Mamuya, S.H.D and L.M.B. Rongo

1994 "Introduction of Community Based Manual Pit Emptying Technique (MAPET) to Buguruni and Vingunguti - Ilala District, Dar es Salaam." Plan International Report.

Sustainable Dar es Salaam Project

n.d. "Sinza Pit Emptying Technology Project. Notes on Three Months Project Report."

UNDP

1991 *Cities, People & Poverty; Urban Development Cooperation for the 1990s.* A UNDP Strategy Paper, New York, United Nations Development Programme.

WASTE Consultants

1989 "Social Study of Pit Latrine Emptying in Dar es Salaam, Tanzania." Progress Report No. 6.

1990 "Mission Report of the 4th mission to Dar es Salaam, 19th of February till 13th of March 1990." Propgress Report No. 7.

1993 "Proceedings of the Closing Seminar of the Comparative Study on Pit Emptying Technologies, 8 - 11 March 1993, Dar es Salaam." Gouda, Waste Foundation.

1993 "Project Proposal Mapet Stage II; Expansion of Manual Pit Emptying Services and Further Development of Sludge Transfer Technology for Low-Income Squatter Areas in Dar es Salaam, Tanzania, 1994-1998." Dar es Salaam, Sewerage and Sanitation Department, Tanzania and WASTE Foundation, The Netherlands.

1993 "Summary of the Comparative Study on Pit Emptying Technologies (COMPET) executed in Dar es Salaam (1991-1993)." Gouda, WASTE Consultants.

1994 "MAPET Manual Pit Emptying Technology Project; Development and pilot implementation of a neighbourhood based pit emptying service with locally manufactured handpump equipment in Dar es Salaam, Tanzania. 1988-1992." Gouda, WASTE Consultants.

n.d. "Capabilities for the Support of Projects in the South on Urban Environment and Development. Integrated Waste Management. Resource Recovery. Neighbourhood-based Environmental Improvement. Training and Dissemination." Gouda, Waste Consultants.

World Bank

1991 *Urban Policy and Economic Development; An Agenda for the 1990s.* A World Bank Policy Paper, Washington, D.C., The World Bank.

ANNEX 3: ORGANISATIONS AND PERSONS CONSULTED

Waste Consultants
- o Jaap Rijnsbuger (Physical Planner).

Dar es Salaam Sewerage and Sanitation Department (DSSD)
- o Acting Head of Department (Mr. Simon Chale).
- o Low-Cost Sanitation Engineer (Mr. Mvano).
- o Electrical and Mechanical Engineer (Mr. Patrick Lacha).
- o Technician (Mr. Xavier Haule).
- o Emelda Mwakifuna (former MAPER coordinator for Waste).

Health Education Section
- o Head (Mrs. Swai).

Plan International
- o Field Operations Manager (Mr. William M. Baynit).

Population Services International (PSI)
- o Mr. Timothy G. Manchester.

Royal Netherlands Embassy Dar es Salaam
- o Ambassador (H.E. Mr. J. Weijenberg).
- o Head of Development (Mr. Jef Ijzermans).
- o Second Secretary (Mr. Bob Hensen).
- o Sector Specialist Health (Mr. Ger Steenbergen).
- o Sector Specialist Health (Mr. Thomas van der Heijden).

Sustainable Dar es Salaam Project (SDP)
- o Chief Technical Adviser (Mr. Chris Redford).
- o Coordinator Surface Water and Liquid Waste Working Group (Joyce Ndesamburo).

Municipal Council Morogoro
- o Municipal Director (Mrs. Elisabeth Munuo).
- o Health Engineer (Mr. Masebu).
- o Former Pit Emptier (Mr. Shabani Haji).

Swisscontact Morogoro
- o Co-Project Coordinator (Mr. A.J.M. Mbugi).

National Engineering Co. Ltd.
- o General Manager (Mr. Ing. L.M. Salema).

Intermech, Engineers Tools & Equipment
- o Director (Mr. Peter D. Chisawillo).

Small Industries Development Organisation, Common Facility Workshop DSM

- Project Manager (Mr. E.M. Mshana).

Institute for Production Innovation
- Director (Prof. J.S. Mshana).
- Head Research (Mr. Emrod Elisante).

The World Bank, Urban Sector Infrastructure Project.
- Sanitary Engineer, Energy and Infratsructure Operations Division, Eastern Africa Department (Mr. Joseph Gadek).

Guru Machine Tools Manufactur & Co. Ltd.
- Director (Mr. Rajesh Soni).

Shefa Co. Ltd.
- Managing Director (Ms. Susan Kisanji) .

Mwabuka Furniture Mart
- Managing Director (Mrs.N. Ndelwa).

TAMECO (Cooperative Society)
- Chairman (Mr.Remigus Mbawala).

Tegemeo Youth Programme

UVIKIUTA (NGO of group of unemployed youths)

Amazon System

Sunbird International
- Managing Director (Ms. Adeline Mlay)

Health Department (Dar es Salaam)
- City Health Inspector (Mr Juma Kinwari).

ANNEX 4: VISIT REPORTS

Date: 31 January 1996.

Organisation: Waste Consultants (Gouda, The Netherlands)
Spoken to: Jaap Rijnsburger

Mr. Rijnsburger was the project officer for the MAPET-1 project and has contributed substantially to the draft of the proposal for MAPET-2, submitted by DSSD and WASTE consultants to the Netherlands government. For the last three years no monitoring of the project activities took place, because there was apparently no budgetary provision for such activities.

WASTE has only to a very limited extent used local technology institutions for the development of MAPET units. The Faculty of Engineering of the University of Dar es Salaam has manufactured a prototype, while the Institute of Production Innovation (IPI) has produced drawings of the MAPET equipment.

WASTE consultants believe in the increased privatisation of the operation of the MAPET teams with DSSD having mainly a monitoring role to play. It was further observed that MAPET teams would be able to operate in a commercially viable manner, even if depreciation of the equipment is accounted for. However, when on-site disposal is not possible and tanker services are needed for sludge disposal, the costs would go beyond the affordability of most customers. In that case the capital costs (for the tankers) should be separated from the operational costs. According to WASTE, the introduction of Mobile Sludge Transfer Stations should be the backbone of MAPET-2. For transport locally assembled VALMET tractors may be used. It was reported that it not worthwhile to investigate end-uses of sludge from pit latrines. This sludge can, at best, be used for soil improvement, but certainly not for gasification. Even in the case of soil improvement major cultural objections are likely to emerge in Tanzania.

WASTE considers itself the only suitable party for the implementation of MAPET-2 because of the trust and working relations which have been build with local stakeholders.

The original design of the MAPET-2 project, prepared by WASTE Consultants allegedly was more private sector oriented that the final proposal which was prepared under the jurisdiction of the DSSD, as directed by the Royal Netherlands Embassy in Dar es Salaam. In the process, the project costs increased from the original Dfl. 500,000,-- to more than Dfl. 2 million.

Waste Consultants is presently executing an Urban Waste Expertise Project with funding from the Netherlands government (DST/SO and DST/UR). The project has a duration of six years and is meant to address the issue of neighbourhood sanitation, a policy priority of the Netherlands programme for urban development. The idea is to arrive at context-indifferent solutions, including waste treatment at the neighbourhood level and adapt these solutions locally. The research is being undertaken jointly with the Agricultural University of Wageningen.

WASTE consultants declined to make the drawings of the MAPET equipment available to the mission, and also refused to provide (or sell) copies of the technology development reports mentioned on page 58 of the Final report dated 18 March 1994.

Date: 5 February 1996.

1. Population Services International
Spoken to: Timothy G. Manchester, Director, Project Support Unit

Population Services International (PSI) is an NGO that uses commercial marketing techniques and the resources of the local private sector, such as distributors, retailers and advertising agencies. Products are sold, rather than given away to ensure that the recipients truly want them and will use them. Subsidies are underwritten by contracts or grants from governments, international agencies and foundations. Project revenues are reinvested in programme activities.

This system, known as social marketing, uses commercial marketing techniques to achieve a social objective, assures widespread distribution of commodities and effective dissemination of information to populations that cannot afford commercially priced products or are not reached by government health programmes.

PSI uses creative means to motivate behavioral change and to educate and increase product awareness. PSI conducts social marketing programmes in 23 countries in Africa, Asia, and Latin America.

PSI collaborates with local NGOs, and trains their staff so that they can assume operational responsibility. PSI personnel have expertise in marketing, public health, management, health communications and advertising. PSI projects complement local government programmes.

PSI Tanzania would be interested to implement a MAPET-2 project if this would prove to be a profitable undertaking. Since PSI would tag this task on to a number of other managerial responsibilities, such as managing an aids prevention project and the marketing of impregnated mosquito nets, important economies of scale in project management could be realised.

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2. Dar es Salaam Sewerage and Sanitation Department & Field visit to MAPET operations.
Spoken to:
- **Mr. Patrick Lacha, Engineer**
- **Mr. Xavier Haule; Technician**
- **MAPET operators.**

Joyce Ndesamburo organized for the mission to see MAPET in operation. We met at the DSSD headquarters in Mwananyamala. We met Mr Patrick Lacha, mechanical engineer and in charge of the DSSD workshop and Mr Haule, technician at the workshop, in charge of the MAPET equipment.
There were no MAPETs around. A number of MAPET operators were waiting for jobs. When we asked why there were no customers, the engineer said that during the project, the health inspector would go around with the MAPET team and would tell people that their pits were overflowing and that they had to have them emptied. Now the health inspector was no longer working with them. One team, consisting of four people, three of them trained by WASTE, were going to do a job for us to see. In the yard were quite a number of large tankers, most without wheels and the two mini tankers, which are no longer in operation. Apparently they went out of order soon after the COMPET study was finalized, because of mechanical problems with the

engine and shaft which needs spareparts which are not available in Tanzania.

The MAPET was stationed at the compound of the last customer in Kijitonyama. The pick-up truck of Mr Lacha was needed to ferry the MAPET from the last customer to the next one. We paid Tsh 5000 for the fuel needed to Mr Lacha who drove the car himself an extra hose was also taken.

The place were we picked up the equipment was a motel (Executive Motel) near the main road and on a wide murram road. The pit emptied was a septic tank, 23 tankloads of 200 litres were taken out. A hole was dug next to the septic tank and the sludge was buried and few signs of the desludging exercise could be seen, except the loose earth covering the pit. Although accessible by large vehicles, the septic tank was located at the back and the pump of the tanker apparently not strong enough to desludge over that distance. The engineer said that the mini tanker would have been strong enough to desludge it as its reaching capacity was about 45 meters. According to the engineer, most MAPET customers are like this one, that is, people whose pits cannot be reached by the large tanker, but who are very much able to pay (at least middle class). The desludging was four weeks ago.

We proceeded to Manzese (Friends Corner, Bwana Doho). House difficult to reach, even MAPET equipment had problems and the wheels were taken off the tankcart to carry it over the fence. Nice house (latrine 10 years old, never emptied 1.5 m square and almost 5 m (14 ft) deep), plot next to the house empty and the hole (1,5 square meter, 2 meters) deep had been dug the day before by the operators, price Tsh 3000 for the digging and a hole had been made in the wall of the latrine for the hose to come out at the side of the dug hole.
State of the equipment: both hoses were leaking, only the newly brought one was in good order. The cart with the pump also had car tires, the pump was leaking and had to be primed several times. The tank was leaking in one place but, the hole covered in mud to close; the safety valve and place for the small hose to create pressure was in bad condition, the small hose had to be buried in mud to keep it close to keep pressure. in doing this, mud/sand was able to get to the pump. One of the car tires under the tank was flat.

The first tank load took 10 minutes to have the vacuum, to fill up and to empty straight away from the tank into the pit. They then decided to change the hose and use the one brought. Since the coupling was still on both sides, the hole in the wall had to be widened and also the squat hole had to be widened. This was done with rudimentary equipment, not a chisel and hammer. With the new hose, the machine worked much more efficient and in 2 1/2 hours, 14 tankloads were taken. The first 10 loads were mainly water and only the last 4 were more sludge like, but still very watery. But the soil was quite sandy and elevation compared to surrounding houses high and on a downward slope. Only with the last load there was a bit of blockage caused by a small bottle, already sucked in the tank and taken out of it at the time of emptying in the dug pit.

The owner had paid Tsh 18.000 for 15 loads, Tsh 1300 per load. This he paid to the operators. The operators pay a lease fee of Tsh 500 per day to DSSD. They had not been working for the past 4-6 weeks as there were no customers. They wait daily at the DSSD for their customers. When we asked why not one of them was going around in the same area to get more customers, they said it was hard to get customers because the cost was too high. The owner, like the previous customer had gone to DSSD for tanker service (Tsh 8000 per full load capacity not known, but at least 5000 litre), but was told he had to hire the MAPET as his plot was not reachable for the

tanker. He thought service very expensive, but there is no choice and he was happy with the service (they came in two days). if it would have been more expensive he would have relied on traditional frogmen, which is messy and takes a long time. It is unclear if he would have had to pay for the ferrying of the equipment if we would not have done so.

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3. Dar es Salaam Sustainable City Project
Spoken to: Joyce Ndesamburo

According to Joyce people will pay for the service even if they are poor. if there are tenants, they also have to pay part of the cost (divided among number of households living on premises, if only one tenant and no landlord, the tenant pays).
For DSSD to keep all equipment running is impossible as the fees are not enough. Fees for tankers are determined by the councillors and have no relationship to the cost. She says DSSD would be happy not to have to look after the equipment and give out the service to private operators and for them only supervising and if necessary receiving clients.
We heard that private tankers are also operating, but she says they are not privately owned but are either DSSD tankers or owned by other Council departments (health) or parastatals. There are middlemen operating who get customers and meet the tankers at a certain place, make a deal (Tsh 10.000 for tanker, Tsh 5000 for middlemen) and direct tanker to the customer. The middlemen go around to get customers, but do not have the funds to finance their own tanker. The DSSD tankers have to have 7 to 8 trips per day to account for, so there is some control. The health department vehicles do not have that control mechanism.
She said that probably the MAPET operators are not educated enough or do not have the business attitude to create demand for the service.

Date: 6 February 1996.

1. Plan International (Headquarters and Buguruni Office)
Spoken to: William M. Baynit

We met William M. Baynit, in charge of the Vinguguti and Buguruni urban projects of Plan International. They hired a consultant in 1994 to see if the MAPET could work in these areas and to see wether PLAN should get a MAPET. The report of the consultant was given to us. Apparently, the consultants thought it was feasible and set out a plan to introduce a MAPET service. Even some operators were trained by the DSSD operators. A list of parts needed for the MAPET was obtained by these consultants, but they had not been able to get the drawings. We heard yesterday from mr Haule at the workshop that they were at one stage asked to construct a MAPET for PLAN, but that it had not materialized. Mr Baynit said that the consultants had said that construction at the DSSD workshop was deemed too expensive.
However, when the MAPET was discussed with the community development committee, they said they did not want the MAPET as there would be no place for the sludge. They were not willing to run a MAPET service. Since that was the case, PLAN opted out.

A visit to Buguruni was made with Jane Mwaipopo, PLAN community development worker in the area and a member of the PLAN community development committee. Buguruni is one of the poorer unplanned areas of Dar es Salaam. Water supply is available only 2 days a week at

houseconnections, no public standposts. During those days, water is sold by vendors for Tsh. 50 per 20 litre, on the other days the cost is 100 to 150 Tsh. Most houses have a latrine, usually a pit covered with wooden poles on which a rough cement platform is made. The platforms have cracks and are quite large 1.5 m square, often the superstructure is corrugated iron sheets or wooden fence and no ceiling. Many pits were full. people would either do nothing and abandon the pit and let the sludge go down or they would dig a pit next to the full pit and make a connection to the full pit, let it drain and reuse the latrine (cost tsh. 30.000). Or they would get frogmen to empty the pit and throw the contents in another dug pit (cost depending on amount taken out, but about tsh. 10.000). Cost for the emptying is with the landlord. PLAN has been introducing VIP latrines, so far 40 have been built. The beneficiary has to apply for a VIP (cost Tsh 500 for application) and has to pay for the digging of the pit and the fundi. Initially, it was up to the people to agree on the price for the fundi, but as not all fundis were conversant with the requirements for a VIP latrine, a training for local fundis was carried out and at present the price is standardized at Ths 25.000. The cost of the construction and materials for the VIP is Tsh. 290.000. This is all paid for by PLAN. The cost recovered from the beneficiaries goes into the community fund, to be used for instance to help people who cannot afford the cost of the fundi, but more or less at the discretion of the community committee.

The VIP latrines are very beautiful, but the fact that they have to be emptied at one stage is not taken into account. According to Mr. Baynit, if that time comes, maybe we will get a MAPET. One of the VIP owners, a lady who is also on the committee, said that she would get the DSSD tanker, as her house could be reached. When asked about the MAPET, she knew about the existence and when asked how much she thought people should be willing to pay for desluding she said Tsh. 2000. Yet, she knew the DSSD price to be Tsh. 15.000 and was willing to pay that. Obviously, she thought MAPET is also a Mzungu (white man) operation and therefore the price should be low. When I said MAPET is a DSSD operation and therefore needs to be cost effective, she shrugged her shoulders. It seems that this community committee is so used to PLAN more or less giving things for free that sustainability is none of their business (for instance school uniforms are acquired through PLAN at a cost of tsh 650, while actual cost is Tsh 6.500, again the price paid for the uniforms goes to the community account). Moreover, this lady already had a latrine in her house of the above described type. As it was almost full, she opted for a new VIP. She would let the sludge of the old latrine settle, then cover it with soil, take away the CI sheets surrounding it and use the space as courtyard.

There are many places where on plot desludging and burying is feasible and possible, and culturally acceptable as this is the traditional way of doing it. Yet there are also houses where it is not as all the space is built up. here, the option of a mobile desludging station would be the only possible alternative. Given the present attitude of the people, it is very questionable if they would be willing to pay for services of both MAPET and mobile transfer, apart from the fact that indeed there are people who cannot afford this.

Date: 7 February 1996.

1. Dar es Salaam Sewerage and Sanitation Department (DSSD)
Spoken to: Mr. Simon Chale, Acting Head.

Mr. Chale assumed duties about two months ago. He pledged full support for the mission and

promised to mobilise the appropriate staff of DSSD. Persons suggested to meet: Mr. Mvano, Low-cost sanitation engineer; Mr. Xavier Haule, technician; Mr. Patrick Lacha, mechanical and electrical engineer. Mr. Chale made a very accommodating and professional impression.

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2. Sustainable Dar es Salaam Project (UNCHS/Habitat)
Spoken to: Mr. Chris Radford & Mrs. Joyce Ndesamburo

Although slow, the Dar es Salaam City Council is changing its perception of its role and its relationship with the private sector and local communities. Since a short time, the City Council has a strong and able City Director.

The approach of the Sustainable Dar es Salaam Project (SDP) since 1991 has been to more or less 'plunge' into the privatisation of solid waste collection services and learning while doing. A private company, Multinet, has been awarded a five year contract for the collection of solid waste from commercial and, to a lesser extent, domestic, premises in the centre of Dar es Salaam. The alternative approach of starting with policy reform from the top and pushing it down to the level of local authorities was rejected as a strategy, because it would take too long and immediate action was needed.

The role of the Health Department is now changing from solid waste collection to monitoring and conflict resolution. The Regional Medical Officer of Health for Dar es Salaam has been instrumental in changing regulations and making appropriate bye-laws to enable reform of collection charges. Commercial units have to pay refuse collection charges before they can get their annual business licenses issued. The project now attempts to move to residential areas and make use of the possibility that at the sub-ward (*mtaa*) level house-to-house collection of fees is allowed on behalf of the local authorities.

Although the project has known its difficult moments, overall it has been rather successful in creating new private-public partnerships and in gaining experience how to operate a public service in the private sector on a cost-recovery basis. The project stressed the importance of establishing mechanisms (through workshops, seminars and otherwise) in which the private sector and local authorities communicate and appreciate each other's problems and constraints. A number of issue specific workshops, such as for solid waste and for liquid waste, regularly meet for this purpose. When engaging the private sector in municipal services it is important to include in the contract a clause stipulating an obligation to establish and maintain a proper database and to issue regular reports to the authorities.

Recent press reports mention serious contractual problems between the City Council and Multinet. Multinet allegedly does not have sufficient facilities to fulfill its contractual obligations. The City Director has now announced to review the arrangements due to poor performance of the firm. The firm maintains that although it has the authority to collect fees, it does not have the authority to prosecute non-payers. For this, it is dependent on the City Council that does not act.

Even when privatising, it is considered important that the City Council department concerned continues to operate a few units on its own to ensure appreciation of the technical, administrative and financial possibilities and constraints of the service and to have control mechanisms to

compare the operation with the achievements of the private sector. Such an approach would also inculcate a more business-like orientation in local authorities.

The SDP is in the process of applying the basic principles of the privatisation of solid waste collection services to liquid waste collection and disposal. Within the SDP a special working group on liquid waste has been established for this purpose. Mrs Joyce Ndesamburo has been delegated by the DSSD to the SDP to coordinate this working group. The SDP is of the opinion that local communities have an important role to play in the monitoring of the provision of privatised services and will also allow for proper checks and balances.

Asked about suggestions for the implementation of a MAPET-2 project the following emerged:

- There is an ongoing discussion to consider the already polluted ground- and surface water also as a potential disposal and transfer medium, although no data could be given about the possible health risks of such a strategy.
- The SDP would welcome support to the working group on liquid waste, which is in need of resources to function.
- The project should start in a limited number of selected areas.
- MAPET related activities cannot and should not be separate from the tanker services of DSSD. An integration of technologies for pit emptying would provide the opportunity to integrate different technologies within the DSSD.
- In places where on-site disposal is a problem, eventually transfer or collection points need to be established on the fringes of the areas concerned. Customers should pay for all the costs up to transport to these collection points. The City Council or a donor should at least temporarily) bear the costs for final sludge disposal from the collection points to the existing stabilisation ponds. A general tax basis needs eventually to be established to realise cross-subsidies to ensure that everybody pays similar amounts, regardless of the method and real costs of sludge disposal.
- The project may consider linkages with the National Income Generation Project (NIGP) of the UNDP under the directorship of Prof.Mawenya and Deputy Director Mike Laser.
- A MAPET-2 project could be brought under the umbrella of the SDP, which has created the Sustainable Dar es Salaam Development Fund for such purposes. Donors can deposit contributions for specific activities to this fund in a special bank account. Project brought under the umbrella of SDP can operate in a rather autonomous manner, without undue interference of the City Council. However, the City Council seconds its own staff to the project. An example is the Community Infrastructure Project (CIP), a US$ 6.4 million project with contributions from the World Bank (US$ 4.5 million), Japan (US$ 0.5 million) and the Irish Government (US$ 1 million). A steering committee has been established with the following members: City Director; representative of the NIGP; representative of the SDP; City Planner; Head of the DSSD; and the City Engineer.

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2. Mrs. Emelda Mwakifuna (ex-coordinator of MAPET).

With Mr. Haule from the workshop, we went to visit mrs Emelda who used to work with the MAPET project and used to monitor the crews. She lives near Bahari beach and owns a hotel. She has one MAPET equipment.
There are 9 MAPETs constructed during the project, one of these is in Morogoro. In 1994, all

8 other MAPETs were collected from all over Dar es Salaam and brought to the workshop. Out of these, four units were repaired and put in working order, the other four were used for spare parts and do not exist any more. Four crews were given a MAPET and it was agreed that a lease fee of Tsh. 12.500 per month would be paid. Initially, this was paid, but this soon stopped. One crew works in Mwananyamala and does a lot of work through DSSD. One crew used to be with Emelda, but only one operator is left. This MAPET is now out of order as the piston is broken. Emelda wrote to WASTE to ask for another piston, sending the letter through Kirango, but she has never received a reply. The MAPET is stored somewhere else where it is kept in an empty house; the hose is in good condition and apart from the piston, they say it is in working order. She last did desludging in october, over the last year, she says she emptied about 6 pits twice in her own premises. her customers are people from the neighbourhood, but this is more or less a rural area and to transport the equipment she uses a car. She charged tsh. 1000 for a load, but only tsh. 600 for water only. Her customers come to her because the city tanker does not cover this area (too far).

She is not operating a 'proper' business in MAPET because she is not licensed and does not know if she can operate as a private person a service which is deemed to be a council service. She says there would be a lot of interest to run private MAPETs if the council allows it.
According to her, the two remaining MAPETs should be taken away from the operators because they do not pay the fees and have more or less 'hijacked' the equipment. Whenever she would go to their area, the crew would make itself scarce so as not to pay their fees.
DSSD is not training any more crews and she would be willing to pay for training from haule if she would get a licence to operate. DSSD does not do any monitoring or control of the MAPETs or crews.

The only problem for MAPET is if the yards are cemented over, then usually they bury the sludge on the adjacent plot. Poorer people get only few loads, but most of her customers are not poor (like the army barracks near) and have the whole pit desludged. According to her, MAPET should be privatized, order a MAPET from Haule and make sure it keeps running. Most repairs can be done by small workshops and for complicated repairs they can go to DSSD yard (where Haule knows the equipment best) and pay for the repair.

The equipment and outfit and bicycle given to the crews on loan disappeared very soon. Some crews paid back about half the loan , others never. She thinks MAPET should be run privately and not through community organizations, too much trouble about the money. The Kibuyu type of tank was not acceptable to the people because they thought it was too small, could not be convinced that it had the same contents as the regular tank. Also some technical problems (for Leon to ask Haule). The information/education campaign during the MAPET project was carried out only in the planned areas, not in squatter areas. That is why it is not known there.
Now a MAPET equipment costs about Tsh. 900.000, in '93 this was between Ths. 350.000 and 400.000.

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3. Two mapet crews in Mburahati.

Directed by Mr. Haule, we went to look for the two remaining MAPETs. First to the CCM office who directed us to the pub where we found the two crews, 5 men with a lot of drink in them. They agreed to talk to us and we went to the CCM office. People come here to ask for the

service. Each MAPET has one DSSD trained operator. Last week, one MAPET had three jobs, the other four. There is a waiting list of 5 and 6 customers for the MAPETs. Number of loads depend on the customer from 1 load to more than twenty. each load costs Tsh 1000, regardless of number of loads. Digging the pit costs Tsh 1500 regardless of size, the customer can also dig the pit themselves. If the customer lives far, the crew goes to the DSSD to arrange transport and the customer pays for the fuel, no other costs. This does not happen often, less than once in two months.

They say the lease for the MAPET is Tsh 2000 per week, either they go to DSSD to pay or DSSD comes for the money. In DSSD, they pay the cashier and receive a receipt. In exchange, large repairs are done at the workshop for free officially, but some money does change hands. Small repairs are organized by themselves, cost varying from Tsh.10.000 to tsh 30.000 per month.
They get customers without any effort. once they put an advertisement in the Uhuru newspaper. If they walk around with the MAPET, they often get new customers who ask for service. They earn about tsh. 200.000 per month per MAPET.
Sometimes they spent one day pushing the machine to the customer (up to 7 hours) but do get more customers on the way and at final destination.
There is not control whatsoever from DSSD.

Most pits are lined, they do not experience collapses. The only problem is blockage and then they clear the hose. They tell the customer to put 2 kilo salt (makes sludge easier to handle) and water. Depth of pits is about 12 ft on average, width varies from 5 ft upwards.
It is always the landlord who pays and arranges for the service. At present both MAPETs are in Mabibo, they will take us there on friday. The MAPETs are always left with the last customer, in that way, the customer knows that they will come back to close the pit when the sludge is settled.

Date: 8 February 1996

1. Dar es Salaam Sewerage and Sanitation Department.
Spoken to: Mr. Mvano, head of the Low Cost Sanitation Division

The DSSD is in principle responsible for pit emptying services in Dar es Salaam. However, the Health Department has the largest fleet of emptying trucks, obtained through a grant from the Japanese Government.

DSSD also controls the dumping sites, which consist of stabilisation ponds. The present dumping charges are Tsh. 2,000 per load of $5m^3$. Policy changes are under way to increase the fees for desludging by tankers for domestic plots to Tsh. 20,000 and to Tsh. 25,000 for commercial plots, which is more in line with the actual costs.

Next to others, DSSD also operates tankers. The Health Department has 8 tankers, the harbour authorities 3 and DSSD has 3 operational tankers. Eleven other organisations have one tanker each. This brings the total number of vacuum tankers in Dar es Salaam to 25.

DSSD has established a special unit, the Low-Cost Sanitation Division which has the following

responsibilities:

- Construction of pit latrines.
- Health education.
- Provision of pit emptying services.
- Management of treatment ponds.

The Low-Cost Sanitation Division has only two employees (Mr. Mvano the head of the division and one technician, Mr. Haule). The head of the division reported that nearly all its operations, except the building of pit latrines, have come to a halt due to lack of funding. DSSD builds three different types of pit latrines, ranging in price from Tsh. 130,000 to Tsh. 200,000, which only covers the material and labour costs. Other costs are subsidised. Mostly customers are schools and government buildings. Only a few individuals are served.

There are conflicting reports about the number of people that received a 'license' from DSSD. This license is in fact more a training certificate giving evidence that the person concerned is properly trained in the operation of a MAPET unit than a real licence. The management claims that only 6 such 'licences' were given to trained pit emptiers, while the former in-charge of project monitoring claimed that after training 21 emptiers received a 'licence'. Presently there are only four teams existing.

Initially the project idea was to levy a 'lease' fee of Tsh. 12,500 for the MAPET units. After Waste Consultants insisted on making the equipment freely available during the first year of project implementation, it became very difficult to introduce this system. For this reason the DSSD decided to waive the lease completely in 1992.

One team reportedly had 60 customers in 1995, who emptied 540 loads of 200 liter each. This implies an income of 540 x Tsh. 1,300 = Tsh. 702,000. Each of the 3 team members would thus earn Tsh. 19,500 per month.

Note: These figures may be heavily underestimated. The mission observed one team emptying 15 loads from one latrine in 2.5 hours. With a price of Tsh. 1,300 per load and an additional Tsh. 3000 for digging the pit, this amounts to Tsh. 21,000 for the whole job. If the teams would have only one such a job per day, during 5 days per week, and 45 weeks per year, their income would be Tsh. 4,725,000 per annum or for each member Tsh. 131,250 per month.

Emptiers pay for maintenance and major repairs. Currently DSSD charges Tsh. 15,000 fuel costs to transport the MAPET units to the workshop and back for repair.

DSSD is apparently not keeping a record of the licenses it issues and has not undertaken any monitoring activities of the MAPET teams. The DSSD management claims that lack of means (transport, drivers, etc.) is the reason for this. DSSD is not even aware of the location of the units.

DSSD has recently calculated the present price of MAPET units and arrived at the following figures:

Piston pump	:	Tsh. 508,200
Pump cart	:	Tsh. 83,600
Tank cart	:	Tsh. 308,000

Control gauge : Tsh. 36,410

Total : Tsh. 936,210 (equivalent of US$ 1,733)

These costs exclude the labour costs and overheads. It proved impossible for the mission to analyse the precise cost of the MAPET equipment developed with the assistance of WASTE Consultants, since they did not leave any financial records behind with the DSSD. The special account opened for MAPET was closed after WASTE Consultants left.

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2. Dar es Salaam Sewerage and Sanitation Department.
Spoken to: Mr. Xavier Haule, mechanic

Mr. Haule has from the beginning been involved in the assembly, repair and maintenance of MAPET equipment in the DSSD workshop.

In 1991 4 units were assembled and another 5 units in 1992. Of these units one was brought to Morogoro, while the other 8 operated in Dar es Salaam. In January 1995 all eight units, which were in disrepair, were brought to the DSSD workshop where they were combined to 4 operational units. Four units were scrapped. At the moment of the mission, of the four units only two were operational.

Mr. Haule suggested the following improvements:
- o Change the flywheel, because it is too heavy (may be a pivot or pedal system would work better).
- o Change to relative position of the handle on the flywheel in relation to the crank of the piston rod.
- o Use better wheels and tires.
- o Find a local solution for the imported leather piston cups which now have to be imported.
- o Modify the looking glass.

Another problem is the hose pipe used for pumping. Plastic pipes wear out in 1.5 to 2 years. Better quality hoses are prohibitively expensive.

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3. Private entrepreneur
Spoken to: Mrs. Emelda Mwakifuna, former MAPET coordinator.

Mrs. Emelda was employed by WASTE Consultants till the end of the project in May/June 1993. On the request of the head of the DSSD she continued to undertake monitoring duties till the beginning of 1994 when she stopped after having failed to receive any payments from the DSSD for the period after the project stopped.

Mrs. Imelda has one MAPET unit which needs essential repairs. She would immediately buy a MAPET unit if this would be available. Her sister would also buy one.

She suggested that the specific role of the DSSD should be: to issue licenses; do the marketing of MAPET; issue identity cards and establish the credibility of pit emptiers in the areas where they work.

She also was of the view that any project design should be based on the reality that in business nobody can be trusted, not even one's relatives.

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4. Communities in Mburahati and Kigogo

Aim of the visit was to get information on knowledge about the MAPET service, appreciation of the service and alternative desludging activities. We assumed that because the MAPET is working from the CCM in Mburahati, we would get people who knew about MAPET and had experiences with it. Kigogo is situated quite near across a small stream.
Most people in Mburahati indeed knew about MAPET, but only few (2 people out of 20) had actually used the service, one of which several times - once a year- as she lives in a waterlogged area (sludge buried away in a higher area). Those were quite happy with it. Most others had not had their pits full (even those who lived there more than 10 years), or had made a new latrine when the old one was full. Also frogmen method and digging a hole next to the full pit and channel the sludge into the dug pit. It is not known that they can ask for the service at the CCM, most assume that you have to go and look for the operators. When they cannot find the operators they ask a traditional frogmen (cost depending on amount taken out, more or less Tsh. 3000). Another argument against MAPET, is that the price is not known and/or not fixed. Whenever possible, people prefer to hire a tanker (regardless of the cost) as in that case the sludge is taken away, problem is to get the tanker and to get them to come soon. The idea of burying it on plot was resented by a number of people.
Generally, it was felt that if the MAPET would be marketed better (posters and going around to get the service known) there would be a great demand, one man was even interested to buy a MAPET and run the service.

Date: 12 February 1996

1. Dar es Salaam Sewerage and Sanitation Department.
Spoken to: Mr. Simon Chale, Acting Head

Sewer charges are a function of the capacity used by commercial units and households using the sewage pipe. Typically the charge for a standard household would be Tsh. 600 per month. Sewage fees contribute for 80% to DSSD's budget.

The diameter and location of the present sewage pipes makes them unusable for sludge disposal from neighbouring unsettled areas.

DSSD has forwarded a proposal to the Dab e Salaam City Council to raise the tanker charges to Tsh. 20,000 for residential units and 25,000 for commercial units.

In spite of reports from the emptying teams that lease fees have to be paid to the DSSD the acting head has no knowledge or records of such payments at all.

The acting head of DSSD is of the opinion that DSSD should have the following tasks in the next phase of the expansion of MAPET:

- o Training of MAPET operators
- o Licensing (based on having following training).
- o Providing a final disposal system.
- o Monitor the operations of the emptying teams, particularly with respect to hygiene.

Lack of coordination between the DSSD office in Mwananyamala and the office of the Low-Cost Sanitation Division in Temeke was quoted as the cause for poor performance in the past. Also the fact that nobody in DSSD has MAPET as his or hers main responsibility has hampered operations. For this situation to change, only organisational measures are required. With respect to the bye-law that prohibits on-site sludge disposal in residential areas, DSSD feels that this bye-law should be amended to allow on-site disposal under well defined conditions.

After one week of daily visits the drawings of the MAPET equipment were finally made available to the mission.

2. Dar es Salaam Sewerage and Sanitation Department.

Spoken to:
- o **Mr. Patrick Lache, Mechanical/electrical Engineer**
- o **Mr. Xavier Haule, Mechanic.**

Both engineers were of the opinion that the design and functioning of the diaphragm pump (Leenstra pump) is by far superior to the vacuum piston pump developed by WASTE consultants (hereinafter referred to as the 'Waste pump'). The diaphragm pump has recently come to the DSSD workshop for servicing and repair of the bearrings for the first time. They were not aware of the condition of the pump in Morogoro.

Although heavier, the reliability and durability of this pump exceeds the Waste pump by far. It was believe that the diaphragm pump is more expensive than the Waste pump, but since WASTE Consultants did not share financial data with the DSSD staff, this could not be verified. The engineers considered it absolutely feasible that a modified (lighter) version of this pump could be locally manufactured. This would have the advantage that part could be standardised and spare parts would be locally available.

Asked about the history of technology development in MAPET 1, they considered it an experimental phase where new things were tried out on a trial and error basis. However, no systematic technology assessment of different options had taken place.

The Waste design is, according to them, not standardised. It also has the disadvantage that it has been made of parts which are not all available on the local market. Due to the chosen pump design, the piston cup has to be imported. The pump cylinder is made of 6" PVC pipe of which DSSD happened to have a small stock which is now exhausted. If more Waste pumps would have to be made, this part would also have to be imported.

Mr. Patrick Lache, the mechanical/electrical engineer of DSSD, inquired if he and Mr. Haule could be compensated for the time they have spend with the mission.

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3. Mapet crew in Mwananyamala

This is the crew we saw in operation on 5-2-'96 and who do a lot of emptying through DSSD. In principle, they look for their own customers, but if they do not have any, they go to DSSD to see if they can pick up some customers through them. On average they do two or three emptyings per week (since last monday they did two jobs), but it depends very much on the season. In the rainy season, they have much more customers than in the dry season. They do not market themselves at all, but get their customers through being seen in the roads or at work. They are hesitant to market themselves door to door because they say people do not want to be 'accosted' like that and they are also afraid that if they look at latrines and advise them to be emptied and if after that the health inspector comes by, the people will say that they sent the health inspector (this was how they used to work in the beginning of the project). If that happens people will not trust them any more. They would prefer to work for somebody who would do the marketing. They used to also work through the CCM branch and leave the equipment there, but they had to pay Tsh 200 per night. So now they leave the equipment at the last customer. Their area of work is wide, they push the equipment for up to 6 hours to a customer.

They pay the DSSD a lease for the equipment. We saw a bundle of receipts for '94 and '95 (last receipt for Tsh 2000 on 17-7-'95), they said they last paid in december '95. The receipts are mostly for tsh 1000, but also for Tsh 2000 and Tsh 3000, all in name of Steven Vincent.
Small repairs they do themselves - even stitching of the leather piston cup. This leather has to be renewed twice a year. Large repairs are done at DSSD by Mr. Haule, no payment required and often ready on the same day or the next day, depending how much other work Haule has.
They prefer the diaphragm pump to the piston pump as it works more effectively. The only problem is the weight of that pump and therefore difficulty in transporing it. This would be easier if there would be a separate cart for this pump.

Income earned from MAPET varies per season (Tsh 20.000 to Tsh 100.000 per month in total). They are completely dependent on this income. They work with a crew of four. Many people can only afford to have a small number of loads taken out. If they have customers near each other, they can do two emptyings per day. They cover the hole after desludging on the same day, with 2 ft of soil. If they work in an area with a high water table, they scoop out the groundwater when digging the pit. once the first sludge is out in, the groundwater does not come back.

All pits are lined and vary from 6 to 14 feet in depth. In high water table areas, many pits are raised, sometimes only 3 feet under ground. Their biggest problem in operating is not blockages, but the fact that cusomers keep changing their minds and interfere, for instance telling them to dig a pit somewhere else if they have already started digging. They would like to get clothing, boots and gloves from DSSD as the things they had are worn out.

Date: 16 February 1996.

1. Municipal Council Morogoro

Spoken to:
- **o Mrs. Elisabeth Munuo, Municipal Director**
- **o Mr. Masebu, Health Engineer**
- **o Mr. Shabani Haji, former Pit Emptier**

The municipality of Morogoro presently has no sewerage system, no tanker service and no MAPET service. Work on a sewerage system has been ongoing for the last 20 years without any

tangible result. The MAPET team was only active for 9 months, after which it ceased to function (see below). The World Bank is negotiating the participation of the Municipality in the Urban Sector Rehabilitation Project, due to take off in June 1996. The expected activities for Morogoro include the construction of roads, solid waste and sewerage. The municipality expects to get 3 trucks for cesspit emptying through this project.

Most pit emptying in Morogoro is done by *frogmen* who work only in the night because of the social-cultural inhibitions the population have against people handling sludge.

MAPET equipment was brought from Dar es Salaam and handed over to the Health Department of the Morogoro Municipal Council, where GTZ supported the introduction for about 3 months. After the German in-charge left, the municipality continued the service now and then for a period of 6 months and then abandoned the project completely. The reasons given by the Municipal Director for stopping the activity is that the introduction of the MAPET was not accompanied by awareness training of the population and the lack of cooperation of the municipal councillors for whom the MAPET equipment appears to be not prestigious enough. Another reason mentioned was lack of incentives for the emptiers and the lack of a full time responsible person within the Health Department. Health inspectors and a former frogman mentioned as reasons for failure the following:

- It is too heavy work to turn the flywheel for a long time.
- The operations of coupling and decoupling hoses and opening and closing valves was considered too cumbersome.
- The fact that two operators were needed for operating the equipment was considered a disadvantage.
- The vacuum tank developed a leak.

The booking for the MAPET service in Morogoro had to be done though the Municipal Council. Frequently health inspectors forced people to use the service on health grounds. The emptying fees in Morogoro were much lower than in Dar es Salaam. Considering the low income level of the people the Municipal Council considered subsidising justifiable. The charged per load were Tsh. 300 and, on average, 10 loads per latrine were emptied. Due to the high water table in most squatter areas in Morogoro, latrine pits need to be emptied twice a year.

The locally manufactured diaphragm pump was found to be in good condition. However, the whole unit has been laying idle because the tank started leaking. An attempt to stop the leaking by pouring tarmac in the tank failed.

A former frogmen of the Morogoro team declared that initially he was experiencing cultural or other inhibitions of the people against handling sludge. Probably because the MAPET uses equipment which resembles a machine, there were less reservations against the MAPET operators as there are against *frogmen*. The operator confirmed the high demand for MAPET services which apparently also exists in Morogoro.

2. Swisscontact

Spoken to: Mr. A.J.M. Mbugi, Co-Project Coordinator.

Swisscontact is a project meant to assist the development of micro and small enterprises in Morogoro. The project director welcomed the idea of a design and prototype competition and pledged his support for the exercise. He should be approached by the time the competition takes place so that he could mobilise potential contestants. From the enterprise files that the project maintains, the following seven enterprises appear to have the equipment, personnel and organisation required to seriously attempt to develop improved MAPET equipment:

- Intermech.
- Mshanga Enterprise Services and General Suppliers.
- John's Engineering Works Ltd.
- Singh.
- Tens Injection Pump.
- Krishana Industries.
- CAP

Since some of the enterprise have complementary skills and expertise, it may be beneficial for some of them to form join forces and to form teams.

3. Urban Sector Rehabilitation Project (World Bank)

Spoken to: o Joseph Gadek

The Urban Sector Rehabilitation Project of the World Bank is meant to improve the urban infrastructure (roads, solid and liquid waste, etc.) in 8 major towns in Tanzania: Dar es Salaam, Arusha, Moshi, Tanga, Mwanza, Iringa, Tabora and Morogoro.

The World Bank is rather sceptical about the enabling environment and the political situation in the Dar es Salaam City Council. The project intends to spend about US$ 5 million in Dar es Salaam alone through the SDP. The project has not set any specific physical targets for any of the 8 towns, but will rather base its interventions on community participation. In order to become eligible for support, each town has to submit a Sanitation Management Plan and, separately, a Sewerage Management Plan. In each town there will be at least an amount of US$ 250,000 available as seed money for sewerage activities.

Earlier the project has made attempts to find support for the introduction of the MAPET concept, but found little enthousiasm with municipal councillors. Allegedly they prefer large tanker services becausethe purchase and operation of tankers offer better opportunities to supplement incomes. The World Bank intends to finance the purchase of two tankers each for the 8 towns. However, a condition is that the tankers are leased out to the private sector.

BUSINESS ENTERPRISES VISITED

To make MAPET project attractive to business firms, Consultants made visits to 9 Business Enterprises. The purpose of the visits was to explain the MAPET project and get their views on the commercialization of the MAPET project and their interests in participation in this project. The enterprises visited were trading companies, NGO's, manufacturers and consulting firms.Below are the findings from the interviews to these enterprises.

1. **SHEFA CO. Ltd.**

This enterprise is a partnership of 5 women. According to the Managing Director of the company Ms. Susan Kisanji, the firm operates three business including; Clearing and Forwading, Cartering services (to canteens, individuals, institutions and at functions by orders). Also the company sells flower pots. The company response to MAPET project was positive. They felt that this project has come at the right time where by most of urban people are aware of sanitation. but only they lack services for improvement. But she also thought that the project operators needs to be trained and sensitize of the health hazards which they are exposing themselves through under taking such services. She expressed of her company interest in participating or taking up MAPET project as one of their businesses. She said for the time being she is unable to raise enough money to buy the MAPET equipment. The business her company are involved has good market but the competition to be awarded tenders is cut throat and not always you will be lucky to get. She therefore suggested that the MAPET project organizer to find a means for enterprises to obtain machinery under lease arrangements.

2. **MWABUKA FURNITURE MART.**

This project is owned by two people as partners. The enterprise Managing Director, Mrs.N.Ndelwa told the consultants that her enterprise is involved in Timber selling, Timber cutting and planing services and manufacturing of furniture and sales. She said though her company is in the Timber business, they can as well participate in the MAPET project. She feels that her company can manage the MAPET project well because of their experience in services rendering business to customers. She said buying of the MAPET equipment depends on actual price by then. If prices are reasonably small they can afford buying from their company funds but if the price is higher then she felt as a pilot project the MAPET project organize should provide these equipment on a lease basis.

3. **TAMECO**

This is a cooperative society owned by 300 members of which 75% are employees of the firm itself. The company manufactures knives and products of the like including Pangas, Buckets e.t.c. The company also owns a roof tile manufacturing unit. They also provide grain milling services to the surrounding households at a reasonable minimal charge. According to the chairman of this cooperative society Mr.Remigus Mbawala. they are interested to venture into the MAPET business. Their only constrain is funds to buy the equipment. He said that business is now very competitive due to the fact that trade is now liberalised and they do not hold the monopoly as they used because of the saturated imported products which they have to compete to. They expressed their concern if there will be a reliable supplier of MAPET equipment so that not to frustrate customers as well as clients when services are requested. They suggested this because of the experience of which many donor funded projects had gone through died after the donor left by completion of the contract.

4. **TEGEMEO YOUTH PROGRAMME.**

This is an association of youth who are selling newspapers in the streets. There are more than 400 youth in this business. The TEGEMEO group was established in 1993. The organizer of this group are the owners of one of the daily Swahili newspaper caled MAJIRA. This group hailed the idea of MAPET business they are ready to be employed as operators.

5. **UVIKIUTA.**

This is group of unemployed youths who formed their NGO (UVIKIUTA). It is a business

oriented NGO. They own a big land and engaged themselves in Horticulture business. The NGO is very much well organized and run their business profitably. They are interested in the MAPET business. Their capital is small, they therefore argue the MAPET project organizer to lease equipments to the enterprises as a pilot project.

6. **AMAZON SYSTEM.**

The company deals with Transportation business. They provide services to the low income people at a reasonable price. A quick observation showed that all the vehicles belonged to this small company are second bought as scrapes from the auction and the repair them and put them on the road. Therefore the conditions of their vehicles forced them to provide service within the area and it is a good relief to the residents of this Mbezi area. Main type of services provided by this firm are; carrying of building materials such as cement bags, concrete bricks, logs, fire woods, charcoal e.t.c. The company also manufacture concrete bricksand sells to building contractors. They would like to participate in the MAPET business but will need a little investment which means that a special lease and pay back by installments.

8. **SUNBIRD INTERNATIONAL.**

This is a business consulting firm which deals with the following businesses:-

1. Business consultants
2. General Trading
3. Expoters and Importers of commodities
4. Sustainable environment issues.

According to Ms. Adeline Mlay, the Managing Director of the firm, their company will be interested to venture into this business because it is also in line of what they are planning to do in future for sustainable environmental issues. She suggested that the project to start as pilot and few private enterprises to be identified, provided with loans and establish MAPET business as a trial before getting into full business.

ANNEX 6: CHECKLIST FOR PERIODICAL TECHNICAL CHECK UP

ANNEX 10: ENTERPRISE VISITS

In order to assess the general interest of potential investers in MAPET equipment, the mission visited 9 business enterprises. The purpose of the visits was to explain the MAPET project and get their views on the commercialisation of the MAPET project and their interests in participation in this project. The enterprises visited were trading companies, NGO's, manufacturers and consulting firms. Below are the findings from the interviews with these enterprises.

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ANNEX 11: BASIC PRINCIPLES OF MONITORING, EVALUATION AND RESEARCH

Monitoring

Monitoring is the routine collection, analysis, and use of information about how well the project is being implemented. In the project, a Management Information System (MIS) will be established and maintained to provide timely information that is necessary for decision making. It will serve as an early warning system, and identify problems to be solved. More in particular, the MIS will provide information:

- To assess whether the short term objectives and quantifiable expected outputs have been realised.
- To help the project management, the Dar es Salaam City Council and the Royal Netherlands Embassy to make decisions to improve the project.
- To ensure accountability to all parties with a stake in the project's outcome (DSSD, implementing NGO, participating private sector parties, the community, project staff, the embassy, and others.

The project manager will be responsible for the monitoring of the implementation process and the use of resources. He or she will write quarterly progress reports. If and when need be, he will be assisted by back-up missions. Monitoring will take place in cooperation with the DSSD, the Health Department and the SDP. Results will be regularly disseminated through meetings and workshops, in particularly for the Surface Water and Liquid Waste Working Group of the SDP.

Evaluation

Impact evaluation is the periodic assessment of the effectiveness of the project activities. A system of ongoing evaluation will be developed to measure the extent to which the medium and long term objectives have been accomplished. In particular, the impact the project is having on the sanitation in Dar es Salaam will be recorded. Also, the impact of the project activities on the profitability, sustainability and employment generation in the manufacturing and operating micro and small enterprises will be monitored.

One element of this system will be to allow SDP to undertake external evaluations to measure the impact of project activities on sanitation and health, employment generation in the sector, working condition of the pit emptiers and their income levels.

Relationship between monitoring, evaluation and research

Monitoring and impact evaluation are not distinct operations. Monitoring provides information for day-to-day management and, to a lesser extent, also for impact assessment. When an impact evaluation is called for, whether by outsiders or by staff, then the results will be more accurate and revealing when they draw on information that has been routinely collected over the history of the project.

In the project systematic information will be collected through monitoring and evaluation activities on the following aspects of development:

- Changes in sanitary conditions in unplanned areas of Dar es Salaam: less environmental pollution and diseases.
- Economic changes in the pit emptying enterprises: increased profitability and sustainability of the enterprises.
- Economic changes in the manufacturing enterprises: increased profitability and sustainability of the enterprises.
- Technological changes: increased indigenous capability to choose, adapt and innovate.
- Economic change in the community: increased access to affordable pit emptying services and more jobs.
- Social changes: individuals and groups gaining more self-confidence and control over their lives.
- Effectiveness of the project on institutional change: the emerge of new and sustainable public-private partnerships.

For instance, a pilot could be done to assess the feasibility of serving one neighbourhood at the time for a certain period with both large tankers and MAPET services. In this period, not only completely full pits should be emptied, but also preventive emptying should take place (at a reduced price), accompanied by awareness raising and social marketing " desludging campaign in area X, during weeks Y".

SDP should also be supported to undertake additional experiments with integrated sewerage services, involving partly settled and partly unsettled areas where the technological integration of tanker and MAPET services would provide the key to long term policy formulation as well as to the solution of final sludge disposal.