社会開発調査部報告書

No. 42

Japan International Cooperation Agency (JICA)
The Ministry of Public Works and Regional Planning
The Municipality of Bucharest
Romania

The Study on the Solid Waste Management System

The Study on the Solid Waste Management System for Bucharest Municipality in Romania

Final Report

Volume 7

Studies on Technical Assistance, Waste Education and Waste Bins Supply

December 1995

EX Corporation
Yachiyo Engineering Co., Ltd.

SSS
JR
95-150 (7/10)

Japan International Cooperation Agency (JICA)
The Ministry of Public Works and Regional Planning
The Municipality of Bucharest
Romania

The Study on the Solid Waste Management System for Bucharest Municipality in Romania

Final Report

Volume 7

Studies on Technical Assistance, Waste Education and Waste Bins Supply

December 1995

EX Corporation
Yachiyo Engineering Co., Ltd.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
PRIMĂRIA MUNICIPIULUI BUCUREȘTI

un loc curat este un loc mai vesel

cine păstrează curățenie este mai simpatic.

JAPAN INTERNATIONAL COOPERATION AGENCY (

Table of Contents

Chapter 5 Feasibility of Composting in Bucharest

APPENDIX

INTRODUCTION

This report contains the results of the studies on the following 5 topics:

1. Study on Technical Assistance (needed for strengthening of the Bucharest Municipality's contract management capacity and for preparing well designed waste tax system)
2. Study on Waste Education
3. Study on Waste Bin Supply
4. Information on Incinerator
5. Feasibility on Composting in Bucharest

Appendices for the above Studies 1, 2 and 3

The Study Team has carried out the above studies based on the request of the Romanian side. Those studies would serve as supplementary information for the Master Plan.

Chapter 1
Technical Assistance Studies

CHAPTER 1 TECHNICAL ASSISTANCE STUDIES

1.1 Study on Strengthening Bucharest Municipality's Contract Management and Service Monitoring Capacity

1.1.1 Introduction

Contract management and service monitoring capabilities remain largely undeveloped in the Bucharest Municipality (MB). This is not surprising since MB has had little experience of contracting out municipal services in the form of municipal service contracts.

However, MB is now poised to contract out its solid waste collection and haulage services, as well as, establishing municipal service contracts with the water Regie, RGAB, the heating Regie, RADET, and the public transport Regie, RATB. It clearly needs to develop a strong contract management capability. MB clearly recognises the need to do so and is committed to implementing arrangements which will ensure effective, efficient and economic contracting.

By contract management is meant the system of controlling and managing contracts from their inception, i.e. preparation of the contract specification, to contract completion. Good contract management will ensure that a contract is carried out efficiently and effectively, that both parties fulfil their obligations, and that it provides best Value For Money (VFM) for the MB.

For the purposes of this report contract management is also defined to include the procedures and systems to monitor the delivery of services.

1.1.2 Objective and Scope of the Study

The objective of the study is to identify and recommend what type of technical assistance (TA) MB needs in order to strengthen its contract management capability, with particular reference to contracting out SWM collection and haulage services.

The scope of the study covers MB's contract management arrangements with respect to SWM services, and the consideration of legislation which governs contracting. Proposals for legal adjustment or reform are beyond the scope of this study.

Since the inception of this study we have met with the World Bank and understand that the Bank is intending to supply TA for contract management to the Municipality. The Bank will be the implementing agency. We understand from the Bank that the TA will start this year, possibly in about 3 months time. The Bank as well as the Municipality is keen to implement the TA as soon as possible.

We understand that the scope and coverage of the Bank's TA is very similar to what we have identified and recommended. As a result we consider that providing TA under the Japanese ODA is not required since the World Bank's TA will be more than sufficient and, we understand, will be quickly implemented.

The Municipality also agrees with this and that further TA for contract management provided under Japanese ODA would be an unnecessary duplication.

1.1.3 Main Study Tasks and Outputs

1) Diagnosis

A high level diagnosis of the existing contract management arrangements was carried out to identify where technical assistance could be provided to strengthen the contract management capabilities of MB.

It is not the purpose of this study to carry out a detailed diagnosis since this would be undertaken by the consultant carrying out the TA. The diagnosis carried out was sufficient to identify where TA would be appropriate.

2) Outline of the Type of TA Required

An outline of the type of TA required was determined based on the diagnosis and identification of the deficiencies in the contract management arrangements.

3) Outputs

On the basis of the diagnosis and the type of TA required, outline TORs for prospective TA consulting services were prepared for the World Bank. These TORs are indicative only and should be used and amended by the World Bank as necessary.

1.1.4 Why is Good Contract Management Necessary?

Contracting out municipal services is an opportunity to gain from the benefits of competition and from using the private sector. Private sector involvement should be considered as a means to:

1. improve the quality of the service;
2. enhance efficiency and reduce costs ; and
3. mobilise private investment, thus expanding the resources available for capital investment.

These benefits can be achieved with good contracting arrangements which will ensure that contracts are carried out efficiently and effectively, that both parties fulfil their obligations, and that MB achieves best Value For Money (VFM) from the contractor.

In particular effective contract management will ensure that:

1. a system of effective contract control is established over the whole contracting process;
2. contract performance and quality standards are complied with;
3. documentation is properly maintained;
4. optimal VFM is assured for the Municipality;
5. there is effective control over change to the contract ;
6. problems are anticipated;
7. the Municipality's senior management is kept appropriately informed; and
8. a workable structure to resolve disputes is implemented.

MB should adopt a policy of implementing good contract management. Technical assistance should be provided to ensure that the above capabilities are developed at MB.

1.1.5 Outline Diagnosis and Assessment of MB's Current Contracting Arrangements and Identification of TA Needs

1) Introduction

The deficiencies in contracting arrangements at MB are primarily due to the Municipality's inexperience in contracting, coupled with an absence of legislation and guidance from government on how to tender and manage municipal service contracts.

As a result there is currently no framework by which the Municipality can define and formulate contract management procedures. In our discussions with MB concerning contract management, MB has stated that it needs assistance in developing contract management arrangements. It has proposed contracting arrangements which are primarily based on Law 66, 1993 and Government Decision (GD) 263, 1994, and which remain untested since it has not yet let a municipal service contract.

From our diagnosis and assessment of proposed arrangements we identified a number of areas in the contract management process which are deficient and where TA would be very beneficial.

These deficiencies are now broadly considered under each of the main stages of the contract management process and TA requirements are identified. We recommend that these deficiencies and requirements are addressed under the proposed World Bank TA which will more than adequately meet MB's needs.

To simplify the diagnosis, pre contract award and post contract award activities are separately considered. Figure 2.1-1 below shows the typical stages in the contracting process.

Before the assessment, a brief consideration of the deficiencies in the legal framework is presented. This is necessary to understand the background to the current situation.

2) Legal Deficiencies

Current legislation on contracting with state owned Commercial Enterprises (CCs) and Regie Autonomes (both national and local) is contained in Law 66, 1993 and GD 263, 1994. These laws only cover "management contracts" with CCs and Regie Autonomes.

Management contracts are agreements which are made between MB and the ***managers*** of these organisations and not with the organisations, as juridical bodies, themselves. So far no management contract has been let by MB with a CC or a Regie.

Law 66 and GD 263 fail to enable municipalities to regulate municipal service contracts under which they can contract directly with a local Regie. Furthermore Law 66 and GD 263 do not govern contracting with private companies. They are also deficient in a number of other areas.

Furthermore, other than Law 66 and GD263, there is no legislation specifically covering municipal service contracts under which MB can directly contract with an organisation.

Therefore, it appears that if MB wishes to contract with a CC or a Regie it is obliged to apply Law 66 and GD 263 with their deficiencies. If it contracts with a private sector company, e.g. a collection and haulage company, it appears to be free to decide how to contract in the absence of any legislation. However, MB has no experience of how to do this.

In the absence of robust legislation and any experience in contracting out services, MB lacks the proper framework to set contracting procedures and arrangements which will ensure that contracting is effectively and properly carried out. These arrangements should cover all the stages in the contracting process from drafting the specification to contract award and subsequent contract monitoring. MB recognises this and wishes to have TA to improve its contracting capability.

The World Bank has recently carried out an evaluation of three draft management contracts (DMCs) with RGAB, RADET and RATB respectively, which MB has recently prepared under the provisions of Law 66 and GD263.

Pre Contract Award Activities

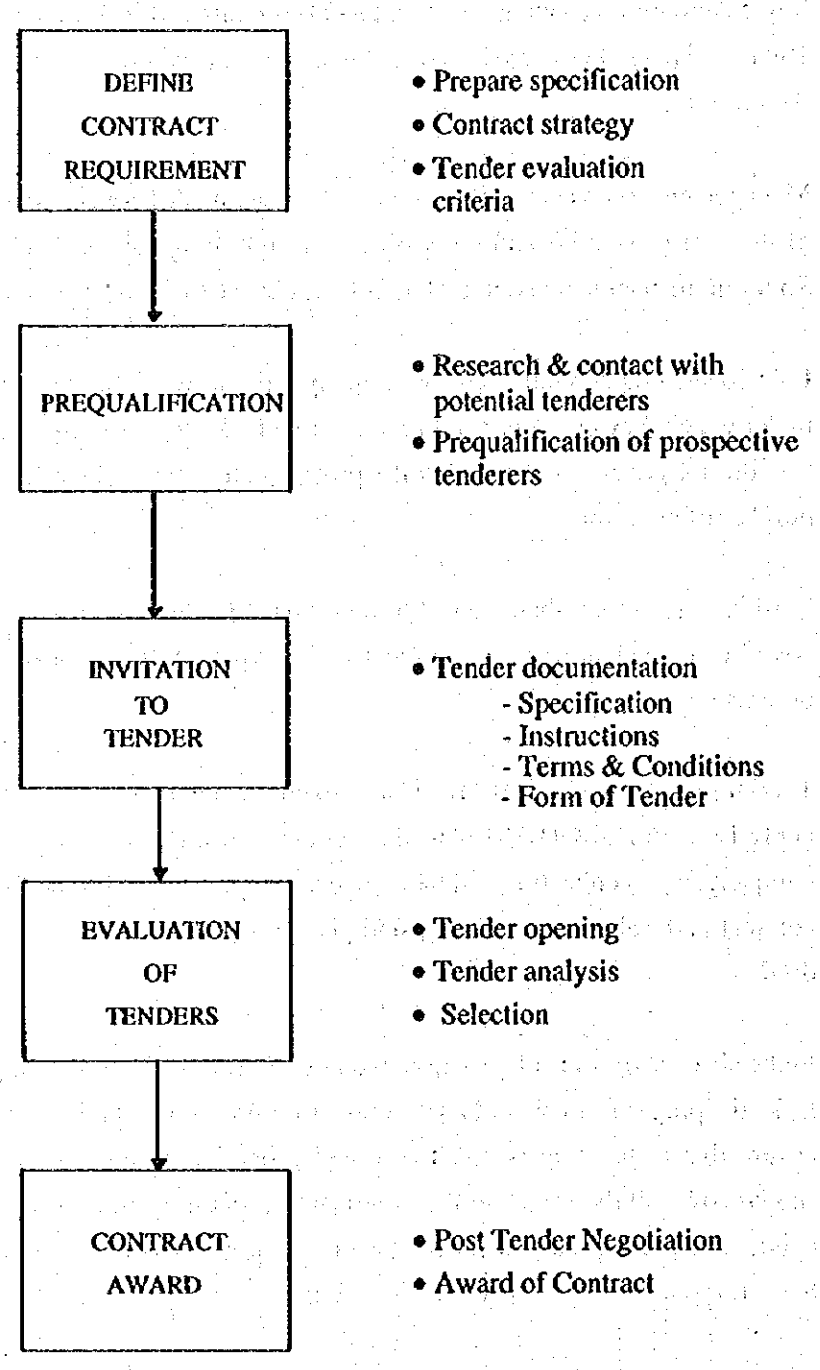


Fig. 1-1 The Contract Management Process

Post Contract Award Activities

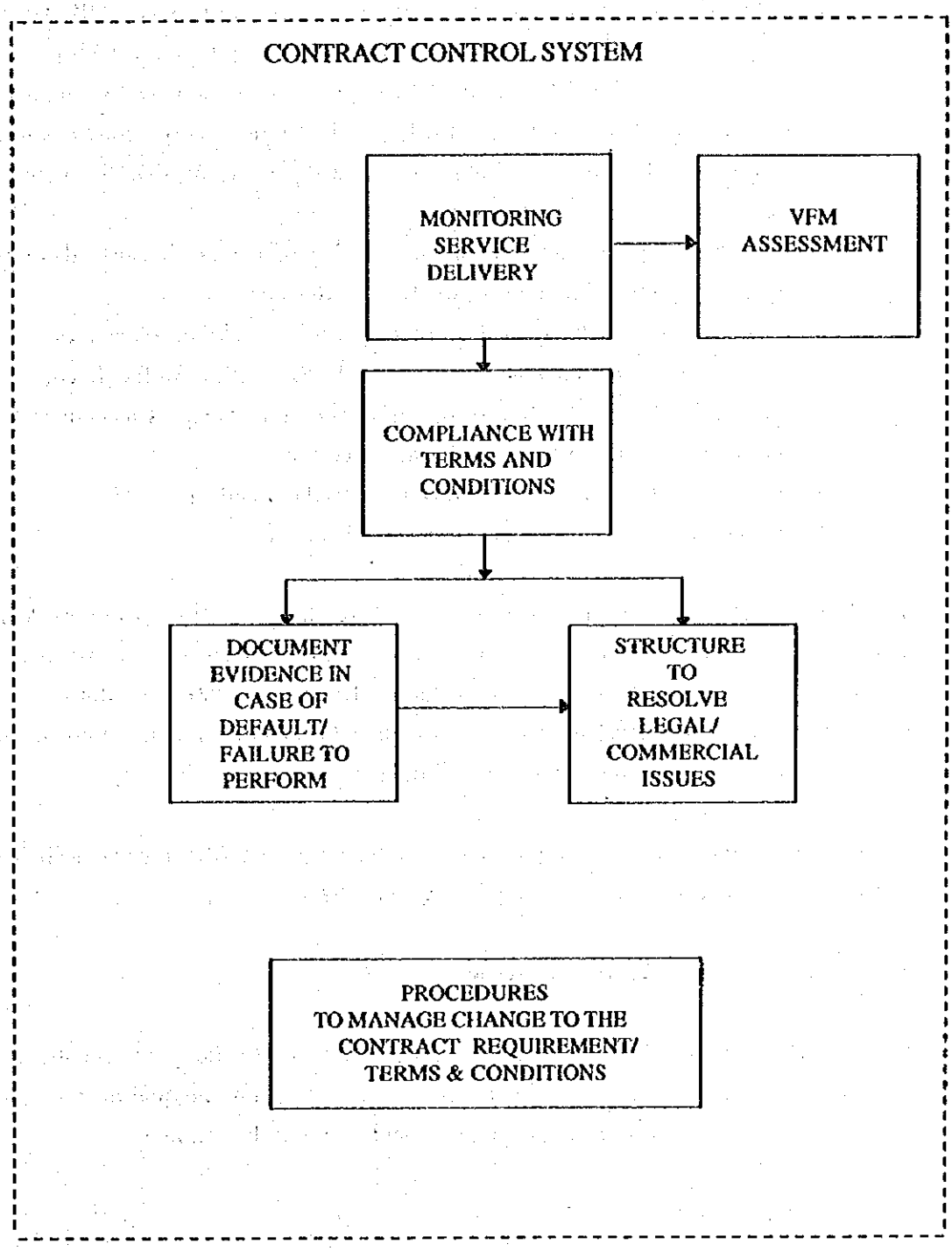


Fig. 1-1 cont.

The results of the Bank's evaluation illustrate the legal issues involved. The Bank's main findings were:

1. the DMC's are not genuine municipal service contracts between MB and the Regies since there is no direct contractual relationship between both parties. This is because Law 66 and GD263 lack the legal framework to delimit the contractual relationship between MB and the Regie, and the corresponding rights and obligations of both parties, and to ensure that the contract objectives are met;
2. there is ambiguity over who the contracting parties are because there is, e.g., ambiguity on the status of the Regie's manager;
3. the contracts are unlikely to allow managers to achieve their objectives;
4. the relationship between the manager and the Regie is not well defined;
5. Law 66 and GD263 fail to distinguish between the managers incentives and the contract's objectives and performance criteria;
6. reference and performance criteria are not well defined; and
7. procedures to measure the performance criteria are unclear.

The Bank's main conclusion is that initially there must be some form of legal adjustment to enable the MB to contract directly with a Regie under a municipal service contract. This may include expanding the scope of the existing DMCs or adjusting the Regies institutional and legal framework through a Local Government Decision, to make direct contracting with the Regies rather than the manager a possibility.

As a result of the study, the Bank has recommended that MB receive technical assistance to set up and manage municipal service contracts.

3) Pre Contract Award Activities

Pre contract activities include preparation of the contract specification, contract strategy and planning, setting evaluation criteria for tender selection, prequalification, the tendering process itself, post tender negotiation and award of the contract.

a Specification

The specification which is prepared at the initial stage of the contract process is a key document. It defines the services to be provided, the quality and performance standards and other crucial aspects of the proposed contract. It will be used in the invitation to tender and later incorporated, in its final form, in the contract.

Good contract design begins with the specification. As part of the contract design a risk analysis should be undertaken to ensure that the contract minimises risk to both MB and the contractor, e.g. that the contract duration is long enough to allow the contractor to finance his non recurrent expenditures.

Currently, MB has not fully determined these procedures and is uncertain as to what should be in the specification and how to ensure that it is completely and properly documented. Under Law 66 and GD 263 the specification is called the "File of the Offer Request" which is required to contain a number of components and which can be added to.

In particular, the specification should include well defined service outputs, the pricing structure, quality and performance standards, how the quality and performance standards are to be measured. It should also define, where appropriate, the resource inputs required and contract duration.

Our assessment indicates that MB will require assistance to define and to prepare the specification.

b Contract Strategy and Planning

MB has not proposed any arrangements for contract strategy and planning. They will need assistance to do so.

This will normally involve a plan on how the contracting process will be carried out. MB will need assistance to ensure that all the components of the planning are covered.

c Tender Evaluation Criteria

A number of criteria are specified in Art6 Law 66 for the "Management Contract". These relate to the managers qualifications only. Additionally, the Public Services Department (PSD) has itself proposed a number of selection criteria for service contracts.

From a preliminary assessment of these and from discussions with the PSD it is apparent that MB need assistance in setting appropriate criteria to evaluate tenders.

d Prequalification

Prequalification procedures for prospective tenderers for municipal service contracts are undefined. Prequalification requirements for the management contract are however defined under Art 8 of GD 263. These define the qualifications that a suitable manager must have in order to qualify for the tendering process.

It is recommended that MB should adopt and develop prequalification procedures before the tender submission. This is normal contracting practice and ensures that the Tendering Committee does not waste its time considering inappropriate tenders.

MB will need to have assistance in defining procedures for this stage. It is intended that responsibility for the prequalification stage will be the PSD's.

e Tender Documentation

Like prequalification MB needs assistance to ensure that all tender documentation is well prepared, complete and appropriate.

The invitation to tender pack should include as a minimum the:

1. instructions to tenderers;
2. specification;
3. form of the tender; and
4. contract terms and conditions.

Instructions to tenderers should cover the preparation of the tender, tender return information, important issues to be considered and guidance on how offers are to be submitted. A bidding schedule should also be included.
The tender package should also be consistent. Contract terms and conditions should be consistent with the specification.

f The Tender Evaluation and Selection Process

Under Art 3 of GD 263, the Tendering Committee (TC) for a management contract is selected by the Mayor, as the executing authority of MB, under a Mayoral decision.

However, there are no national or municipal laws or procedures which define the Tendering Committee's composition and how it is to carry out its work to award a municipal service contract.

In particular, tender analysis procedures have not been defined. These should be systematic, thorough and fair and **seen to be so.** As a minimum they should include a:

1. capability assessment;
2. technical assessment;
3. quality assessment; and
4. financial assessment.

Procedures to assess the relative costs of bids have likewise not been defined, e.g. by DCF or other means.

It is also necessary to record the reasons and rationale for the selection and rejection of tenders to ensure there is accountability and to inform senior management and other personnel involved in contract management of the decision.

g Post Tender Negotiation and Awarding of the Contract

Procedures for post tender negotiation and contract award are not defined. MB lacks experience in negotiating contracts and would benefit from some negotiation skills training under the TA.

Likewise the contract package may require better definition. Formal award of the contract should be by a properly executed contract.

4) Post Contract Activities

There should be a strong system of contract control and service monitoring to ensure that after the contract has been awarded it is executed and carried out according to its terms and conditions and to the requirements of the specification.

MB will require TA to enable it to set up a system of effective contract control, since it has little experience of how such systems work.

Preferably the system should be established before MB intends to contract out its services. It should include as a minimum:

Monitoring the service delivery. The PSD has proposed some institutional arrangements for monitoring the service. These have not been implemented and therefore remain untested. It will be the consultant's responsibility to assess these arrangements and make appropriate recommendations at the inception of the TA.

The service should be performed to the level and standard of quality which is required under the contract. A performance measurement system should be established by MB to enable it to monitor and to report on the performance of the service.

The contractor should also be made responsible to provide performance data and reports to MB as appropriate. For example, data on collection quantity and frequency, the coverage rate and the number of citizens complaints should be routinely prepared.

In this way the contractor can be made responsible for early identification of problems and to make proposals on how to resolve them. This should be supported by regular meetings between MB and the contractor to discuss progress on the contract and to anticipate and resolve problems that arise.

Monitoring is also essential to enable MB to assess whether the contract is giving Value for Money (VFM). The VFM assessment considers the balance between risk, cost, service delivery and quality. The contract should be managed to ensure that all costs are recorded, that services are delivered on a timely basis, that there is no change to the balance of risk and that quality is assured.

Monitoring for compliance with contract terms and conditions. Contract terms and conditions set out the framework of the respective parties' obligations. Monitoring them is essential to ensure that these obligations are complied with by both parties.

Terms and conditions normally cover the payment conditions, responsibilities for contract monitoring and measurement, and procedures for resolving problems concerning failure to perform, default and termination.

It is an essential part of compliance monitoring that proper documentary evidence is maintained where the contractor fails to perform or there is default. Maintaining good

documentary evidence facilitates the correction of failures to perform and enables default procedures to be effectively implemented.

A workable structure to resolve legal and commercial issues should also be implemented.

Procedures to manage change to contract requirements and terms and conditions. Procedures should be implemented to enable the contracting parties to manage any changes made to the contract specification or terms and conditions.

From time to time such needs arise and it is necessary that they are smoothly and properly handled.

Meeting contracting goals and objectives. As discussed above part of contract management is to ensure that optimal VFM is assured for the Municipality and that contracting goals and objectives are met. Senior management should be kept appropriately informed.

1.1.6 Type of TA Required

1) Objectives of the TA

The objective of supplying TA to MB is to enable MB to implement an effective contract management capability.

2) Scope of TA

The scope of the TA should cover the whole system of contract management, addressing, in turn, each of the main pre contract and post contract award activities outlined in Section 3) above.

Pre contract award will include: specification preparation, contract planning, setting tender evaluation criteria, prequalification, documentation, the tendering process itself, post tender negotiation and award of the contract. An important feature of the TA will be to advise on the most appropriate contract pricing structures.

Post contract award will include: arrangements to monitor service delivery, monitoring for compliance with contract terms and conditions, procedures to manage change to contract requirements and/or terms and conditions, and carrying out VFM assessment.

The TA would be primarily focused on the Public Services Department and also the Legal Department. Other departments would be involved as appropriate, eg, the Economics Department.

3) Outline of the Type of TA Required

It is proposed that one international contract management specialist would be responsible for providing the TA. Two or three counterparts should be selected from the PSD and the Legal Department to work with the international consultant.

The international consultant would assist MB to implement a system of contract management in two fundamental aspects:

1. setting up appropriate contract management procedures; and
2. developing MB's counterparts' (and other staff) in contract management skills.

It is not intended that the international consultant is solely responsible for the implementation of the new system. The focus of the TA will be on involving MB's staff and improving their skills.

The contract management system will be designed by the international consultant but the counterparts will be trained in the new system by being involved at each stage of its design and implementation, i.e. they will be **trained on the job.**

In particular, they will be involved in the design and preparation of the specification, contract planning, setting tender evaluation criteria, designing prequalification procedures, preparation of tender documentation, the tendering process, post tender negotiation and award of the contract.

The counterparts will also need the TA on contract pricing.

Post contract award will include arrangements to monitor service delivery, monitoring for compliance with contract terms and conditions, procedures to manage change to contract requirements and/or terms and conditions and carrying out VFM assessment.

It is also recommended that one or two seminars on specific topics could be provided by the international consultant who should invite the counterparts to identify suitable topics.

From our discussions with the World Bank it is expected that they will take a very similar approach to providing TA as outlined above and we are therefore confident that our recommendation will be implemented under the World Bank TA. The Bank will be the implementing agency and wishes to tender the TA by the end of September.

Draft Terms of Reference for technical assistance are attached in Appendix 1.1 of Chapter 1.

1.2 Study on Strengthening Bucharest Municipality's Capacity to Set and Implement a Waste Tax.

1.2.1 Introduction

The financing of municipal solid waste services in Bucharest, particularly capital investment, has been greatly constrained for a number of years. As a result, the opportunity for the Municipality of Bucharest (MB) and for RASUB, as the major service provider, to improve the quality of SWM services to the citizens of Bucharest has been limited.

Under Law 15 and Law 69 the Law of Public Administration MB is primarily responsible SWM and for financing SWM capex. However MB has been unable to invest at the required level because its fiscal and non fiscal revenue base is severely constrained. This is because MB lacks the financial autonomy to set its taxes and fees (with the exception of those set under Law 27, 1994) and to approve its expenditures.

Likewise, RASUB is unable to finance capex from its tariff revenues because its tariffs are set too low and it has been unable to raise them to the required level. The opportunity for RASUB to finance capex from bank credits has also been constrained because of the difficulty of obtaining loans and the high financing costs which are caused by hyperinflation. The financing of operating expenditures by RASUB has been similarly constrained.

The Municipality has considered how to improve the financing of SWM as part of its institutional and financial restructuring of SWM services. It intends that the financial restructuring involves the introduction of a waste tax which the Municipality is empowered to levy the tax under Law 27, 1994.

MB needs to set and implement these taxes at levels at which it can properly finance SWM services. MB clearly recognises the need to do so and is committed to implementing a tax which will ensure effective, efficient and economic financing of SWM services.

1.2.2 Objective and Scope of the Study

There are two main objectives to the study. These are to:

1. propose an outline policy that the Municipality should adopt towards the waste tax; and
2. identify and recommend what type of technical assistance (TA) the Municipality needs to assist it to set and implement a waste tax, which will ensure cost recovery, and to optimise the collection of the proposed tax.

The scope of the study covers MB's proposed arrangements for the introduction of a waste tax including the method of setting the tax and the arrangements for its collection.

Since the inception of this study we have met with the World Bank and understand that the Bank is intending to supply TA for strengthening the Municipality's contracting capability. The Bank will be the implementing agency. We understand from the Bank that the TA will start this year, possibly in about 3 months time. The Bank as well as the Municipality is keen to implement this TA as soon as possible.

We have discussed the TA we have proposed for the waste tax with the World Bank. The Bank is keen to include the waste tax TA with the TA it is proposing to provide to the Municipality. As a result, we consider that providing the waste tax TA under the Japanese ODA is not required since the World Bank's TA will be more than sufficient and, we understand, will be quickly implemented. The Municipality agrees with this position.

1.2.3 Main Study Tasks and Outputs

1) Evaluation of MB's Proposed Arrangements for the Waste Tax

A high level diagnosis and assessment of the proposed arrangements for setting and implementing the waste tax is carried out.

It is not the purpose of this study to carry out a detailed diagnosis since this would be undertaken by the consultant carrying out the TA. The diagnosis carried out was sufficient to identify where TA would be appropriate.

2) Waste Tax Policy

Based on the evaluation of the proposed arrangements and MB's SWM financing needs, an outline policy for the waste tax is proposed.

3) Type of TA Required

An outline of the type and amount of TA required is determined based on the diagnosis and the identified deficiencies in the proposed arrangements for setting the waste tax.

4) Outputs

On the basis of the diagnosis and the type of TA required, outline TORs for prospective TA consulting services were prepared for the World Bank. These TORs are indicative only and should be used and amended by the World Bank as necessary.

1.2.4 Evaluation of MB's Proposed Arrangements for Introducing a Waste Tax

1) Why is a Waste Tax Necessary?

Why is the Municipality introducing a waste tax? And should it do so?

The Municipality is introducing the waste tax as part of its institutional and financial restructuring of municipal solid waste services under which RASUB and RGR will cease to collect tariffs and will be remunerated under fixed price contracts financed from the new tax.

There are two principle reasons why the Municipality is introducing a waste tax:

Firstly, it is not normal practice for municipal contractors who only provide services to levy their own tariffs. Instead it is usual for municipalities to remunerate contractors under fixed price performance contracts and to bear the financial risks of revenue collection themselves. Lump sum contracts are easier to set up and negotiate, and give the Municipality more financial control over contractors.

Sometimes quantity based, rather than fixed price contracts, are used to incentivise contractors to increase the amount collected and the coverage of the collection. To

ensure that this type of contract is properly controlled and not abused by the contractor, it is vital to implement procedures which accurately measure and inspect waste quantities. Without these controls this type of contract is risky.

Where contracts cover capital investment in facilities, eg under concessions or franchises, it is usual for the contractor to bear more of the financial risk and to collect revenues. However, collection and haulage contracts do not involve investment in facilities and should be let under performance price contracts.

Secondly, MB cannot finance SWM services from general taxation because its general tax base is too small. Introducing a waste tax enables MB to broaden its fiscal revenue base and to finance SWM services without affecting the financing of its other public services from general taxation. MB therefore has no alternative but to implement the waste tax under Law 27, 1994, the Law on Local Taxes.

The reason that MB's is financially constrained is because it lacks financial autonomy. Under the current legal framework, Law 69, 1991, The Law on Public Administration, theoretically gives local government complete financial autonomy. But this is constrained by Law 10, 1991 the Law on Public Finances, which defines the fiscal responsibilities of local and central government for establishing taxes and expenditure budgets.

Municipalities cannot change their local taxes and fees (except those levied under Law 27, 1994) without approval from the MoF, which is exercising strict fiscal control over local government. In part, this is due to the difficulties of economic transition.

In practice, therefore, the MoF maintains absolute control over local governments financing and expenditure by approving and modifying local councils' budgets, establishing local taxes and fees, collecting these taxes, and controlling the timing of disbursements to them.

2) Proposed Arrangements for Setting and Implementing the Waste Tax

The Municipality proposes to introduce a household waste tax and a business waste tax under a Local Government Decision. Both are per capita taxes. The household tax will be levied on the number of household occupants and the business tax will be levied on the number of employees. The Municipality intends that the per capita business tax will be set at the same amount as the per capita household tax.

The Municipality is introducing the tax as part of its institutional and financial restructuring of municipal solid waste services. It is intended that the current service providers, RASUB (collection and disposal) and RGR (collection) will no longer collect tariffs but instead will be remunerated under fixed price municipal service contracts. It is also proposed that street sweeping, currently provided by the ADP's and financed out of general taxation, will be remunerated in the same way.

Under the proposed institutional restructuring, the Municipality is required to close down RASUB under GoR Ordnance No 69, and intends to split RASUB's collection and disposal activities. RASUB's collection services will be provided by a new commercial enterprise (CC). It is intended that disposal will subsumed as an Administration under the Municipality.

Until this happens, the Municipality intends to contract with RASUB to provide collection and disposal services, and also street sweeping, which will be transferred to RASUB from the ADPs. MB subsequently intends to separately contract out street sweeping from collection and haulage when conditions are appropriate.

However, it appears that MB is still uncertain of how to set the waste tax for a number of reasons.

Firstly, MB needs to formulate a SWM financing policy and to develop a financing strategy which will enable it to significantly improve financing of SWM services.

Secondly, MB has not carried out any financial modelling of waste tax revenues and costs to ascertain the level at which waste taxes need to be set to ensure full cost recovery. In part this is due to the MB's inexperience of financial modelling.

Thirdly, a clear policy on cost recovery has not been established. Although it is the Municipality's objective to recover all SWM costs, MB appears to be uncertain of the level at which costs will be recovered.

MB's objective is to recover all the operating costs of collection, street sweeping and disposal, as well as, the capital costs of collection and street sweeping. Initially it considers full cost recovery will not be possible because the waste tax would have to be set at a level much higher than the current waste tariffs. Furthermore, it is unsure of whether capital costs of disposal should ultimately be recovered.

Fourthly, it appears that MB hasn't considered the different types of tax structures in enough detail, particularly for business.

For businesses there is some scope for relating the tax charge to the cost of disposal, e.g. by the weight or volume of waste produced. But it is important to avoid charges that give an incentive for illegal dumping - this limits both the level of cross-subsidy from business to households.

For households it is usual to levy a lump-sum charge, whose level does not depend on the amount of waste produced. Lump sum taxes are economically efficient but inequitable. Charges can be differentiated, e.g. by type of premises (e.g. charging more for individual houses than for apartments) to improve the equity of the charge. However, the level and quality of the collection and haulage service provided should remain the same regardless of the recipient's charging status.

Fifthly, MB has not considered the affordability of the waste tax by citizens and businesses, except in the broadest terms. It has however carried out a household survey whose results indicate that householders are willing to pay a higher tariff but on the condition of service improvements.

The affordability of the tax must be assessed when setting the tax.

Lastly, the procedures and the responsibility for collecting the tax have not been established. The options are:

1. MB itself collects it;
2. MoF collects it on the Municipality's behalf, through its local Territorial Finance Administration (TFA); and
3. the tax is co-collected, e.g., by another utility.

The frequency of collection is still undecided; it may possibly be set once per year.

It appears that option three is unworkable because under the Law a utility (or collection agency) can only collect first time payments but not outstanding debtors. Only state institutions are currently allowed to collect tax debtors (citizens or businesses).

The Municipality would prefer that the local Territorial Finance Administration (TFA) collect the tax for a fee which would cover the TFA's administration costs. The

problem is that the TFA has refused to collect the tax. Under the Law (Law 10) it appears that the TFA is responsible to collect all taxes, although there is some ambiguity in the law.

MB thinks that this issue will be resolved in negotiations with the TFA and that offering the TFA a collection fee will resolve the deadlock. If the MoF ultimately refuses to collect the tax MB will assume responsibility.

The above issues highlight the need for providing TA to MB. The type of TA required is presented in 1.2.6 below. Before considering this an outline of the waste tax policy is presented below.

1.2.5 Policy for the Waste Tax

MB's SWM policy for the waste tax should, as a minimum, contain the following:

1. the overriding objective of implementing the tax is to make SWM financially viable. The tax is not intended to change the behaviour of households or businesses and have them reduce the amount of waste they produce (e.g. through increased recycling);
2. SWM costs are recovered from the waste tax. As a minimum, all operating costs for collection and haulage, disposal and street sweeping must be recovered. This includes the costs of amortisation of plant and equipment, eg collection trucks.
   If the tax is affordable MB should consider setting the tax at a level which partially or wholly covers these costs.
3. Contractors who provide SWM services, eg collection and haulage, are remunerated so that they can finance both their operations and, more importantly, their investment in equipment
4. Where it is feasible, capital costs, primarily those of building landfill sites, should also be recovered in whole or in part. If it is not feasible, investment should be financed from loans or other means. Financing costs of loans should be fully recovered from the waste tax.
5. Household and business waste taxes are structured which optimise revenues and which are socially equitable.
6. The waste taxes are set with due consideration to the affordability of citizens and businesses, as well as, to their willingness to pay.
7. Procedures for the collection of the tax should be implemented which ensure a good rate of collection.

1.2.6 Type of TA Required

1) Objectives of the TA

The objective of supplying technical assistance to the Municipality of Bucharest is to assist it to set and implement a waste tax which will finance its municipal solid waste services.

An overriding objective of the TA should be to ensure that the waste tax is set at a level which is not only affordable but also will enable full cost recovery.

2) Scope of TA

The scope of the TA should cover the methods of setting and implementing the tax which will ensure full cost recovery, and also consider ways to optimise the collection of the proposed tax.

The TA would be primarily focused on the Public Services Department and the Economics Department.

3) Outline of the Type of TA Required

It is proposed that one international consultant would be responsible for providing the TA. Counterparts would be selected from the Public Services Department and the Economics Department to work with the international consultant in the design and implementation of the tax.

The focus of the TA should be to involve the Municipality's staff and to develop their skills. The counterparts would be involved at each stage of setting and implementing the waste tax, i.e. they are trained on the job.

The international consultant will carry out a number of tasks with the cooperation of the counterparts. These are to:

1. evaluate the Municipality's proposals for introducing the waste tax and relevant fiscal legislation;
2. formulate appropriate tax structures for the household waste tax and the business waste tax;
3. formulate an appropriate level of the cost recovery;
4. financially model, including forecasts, the waste tax to ascertain the level which will assure full cost recovery. The waste taxes should then be set taking households' and businesses' affordability and willingness to pay into consideration. Ways to index the tax should also be considered; and
5. assist the Municipality to prepare an implementation plan.

The improvement of tax collection should include:

1. recommending an appropriate method of collecting the waste tax so as to improve the rate of collection; and
2. considering the sanctions available for non payment.

The work of the consultant will be coordinated by the Department of Economics and the Department of Public Services at the Municipality, and its results jointly reviewed and evaluated by the World Bank and the Municipality, as well as any other concerned Romanian authority.

Draft Terms of Reference for technical assistance are attached in Appendix 1.2 of Chapter 1.

Chapter 2
Study on Waste Education

CHAPTER 2 STUDY ON WASTE EDUCATION

2.1 Necessity and Objective of Waste Education

2.1.1 Necessity of Waste Education

The Bucharest citizens are not well informed of the waste management and environmental sanitation. Some citizens do not know, or are not interested in how their waste is collected and disposed of, and are not very cooperative in the waste management. Some citizens do not know how they can be cooperative. It seems that lack of the citizens' understanding on the subjects is a reason for this situation.

Therefore, waste education for the citizens should be promoted. For adult citizens, a primary measure is information campaign by the municipality through media. For school children, waste education at school will be effective. The Bucharest Municipality should play a leading role in the campaign and waste education.

2.1.2 Objective of Waste Education

Considering the current waste problems in Bucharest, the objective of the waste education is proposed as follows:

1. Improvement of waste discharging manner
2. Prevention of illegal waste disposal
3. Promotion of the citizens' participation in the recycling activities

Final purpose of this waste education is to improve the sanitary and aesthetic conditions of Bucharest by enhancing the citizens' cooperation.

2.2 Contents of Waste Education

The Bucharest Municipality should carry out the following activities:

1. To develop citizens' correct understanding on waste management
2. To enhance the awareness of waste management and public cleansing
3. To activate citizens' cooperation

These actions can be generalized into the following three steps.

1. Dissemination of information
2. Strengthening of awareness
3. Model cooperative actions

Detailed contents of each actions are mentioned in the following sections.

1) Dissemination of Information

Dissemination of relevant information is a base for inducing the citizens' understanding. The citizens should be provided with the following basic information:

1. Every citizen is a waste generator.
2. Effort by both the municipality and the citizens is indispensable for proper waste management.
3. Waste problems can be solved if appropriate system is applied.

In addition, specific information covering the following topics, for example, should be provided:

- Who collects the waste, how and where he disposes of it?
- What is proper method for waste disposal - sanitary landfill, for example
- Current situation of Glina landfill site
- What is good for recycling? Where shall we bring them?
- Advantages of recycling such as material and energy saving

2) Strengthening of Citizens' Awareness

Strengthening of the citizens' awareness is aimed at the strengthening of the citizens' sense of responsibility for keeping the city clean and sanitary. Messages to be presented include the following:

1. Every citizen has a responsibility of waste management because everyone is a waste generator.
2. Compliance with the relevant rules is the duty of a citizens as a society member.
3. Importance of citizens' cooperation to keep the clean and sanitary.

3) Model Actions for Cooperation

Model actions for cooperation is very important for the waste education. The Bucharest Municipality should study the citizens' current activities before it select the model actions. The model actions should be clearly described, and must be ones that can possibly be accomplished by the citizens. If the municipality propose impossible actions, the citizens do not take it seriously. There are certain arrangements which the

municipality should make before asking the citizens for specific cooperation. For example, when the municipality plans to collect used aluminum cans for recycling by collection boxes installed on streets, but if sufficient number of boxes are not installed, the citizens will not know where they shall bring used cans and they might leave these cans on the street.

Models of actions selected according to the municipality's objective are proposed as follows:

1. Improvement of waste discharging manner
   - Put the waste into waste bins properly
   - Prevention of littering waste at public places
   - Proper use of dust chutes
2. Prevention of illegal disposal
   - Prevention of leaving waste illegally in vacant areas
3. Promotion of citizens' participation in the recycling activity
   - Bring the following recyclable wastes to REMAT collection points
     Papers such as newspapers, magazines and books, textile, glass bottles, steel cans and aluminum cans
   - Return glass bottles of mineral water and beer which can be reused by refilling the contents to the shops

2.3 Proposed Measures of Waste Education

After clarifying the objective and contents, the municipality have to present its messages to the citizens effectively. Suitable measures for effective presentation should be selected with consideration of the following points:

what - what messages should be presented
to whom - to which type of citizens and which age group should be targeted
how - what kind of method or media should be used

2.3.1 Campaign for the Citizens

Possible campaign include the following:

(1) Dissemination of information by media such as papers, posters, radio and television

(2) Seminar concerning waste management

(3) Study tour of waste disposal site

(4) Best poster contest on waste management and recycling

(5) Contests of handicrafts contest made of recyclable waste material

(6) Occasional exhibition of information on waste and recycling in public space

Information campaign through media is a primary measure of public relations by the municipality. Papers, posters. radio and television are the typical media for public relations. It is recommendable to issue papers periodically. Posters, radio and television can be utilized for the campaign.

Study tour of waste disposal site, best poster contest on waste management and recycling and contests of handicrafts made of recyclable waste material can be incorporated into school education.

Establishment of a information center on waste and recycling, as seen in some Japanese cities, would be too early for Bucharest. Occasional exhibition of information on waste and recycling in public space should be considered.

2.3.2 Opportunity of Waste Education in School

1) Current Environmental Education in Romania

In Romania, reform of education is now in progress, and ecology education program has just been introduced to the school education, but waste education is not clearly proposed. It is desirable that waste education program is also introduced to the school education as a part of environmental education. The waste education will be effective if it is linked to sanitary, scientific and social education in school.

Although introduction of waste education to the school education curriculum will be discussed by the Ministry of Education, presentation of current problem and the necessity of waste education by the municipality is important to start the discussion.

2) Opportunity of Waste Education in Each School

In Bucharest a waste education program can also be introduced to school education by each school's discretion. School teachers prepare yearly schedule of school hours for each class room which they are in charge of, and prepare a detailed schedule once every three months. In this schedule, one unit of school hour per week can be used at the

teacher's discretion, for social education in a local context. Waste education program can be introduced by using this school hour. However, the problem is a shortage of waste education material. Good text books should be prepared. In the pilot study by JICA, a video movie on waste management and recycling was produced and this will be used in primary schools in Bucharest under supervision of Inspector Office of Education in Bucharest which is a local delegation of the Ministry of Education.

3) Promotion of Waste Education in School Education

To introduce waste education program to school education, national curriculum should be reviewed and revised by the Ministry of Education, and the new National Education Guidelines covering the waste education should be provided, since teachers prepare the schedule of school classes along with this Guidelines of Education. Training of teachers concerning waste education method should also be implemented.

Preparation of some waste education material is an immediate issue. Text book, color slides or video movies should be prepared as supplementary material for the waste education. Not only theoretical education but also practical one is desirable in waste education in school.

2.4 Proposed Actions of the Municipality

(1) Establishment of the Public Relations Division

Municipality's public relations activities should be strengthened. It is recommendable to establish a division in charge of public relation (PR) on waste. The division will prepare basic plans for public relations, examine and select suitable measures, and implement them. Major tasks of the division are as follows:

- To prepare waste education plan and strategy for implementation
- To establish distribution system of municipality's PR papers
- To answer the citizens' questions on waste management
- To prepare material for PR such as papers, posters, radio and TV program
- To organize seminars and study tours on waste management
- To plan and arrange contests of posters on waste management
- To plan and arrange contests of handicrafts made of waste

(2) Municipality's Involvement in School Education

Although the municipality has no direct authority on the school education, the municipality can promote waste education in schools through discussion with the Inspector office of Education. This is an efficient way since the Inspector office supervises education programs of all the school in Bucharest. The municipality should present the current problems, necessity and objective of waste education. Points to be discussed between the municipality and the Inspector Office include the following:

- Target grades of waste education
- Composition of the waste education program in schools
- Selection of waste education material
- Messages to be presented in the material

It is recommendable for the municipality to prepare supplemental materials under close cooperation with the Inspector Office. The municipality should send some staff to schools for delivering lecturers, if necessary.

A study tour to some waste management facilities is another good measure of waste education for children. The children will get familiar with the facilities. The tour may be a good opportunity for the municipality as well to make children understand the municipality's activities.

Chapter 3
Study on Waste Bin Supply

CHAPTER 3 STUDY ON WASTE BIN SUPPLY

3.1 Introduction

Over the last few years there has been an acute lack of supply of waste bins to the citizens of Bucharest. This is a result of RASUB, which was the monopoly bin manufacturer and supplier to Bucharest, almost entirely ceasing its production of bins.

Currently, however, RASUB has been able to purchase bins from a small number of suppliers and sell them to citizens. This has temporarily alleviated the shortage. Therefore, it appears that, at the current time, there is no serious shortage of the supply of bins to the Bucharest's citizens.

However, although supply is currently not an issue, there is an issue over the type and size of bins that should be used. Most citizens, with the exception of those in Sector 6, use 110 liter capacity metal bins. This type of bin is not suitable for the efficient collection of municipal waste.

The Study Team's analysis of the required bin specification for Bucharest, which is given in Section 4.4 below, recommends that plastic 240 liter bins for appartments and plastic 120 liter bins for houses, are the most appropriate bins for Bucharest.

RGR has clearly demonstrated this in Sector 6, where it has successfully supplied 240 liter and 120 liter imported bins to Sector 6 citizens at affordable prices. This has significantly contributed to the efficiency of RGR's collection service.

3.2 Objective and Scope of the Study

The objective of the study is to identify the most effective and economic method of supplying the recommended plastic 240 liter and 120 liter waste bins to the citizens of Bucharest. The period which the study is considering is 10 years.

The scope of the study covers:

1. all the citizens and businesses of Bucharest;
2. the recommended bin specification;
3. the demand for bins;
4. the alternative methods of supply; and
5. the institutional responsibility for supply.

An important issue which the study addresses is the contracting out of collection and haulage services in the city, and how this will affect the supply and demand for bins. For the purposes of this study it has been assumed that the collection and haulage services of Sectors 1 to 5 will be contracted out. This is clearly MB's intention.

It is not the intention of the study to carry out a detailed analysis of alternative methods of supply. The study is a broad consideration of alternative options. In particular, it is not intended to carry out a feasibility study of the bin manufacturing option which is considered in section 4.8 below. The feasibility of this option was assessed in very broad terms. Cost estimates were not prepared but obtained from, e.g. RASUB and RGR.

3.3 Main Study Tasks and Outputs

The main study tasks are to:

1. prepare a bin specification for a Bucharest;
2. prepare a bin demand analysis for Bucharest;
3. formulate options for the supply of bins;
4. select criteria to evaluate the options;
5. prepare cost analyses for each option;
6. evaluate the bin supply options and select the preferred option; and
7. prepare an action plan for next steps.

The bin specifications and bin demand is firstly considered before considering the supply option.

3.4 Recommended Bin Specification for Bucharest

3.4.1 Types of Bins Currently Used

Waste bins used in Bucharest have different characteristics reflecting the various collection systems applied by either RASUB or RGR, which are the major service providers of waste collection and haulage in Bucharest. They provide various kinds of waste bins and containers to municipal waste generators by selling or renting them out.

Table 3.4-1 Types of Bins by Collection Service Provider

As of June 1995

Provider	Capacity of Bin (liter)	Material and Configuration	Age	Number of Unit distributed	Distributed by
RASUB	240	plastic bin	used	1,130	sell out
	110	metal bin	new	180,404	sell out
	4,000	metal container	new	829	rent out
RGR	240	plastic bin	used	16,700	sell out
	120	plastic bin	used	1,700	sell out
	240	plastic bin	new	(?)	sell out
	1,100	metal container	new	175	sell out
	4,000	metal container	new	17	rent out
	7,000	metal container	new	13	rent out
Total capacity(m^3)				4,423m^3	

The whole capacity of containers in Bucharest is approximately 13% of the capacity of all waste bins and containers and mostly receives commercial waste. In addition, these metal containers can be sufficiently produced in Romania. Therefore, the analysis and evaluation of the metal container are eliminated from the scope of bin supply study.

3.4.2 Recommended Specification of Bins

From the citizens' view point, the important factors for selection of waste bins are:

1. Low cost
2. Longer life span
3. Collection efficiency
4. Security of supply

1) Life Span

Plastic waste bins were introduced for the first time in 1994 in Bucharest. Therefore no certain proof of their life span has been got yet in terms of real history. German bin manufacturer says the life span of new bins is 6 to 8 years in proper use, and the renewal period of bins is 4 to 5 years in Germany. Accordingly, the used(second hand) bins will be sustainable for 4 years at maximum. Both RASUB and RGR estimate the life span of used bins as 4 to 5 years likewise.

However, bin importers will be able to select better quality used bins and therefore it is reasonable to assume that the bin life will be 5 years. As to new 110 liter metal bins, the life span is 8 years with repair.

RGR has provided 17,710 bins since January 1994 until now. Among them 230 bins (1.3%) were burned, crushed, and wheels broken to become useless. While RASUB repaired 9,740 metal bins (5.4% of all distributed bins) in 1994. A metal bin is easier to be broken, particularly at the bottom, than a plastic bin because of its difficulty of handling. Even though the life span of a metal bin is 8 years, which does not mean the advantages of a metal bin.

2) Cost

The new bins' retail prices are 119 DM for a 240 liter bin, and 89 DM for a 120 liter bin in Germany. The imported used bins' prices vary due to fluctuations in foreign exchange rates. RASUB and RGR sell them in the range of 45,000 lei to 50,000 lei per piece so far, and there is few difference between 240 liter bins and 120 liter ones. As to new metal (galvanised) 110 liter bins, the price is about 49,000 lei, and it is definitively higher than a plastic bin when comparing capacity by price.

According to RASUB, citizens can afford 60,000 lei at maximum for the cost of a bin irrespectively of a new bin or used one. Likewise, the samples of citizens opinion collected by the JICA Study Team show their willingness to pay for a bin must be not higher than now.

3) Collection Efficiency

Collection efficiency is defined as "time efficiency" and "cost efficiency".

1. Time to collect and to haul a certain quantity of waste (Unit: minutes/ton)
2. Cost to collect and to haul a certain quantity of waste (Unit: lei(US$)/ton)

Cost efficiency includes all the cost that a type of collection and haulage system is operated, e.g. depreciation cost of truck, maintenance cost, fuel cost, salary, overhead, bin cost, etc. The ratio of bin cost to all the cost ranges from 8% to 10% among the systems. Depreciation cost and salary are major portions of all the cost. Roughly calculating, if the bin cost increase 4 times higher, the collection efficiency becomes only 1.4 times lower. Therefore cost efficiency is not sensitive to bin costs.

Time efficiency depends on loading time which also depends on easiness to carry bins, and loading system(mechanical or manual). A 240 liter plastic bin is lighter than a 110 liter metal one. In addition, plastic bins are with caster of wheels but metal ones aren't, and some of which are loaded on a truck by manual handling. Thus, plastic bins can be much more easily and fast carried and loaded.

4) Constancy and Adequacy of Supply

It is a certain concern for citizens whether they can replace a damaged waste bin with an undamaged one as their necessity. According to RGR it was easy to replace 230 damaged bins during the past one and half years through an import agent.

Meanwhile RASUB sold 7,495 new metal bins and repaired 9,740 used ones in 1994. According to RASUB, metal bins supply is comparably constant to plastic bins of which supply is lower than demand because metal bins are produced in Romania while plastic bins are imported through an agent. This difference is supposed to happen due to the agents' ability, because the resources of plastic bins for RGR and RASUB are the same as German abandoned ones so far.

However, to realise constancy and adequacy of bin supply from the long time view point, it is necessary to consider that multiple sources of bins including domestic production may be required. The specification of bins based on current condition is given in Table 3.4-2 below.

Table 3.4-2 Specification by Type of Bin

Type of Bin	Collection Cost** (1) (lei/ton)	Loading Efficiency (2) (minutes/ton)	Price to citizen (3) (lei/bin)	Assumed Life (4) (year)
a) German used 240 liter plastic	20,705	10.0	50,000****	5
b) German new 240 liter plastic	24,677	10.0	170,000	8
c) German used 120 liter plastic	23,969	19.0	50,000****	5
d) German new 120 liter plastic	28,328	19.0	127,200	8
e) Romanian new 110 liter metal*	26,600	27.7***	49,218	8

Note * : "110 liter metal" is galvanized bin without caster.
**: Whole the cost on collection and haulage (including depreciation of truck and bin, maintenance cost, overhead and so on) to total collected waste amount per year
***: 27.7 minutes/ton is by mechanical loading, 30.7 minutes/ton is by manual loading.
****: " 50,000 lei" is set for ithe three times installment.

3.4.3 Recommended Types of Bins

Based on the criteria in this section, it is proposed that a 240 liter plastic bin for apartment building dwellers, and 120 liter plastic bin for individual houses dwellers is more suitable respectively. The major reasons of the recommendation are as follows.

Used plastic bin's price is almost same as new metal one, and the former has more advantages than the later in every criteria ie on price, loading efficiency and collection cost.

1. A 240 liter plastic bin has two times or more than of capacity as a 120 liter bin and 110 liter bin. So this type must be used by the apartment houses dwellers. Consequently apartment houses can save number of waste bins and the space for bins realising more efficient collection.

2. About 16% of the citizens live in individual houses in Bucharest with 3.53 family members. It is estimated that a family dwelling in an individual house generates the about 50 to 60 liter of waste per week. Theoretically two families can share one 120 liter bin, however it is not realistic way and it is better that one family share one 120 liter bin. It is estimated that one 120 liter is sufficient for one house with 7 occupants[1].

As an additional recommendation, it is better to supply imported used bins from the price view point. Since a new bin's price is more than three times higher as a used one, a new bin needs not to be introduced for ordinary dwellers for a certain while. Nevertheless this should not preclude citizens from buying new bins, nor deny the possibility of an investor setting up a bin manufacturing plant in Romania. *

3.5 Demand for Waste Bins in Bucharest

Bin demand was estimated for the following 2 cases:

Case 1 (recommended):

Case 1 is based on the recommended bin specification for Bucharest, i.e. both 240 liter bins and 120 liter bins are used. 240 liter bins are used for apartment building dwellers and commercial establishments (excluding markets and industrial factories that use large containers). 120 liter bins are used by those living in individual houses.

Case 2 (not recommended)

Only 120 liter bins are used by both households and commercial establishments (excluding markets and industrial factories that use large containers).

Case 1 is recommended because a waste collection system with 240 liter bins is more efficient than a system with 120 liter bins, as shown in Section 4.4 above, assuming that bins are utilised to their full capacity. One 240 liter bin can be utilised to its full

---

* Note [1]

Assuming that 1) each person generates 2 liter waste per day on average, 2) variation factor is 1.2, and 3) waste is collected once a week, one 120 liter bin is sufficiently large for a house with 7 persons as shown in the following calculation:

2.0 liter/person/day x 1.2 x 7 days x 7 persons = 118 liter, which is less than 120 liter.

capacity if one bin is shared by 25 household persons assuming that maximum interval of waste collection service is 4 days. (See Appendix 4 Section 1.) On the same assumption, 12.5 household persons can share one 120 liter bin. Therefore, 120 liter bins are more economical for individual houses.

Case 2 is presented here for comparison only.

Estimated demand for waste bins is shown in Table 3.5-1, below. The demand was estimated assuming that all Bucharest's citizens have collection service contracts and buy the required types of bins. In reality, of course, some citizens do not have waste collection contracts and most do not comply with the recommended bin requirement. Therefore, the estimated demand is considered to be the optimal.

Table 3.5-1 Estimated Maximum Demand for Waste Plastic Bins in Bucharest

	Case 1 (Recommended) 240 bins are used by apartments & businesses and 120 liter bins by individual houses		**Case 2 (Not Recommended) 120 liter bins are used by all households & businesses**
	240 liter bins	120 liter bins	120 liter bins
1. Bins needed for Bucharest	86,560	96,000	264,000
2. Bins needed per year on average	10,820	12,000	33,640
3. Bins needed for 10 years (Item 2 x 10)	108,200	120,000	336,400

Major assumptions used for the estimation and calculation details are shown in Appendix 4 Section 1.

3.6 What are the Options for Supplying Waste Bin?

To identify the most effective and economic way of supplying bins, a number of options for supplying waste bins were evaluated and a preferred option selected. The options cover both the method of supplying bins and who is to be responsible for supplying them.

The main options for the method of supply are:

1. importing second hand bins;
2. importing new bins; and
3. local manufacture of bins.

The responsibility of procuring the bins from the foreign supplier (or his distributor) or from a local manufacturer, and of supplying them to citizens could be the:

1. municipality's;
2. the collection and haulage contractor; or
3. citizen themselves.

In case 3, the citizen himself is responsible to procure bins which could be imported or locally manufactured.

In addition to considering these options, there is the further question of whether citizens should purchase their own bins or have them freely supplied to them by the Municipality or by collection and haulage contractors. This is considered in Section 3.8.4 below.

Table 3.6-1 below summarises the main options by method of supply and procurement responsibility.

Table 3.6-1 Bin Supply Matrix

Procurement Responsibility	Method of Supply		
	Imported new bins	Imported used bins	Local manufacture
Municipality	buys and sells to citizens	buys and sells to citizens	buys bins from a local manufacturer and sells to citizens
Collection and Haulage Contractor	buys and sells to citizens	buys and sells to citizens	buys from manufacturer and sells to citizens
Citizen	buys new imported bins	buys imported used bins	buys locally manufactured bins

Note: In case of the citizen it is assumed purchases are made from retail outlets.

3.7 What are the Main Criteria to Evaluate the Waste Bin Supply Options?

A number of criteria need to be established by which the options for supplying bins can be evaluated. In establishing the criteria the following should be considered:

Firstly, citizens will buy bins which are affordable. Clearly, if bins are unaffordable, citizens will not buy them. Therefore, the cost to citizens will be the primary criterion.

The cost to citizens can be defined in 2 ways:

1. the cost of one bin, ie its unit price ; and
2. the monthly cost per capita, ie the amortised cost of one bin.

For the purposes of evaluating the bin supply options, both types costs were considered.

The cost of one bin is the fundamental way to assess whether citizens can afford bins. Affordability is a key issue because the affordability of consumer goods in Romania is very low. This can also be expressed as a per capita price, calculated by

the number of people sharing one bin.

The amortized cost per capita, takes account of the bin life, as well as, the number of persons sharing one bin. It is defined by the formula:

$$a \div b \div c \div 12 \text{ (months/year)}$$

where:

a. is the price of a bin;
b. is the bin life (years); and
c. is the number of persons in households sharing one bin

For appartments it is assumed 25 persons share a 240 liter bin. For houses it is assumed 3.5 persons on average share one bin.

Some citizens may base their purchasing decision upon the amortised cost, ie the life of the bin, rather the unit price. For example a bin with a lower price may have a higher amortised cost than a bin with a higher price because it has a much shorter life.

Secondly, citizens will also need a supply of bins which is secure and to which they have good access. By secure supply is meant a continuous, stable and adequate supply.

Thirdly, it is the Municipality's intention to improve the efficiency of collection and haulage services by competitively contracting them out. Service contracts will be set with rigorous efficiency targets. This means that contractors will want citizens to use bins which will enable them to carry out their collection service much more efficiently.

As we have discussed in Section 3.4 above, existing 110 liter bins are unsuitable for an efficient collection service. Therefore, contractors will want to replace old bins with the "efficient" bins as quickly as possible, so that they can realise their efficiency gains. Contractors will also want citizens to have a secure supply of bins.

This has been clearly demonstrated by RGR which rapidly supplied imported 240 liter and 120 liter plastic bins to most of Sector 6 citizens and businesses at affordable prices. This enabled RGR to achieve its high operational efficiency.

Taking the foregoing issues into consideration, the main criteria by which the

options should be evaluated can be stated as:

1. the cost of bins to citizens;
2. a secure supply; and
3. the expeditious replacement of old bins with new "efficient" bins.

The cost of bins to citizens will be the primary criterion because citizens will be very price sensitive. Security of supply is obviously important. The third criterion is highly significant over the short term, and reflects not only the contractor's but the Municipality's objectives, which are to ensure that efficient and effective SWM services are provided to citizens at least cost.

The foregoing could be summarised as: "the best method supplies bins at an affordable price to citizens and businesses and is efficient and secure".

In addition to evaluating bin supply with the above criteria, the viability of the manufacturing option is considered in very broad terms. This includes a consideration of the:

1. level of production;
2. competition from other suppliers;
3. resource issues, eg labour;
4. access to financing the project;
5. time to set up the facility; and
6. market strategy.

3.8 Evaluation of Waste Bin Supply Options

3.8.1 Introduction

To simplify the evaluation the method of supply and the procurement responsibility are separately considered in Sections 4.8.2 and 4.8.3 below. The issue of whether citizens should purchase their own bins or have them freely supplied to them is then considered in Section 3.8.4. The evaluation is then summarised in Section 3.8.5.

The evaluation of the options is based on the following assumptions:

1. the recommended bin specification is that 240 liter bins are used by appartments and businesses and 120 liter bins by individual houses; and
2. the Case 1 bin demand, i.e. total bin requirement for Bucharest is 86,560 240 liter bins and 96,000 120 liter bins.

3.8.2 Evaluation of the Method of Supply

Three options for the method of supply were evaluated. These are:

1. importing second hand bins;
2. importing new bins; and
3. local manufacture of bins.

These options are evaluated firstly by the cost of bins to citizens and then by the security of supply. After this the feasibility of the manufacturing option is considered.

1) The Cost of Bins to Citizens

a. Price and cost data

Altogether seven options were evaluated. Two related to imported used bins, three to new imported bins and two to local manufacturing. To simplify the evaluation, appartments and businesses are considered separately from individual houses.

The two cost criteria were used to assess and compare the options:

1. the cost of one bin, ie its unit price ; and
2. the monthly cost per capita, ie the amortised cost per citizen.

Table 3.8-1 below gives for the 7 options, the unit price of bins, the monthly cost per capita of bins for households, the useful life of a bin and the yearly bin cost (price + life). The amortized cost is shown separately for appartments and houses. Imported bin prices were obtained from RGR and RASUB.

Table 3.8-1 Estimated Waste Bin Prices and Cost of Bins to Citizens

Ranking of the Supply Options	Price (a)	Assumed Useful Life (b)	Cost per Year (a)/(b) = (c)	Monthly Per Capita Cost for Households	
				Apartments [25 (12.5) persons share one 240 (120) liter bin]	Individual Houses [One house with 3.5 persons on average share 1 bin]
1. 240 liter Used German bin	50,000 lei/bin*	5 years	10,000 lei/bin/year	**33 lei/capita/month (Index: 100)**	**238 lei/capita/month (Index: 100)**
2. 240 liter New Italian bin	106,200 lei/bin#	8 years	13,275 lei/bin/year	44 lei/capita/month **(Index: 133)**	316 lei/capita/month **(Index: 133)**
3. 240 liter New Greek bin	135,000 lei/bin*	8 years	16,875 lei/bin/year	56 lei/capita/month **(Index: 169)**	402 lei/capita/month **(Index: 169)**
4. 120 liter Used German bin	50,000 lei/bin*	5 years	10,000 lei/bin/year	66 lei/capita/month **(Index: 200)**	**238 lei/capita/month (Index: 100)**
5. 240 liter New German bin	170,000 lei/bin*	8 years	21,250 lei/bin/year	71 lei/capita/month **(Index: 213)**	506 lei/capita/month **(Index: 213)**
6. 240 liter New Romanian bins	82,765 - 307,204 lei/bin	8 years	10,346 - 38,401 lei/bin/year	34 - 128 lei/capita/month **(Index:103 - 384)**	246 - 914 lei/capita/month **(Index:103 - 384)**
7. 120 liter New Romanian bin	58,930 - 197,211 lei/bin*	8 years	7,366 - 24,651 lei/bin/year	49 -164 lei/capita/month **(Index:147 - 493)**	175 - 587 lei/capita/month **(Index: 74 - 247)**

Source of Information:
- Prices marked with "*" were obtained from RGR.
- Price marked with "#" was obtained from RASUB
- Prices of Romanian bins were estimated by the JICA Study Team

Options 1 to 5 are ranked in ascending order of lowest monthly cost per capita for appartments. The ranking of individual houses tends to follow the ranking of appartments. A ranking index (100 = ranked first) is given and shows the size of the relative cost difference.

It was not possible to accurately rank the local manufactured options because data ranges were used. Therefore they were ranked after the imported options.

The price and cost data for the manufacturing options were estimated under four different production scenarios and, therefore, for simplification, the table gives only the range of data for these scenarios. For example, for option 6 the unit price of a 240

liter bin ranges from 82,765 - 307,204 lei/bin.

As the table shows the estimated prices of locally manufactured bins vary greatly, depending of level of bin production and sales. The assumptions and supporting schedules used for estimating prices of locally manufactured bins are given in Appendix 3, Section 2 and 3.

b. Evaluation

Citizens purchasing decisions will be affected by two factors:

1. the unit bin price; and
2. the amortised cost of a bin.

In either case, informed citizens will also consider the number of persons sharing the bin, i.e. the shared cost.

How are consumers likely to behave? Some citizens may base their purchasing decision upon the amortised cost, ie the life of the bin, rather the unit price. For example a bin with a higher unit price may have a lower amortised cost than a bin with a lower unit price, because it has a much longer life.

However, consumer purchasing power in Romania is very weak and affordability is a key issue. It should be remembered that the unit bin price ranges from 25 % to 100 % of average monthly income. Therefore, some citizens will make purchasing decisions based on the unit bin price **rather** than on the bin life, even though the amortised cost may be significantly lower. Furthermore, citizens may choose a lower price bin if they think there is a risk that bins may be stolen.

In conclusion, therefore, we might expect that more affluent citizens may prefer to buy bins which last longer because they can afford to pay the higher price now and benefit from a lower amortised cost, whilst lower income citizens may choose the lower unit price, because of affordability.

(1) Apartment Dwellers and Business

The results are reasonably clear cut. 240 liter German used bins are the most economical in terms of both the unit price (50,000 lei) and the amortized cost (33

lei/capita/month for apartment building dwellers)

The next best option is 240 liter Romanian manufactured bins. This option might be considered to be as economical as the 240 liter German used bins (50,000 lei/bin) on the basis of amortised cost, if the Romanian bin price is set at 80,000 lei/bin.

However, it is unlikely that the Romanian made 240 liter bin price would be lower than 80,000 lei/bin. As shown in the table, the range of prices of Romanian bins varies greatly depending on number of bins produced and sold. The Romanian bin price is estimated at 82,765 lei, assuming that 2,000,000 bins are sold over 10 years. The price is estimated at 307,204 lei if sales are 108,200 bins over 10 years which is equivalent to the estimated bin demand for Bucharest.

However, it is expected that citizens would generally choose the German 240 liter used bin if the Romanian 240 liter bin price is set at 80,000 lei/bin because of affordability.

Users will not buy 120 liter bins, although they are generally less expensive than 240 liter bins, as they are much more costly in terms of monthly bin cost to users living in apartment buildings. This is because the per capita cost is double that of 240 liter waste bins.

(2) Individual House Dwellers

For individual house dwellers the decision is less clear cut. 120 liter German used bins (50,000 lei) have the cheapest unit price. But, as, Table 4.8-1 shows, the Romanian manufactured 120 liter bin (unit price 58,930 lei/bin) is only 8,930 lei more and has the lowest amortized cost per capita of 175 lei/person/month, which is 74% of the German used bin. Therefore, citizens might choose the manufactured option.

However, this level of price is not achievable unless a Romanian bin manufacturer produces and sells at least 2,000,000 bins or more over 10 years, which is more than 16 times larger than the demand for 120 liter bins under the Case 1 (120,000 bin for 10 years), and 6 times larger than the bin demand in Bucharest under Case 2 (330,000 bin for 10 years). If the quantity of local production and sales is equivalent to the bin demand of Bucharest (120,000 bin for 10 years), the estimated price is 197,211 lei/bin, and, the amortized cost is 587 lei/person/month which is 247 % of the German used bin.

c. Conclusion

Firstly, for apartment building dwellers and commercial enterprises, 240 liter German used bin is the most economical unit price, and we would expect that most citizens would choose this bin.

Secondly, for individual house dwellers, 120 liter German used bin is the most economical, but manufactured bins at 58,930 lei are better value for money. It is not possible to conclude what citizens' preferred choice would be. Either option may be satisfactory. However, it has to be noted that the manufacturing option requires production at 200,000 bins per annum which is very much larger than the demand for Bucharest. A potential investor may find this level of demand unattractive.

2) Security of Supply

A summary of the security of supply is given in Table 3.8-4 below:

Table 3.8-2 Evaluation of the Options for the Security of Bin Supply

Method of Supply Options	Security of supply	Comments
1. Used imported bins	Good	In Germany, Austria and some other European countries, local governments are responsible for supplying waste bins for citizens, and replace old bins with new ones periodically (5 - 10 years). Therefore, used bins are available constantly. It is also possible for suppliers of used bins to select only used bins that are in good conditions.
2. New imported bins	Good	The availability of imported new bins is very good.
3. Local production	Good	Production capacity of a typical bin factory is 200,000 bins/year which is much more than an estimated quantity for Bucharest. If this production level and sales are achievable this method will be a viable and secure supply of bins.

From the evaluation both import options and the manufactured options will provide a secure supply.

3) Feasibility of Supply of the Local Manufacturing Option

It is beyond scope of this study to carry out a detailed feasibility study of the manufacturing option. Therefore, a high level assessment was made which considered the following:

1. the level of feasible production;
2. market strategy - probably export strategy;
3. competition from other suppliers. How vulnerable is the manufacturer?
4. resource issues, particularly labour;
5. access to financing the project; and
6. time to set up the facility.

Bin production and sales of at least 200,000 bins per annum are required over 10 years, to enable a producer to competitively supply bins in Bucharest. Even then, manufacturers will find it difficult to be competitive with bin importers who will be already active in the market before he enters it. 240 and 120 liter bins used bins are competitively priced.

A local manufacturer is particularly vulnerable to a price war to which it would would have to respond by reducing prices but would probably be less able to sustain this than an importer. There is a risk, then, that the manufacturer would be forced to entirely withdraw from the Bucharest market.

Another crucial issue facing the potential an investor is that Bucharest's demand for bins is very much less than the optimal production level. Therefore, his market strategy will have to focus on selling bins outside Bucharest, either for export or for the Romanian market. Export may be the more profitable strategy.

Although it appears that an investor will not be primarily concerned with sales to Bucharest, he may require as a key condition that MB guarantees the purchase of certain quantity of bins at certain prices, (which would necessitate the prohibition of import of used bins.).

In fact, a recent offer from Canadian and Austrian companies to set up a 120 liter

bin factory required production of 200,000 bins/year and included as a condition that MB guarantee the sales of 100,000 - 120,000 bins/year for 10 - 12 years. These quantities are very much in excess of the estimated demand for 33,000 bins/year.

We do not recommend that MB gives such guarantees because:

Firstly, if the Municipality or contractors are required to purchase bins, it will be a very wasteful use of public money to buy more than is required for the city. Furthermore if too many bins were distributed this might affect the efficiency of the collection services.

Secondly, free market competition will ensure that bins are supplied at competitive prices to Bucharest's citizens. MB should not agree to monopolistic supply but allow the market to determine the most economic supply. If imported bins are the most economical then the citizens of Bucharest should not be deprived of obtaining them at the more affordable prices.

We have recommended that contractors are responsible for bin procurement and they should not be constrained in any way as to what, from who and how they procure bins.

In addition to the marketing issue there are also issues of resourcing and setting up the facility. It may take some time to set up the facility. In the meantime imported bins can be supplied cheaply and in large quantities to citizens. By the time production comes on stream, the manufacturer may be faced with virtually no market for supplying bins in Bucharest.

Lastly, will there be sufficient labour resources and material supplies to enable the investor to manufacture efficiently? These questions are beyond of this study but should nevertheless be seriously considered.

3.8.3 Evaluation of the Responsibility for Bin Procurement

The three options for the procurement responsibility are:

1. the municipality;
2. the collection and haulage contractor; and
3. citizens themselves.

The responsibility for procurement needs to address the key issue that contractors will want old bins to be replaced with new "efficient" bins as rapidly as possible so that they can improve their operational efficiency. The choice is also concerned with issues of citizens being able to get good access to an efficient supply. Also the selected option must not compromise the security of supply.

Which option is the most appropriate?

Clearly contractors are the closest to and have direct contact with citizens and are, therefore, in the best position to market, sell and distribute bins. RGR's experience clearly demonstrates this. Conversely, the Municipality is more removed from citizens.

Contractors are also in a better position to benefit from economies of scale by ordering large quantities of bins. Citizens will be at a disadvantage here and will have to rely on the retail system to supply bins at a higher cost.

The contractor as a commercial entity is also more experienced in seeking suppliers and negotiating the best price for bins. The Municipality lacks these capabilities and culture.

The contractor is also clearly much more incentivised than the Municipality or the citizen to procure and supply bins, since the more he supplies the more his operational efficiency will improve.

We therefore recommend that contractors are responsible for the procurement responsibility.

The likely picture to emerge is that contractors will supply large amounts of bins in the short term. Therefore, the provision of bins to the citizens of Bucharest will essentially be supply side driven by collection and haulage contractors as RGR has clearly demonstrated. In the medium term the demand for bins will therefore be much smaller than the steady state.

We would also recommend that the contract necessarily specifies that the contractor is obliged to make available bins to all citizens and at a good price. Time limits do not need to be set as the contractor has the incentive to supply bins as quickly as possible.

3.8.4 Should Bins be Freely Provided to Citizens or Should Citizens Pay for Them?

There are two options to consider:

1. citizens procure bins; or
2. bins are supplied free by the contractor.

Both are considered under the assumption that contractors will be responsible for procuring and supplying bins to citizens. As a result, the free supply of bins by the Municipality is not considered.

Under the first option citizens buy bins from the contractor who will be obliged under his contract to make them available to citizens. RGR's experience of selling bins in Sector 6 shows that the majority of citizens and businesses citizens are very willing to buy bins at affordable prices. Another benefit of this option is that citizens are more likely to look after their bins if they own them. This will increase the average bin life.

Under the second option bins are supplied free of charge by the contractor who is reimbursed through the contract by the Municipality. Although this option would enable bins to be rapidly supplied to citizens, there is the issue of how the Municipality will be recover these costs.

These costs are likely to be substantial in the short term as contractors supply large numbers of bins. In this situation it is unlikely that the Municipality could absorb these costs because:

Firstly, financing from the general tax base is very constrained; and

Secondly, the amount of cost to recover from the waste tax (or from tariffs) would be too large. Even if citizens are able to afford such increases in their charges, they have a low willingness to pay and MB is reluctant to raise charges.

Therefore, we recommend that citizens purchase their own bins. This is a more cost effective solution and has proved to work well with RGR.

3.8.5 Summary of the Evaluation of the Method of Supply and Procurement Responsibility

Contractors should be responsible for supplying bins to citizens and they should be free to decide on the method of supply, ie new imported, used imported or locally manufactured. Obviously 240 or 120 liter used bins are very competitively priced and there is a secure supply. It is very likely that contractors will buy these.

But if an investor wishes to set up a bin facility in Bucharest and can competitively sell bins then this is also a feasible option. Obviously the level of production will need to be well in excess of local demand. Setting up a bin faciltiy to only supply bins to Bucharest is not econnomically viable and contractors would prefer to buy used bins at considerably lower prices.

In the short term contractors will want to supply large amounts of bins. Used bins will be easily available. If it takes a long time to set up a manufacturing facility, there may be no market in Bucharest when the bin facility comes on stream. Therefore a potential investor needs to seriously consider how the supply of used bins will affect his market in Bucharest. He should also consider how he would respond to a price war.

If the Municipality is approached by an investor it should not guarantee that it or the contractor will buy a certain number of bins. The contractor should let the market decide which is the cheaper and more secure supply of bins.

Table 3.8-3 below gives a brief summary of the evaluation of all the options. This summary is indicative only and only gives a broad simplification of the results of the evaluation.

Table 3.8-3 Summary of the Evaluation of Waste Bin Supply Options and the Selection of the Preferred Option

Supply Responsibility and Supply Method	Evaluation Criteria			
	Cost to Citizens	Security of Supply	Expeditious and Efficient Supply	Overall Assessment
Municipality				
-new bin	Poor	Good	Fair	Fair
-second hand bin	Good	Good	Fair	Good/Fair
-local manufacture	Fair	Good	Fair	Fair
Contractor				
-new	Poor	Good	Very Good	Good
-second hand	Good	Good	Very Good	Very Good
-local manufacture	Fair	Good	Very Good	Good
Citizen				
-new	Poor	Good	Poor	Poor
-second hand	Good	Good	Poor	Fair
-local manufacture	Fair	Good	Poor	Fair

Key:

Very Good
Good
Fair
Poor

Chapter 4
Information on Incinerator

CHAPTER 4 INFORMATION ON INCINERATOR

4.1 Introduction

There are two kinds of incineration plants for municipal solid waste treatment, one is stoker type incinerator and the other is fluidized bed type incinerator. Stoker type incinerator is major for municipal waste treatment, but the fluidized bed type incinerator with the capacity of 150 to 200 ton/24h capacity fluidized bed type has been developed and increasing the market shear recently. With regard to combustion time, incineration plant operation is devided with two types, one is batch type and the other is continuous type incinerator. Batch type (8 hours operation) incinerator is adopted for smaller capacity incinerator, and the continuos type (24 hours operation) incinerator is adopted for larger capacity incinerator. The construction cost of the facilities of the former type is lower than the that of the latter.

4.2 Purposes of Incineration

The purposes of incineration of municipal solid waste are summarized as follows;

1) Volume Reduction ;

Tree Components of Waste are converted to;

Combustible	-- Gas (CO2 etc.)	-- Migrate to Air
Moisture Content	-- Vapor	-- Same as above
Ash	-- Incineration Ash, Dust	-- Landfill

2) Scentless;

High temperature incineration -- Thermal decomposition, Pyrolysis -- Scentless (higher than 700 Deg. Cels.)

3) Harmless;

Hazardous material & virus -- Thermal decomposition, Pyrolysis -- Harmless

4) Countermeasure and

Secondary environmental pollution	-- Exhaust gas treatment
(Dust, Hydrogen chloride, Sulfur	-- Waste water treatment

oxides, Nitrogen oxides, etc.) -- Ash harmless treatment

5) Merits.

Heat utilization -- Generator, Hot water delivery -- Benefit for local people

4.3 Incineration Process and Component of the Facilities

1) Stoker Type Incinerator

a. Incineration Process

Incineration process of the stoker type is shown in Fig.4-1. Raw waste on driving stoker is dried by fire and radiant heat, and the waste start burning at a part of the surface layer. The state of burning become active at the center of combustion stoker, and burning is finished at end part of combustion stoker. Even if the quality of input waste quality change, the finishing point is controlled by stoker movement speed and combustion air temperature, quantity of waste, etc. Combustion air temperature shall be kept higher than the burning point of paper for stable burning.

b. Treatment Flow

Treatment flow and the components of facilities of the stoker type incinerator is shown in Fig 4-2, and the treatment flow is explained as follows.

Waste: Collection truck - Platform - Bunker gate - Crane - Hopper - Incinerator (drying stoker - combustion stoker - after burning stoker) - ash

Ash: Ash conveyor - Crane - Bunker - Ash treatment system - Truck - Landfill

Combustion air: Bunker - Forced draft fan - Air heater - stoker

Exhaust gas: Incinerator - Gas cooling chamber - Electric precipitator - DeNox reactor - Dehydrochlorination system induced draft fan - Stack - Dispersion to air

2) Fluidized Bed Type Incinerator

a. Incineration Process

Incineration process of fluidized bed type incinerator is shown in Fig.4-3. Sand and air are the secrets behind fluidized bed incineration system. The sand act as a thermal medium to ignite the waste; and the air moves the sand and waste to distribute the combustion evenly throughout the incinerated bed. The bed of the incinerator contains billions of grain sand. Each grain of sand is only about one millimeter in diameter, but the combined surface area of all grains is several thousand square meters. Since these grains of heat, the incinerator has an effective heating surface with many times lager than a conventional stoker type incinerator. The sand is heated and kept in motion by air blown up from beneath the bed of sand. When the air quantity is small, the bed remains stationary and the air escapes through the sand. As the air quantity increases, through, the bed of sand expands and begins to move very much like boiling water. Once, the fludized sand has been heated by a primary burner to more than 600 deg. cels, waste is fed into the bed, where it mixed with the sand. The refuse starts to burn quickly and efficiently. The heat from this combustion keeps the sand hot, so there is no need for any support fuel. As more than 99 % of all combustible material is burned in excellent fluidized bed incinerators, there is much less residue than from a stoker type incinerator.

b. Treatment Flow

Treatment flow and the components of the facilities of fluidized bed incinerator is shown in Fig. 4-4.

4.4 Cost Information

1) Construction Cost of Incineration

Construction cost of incineration plant consists of two major components, one is equipments cost and the second one is building cost. Building cost changes depending on the construction area and the grade of specifications. In general, the equipment cost is estimated between 70 to 80 % of the total cost as the building is constructed by the standard grade specifications. In Europe, standard construction cost of incineration plant is estimated as shown in Table 4-1.

Table 4-1 Incineration Plant Construction Cost in Europe

Capacity	Number of Line	Unit Cost	Total Cost
200 ton/day (8.3 ton/hour)	1	250,000 $	50 Million $
1000 ton/day (41.0 ton/hour)	2	130,000 $	130 Million $

Note; The cost include basic equipments for environmental conservation and generator system.

In Japan, the cost of incineration plant is estimated almost double compare with the cost in Europe.

Operation and maintenance cost is discussed in Chapter 5 of the Feasibility Study Report.

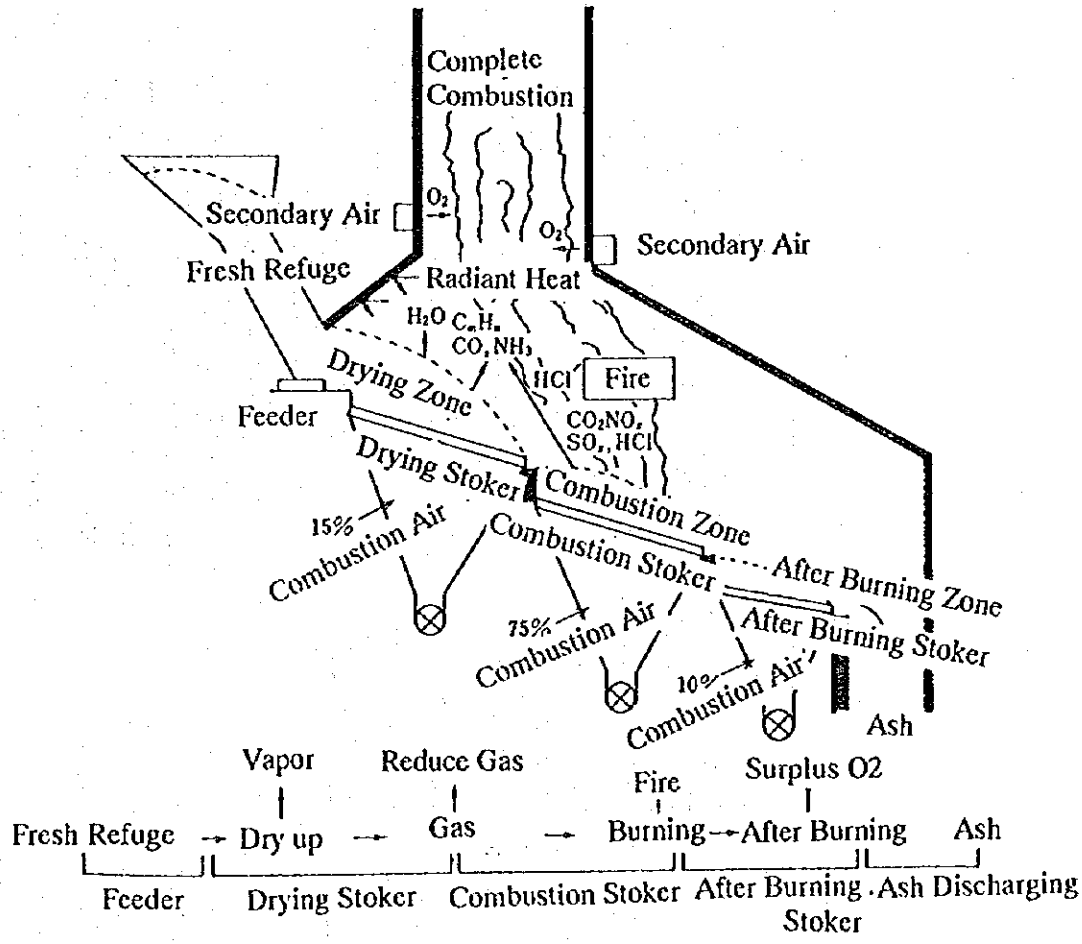
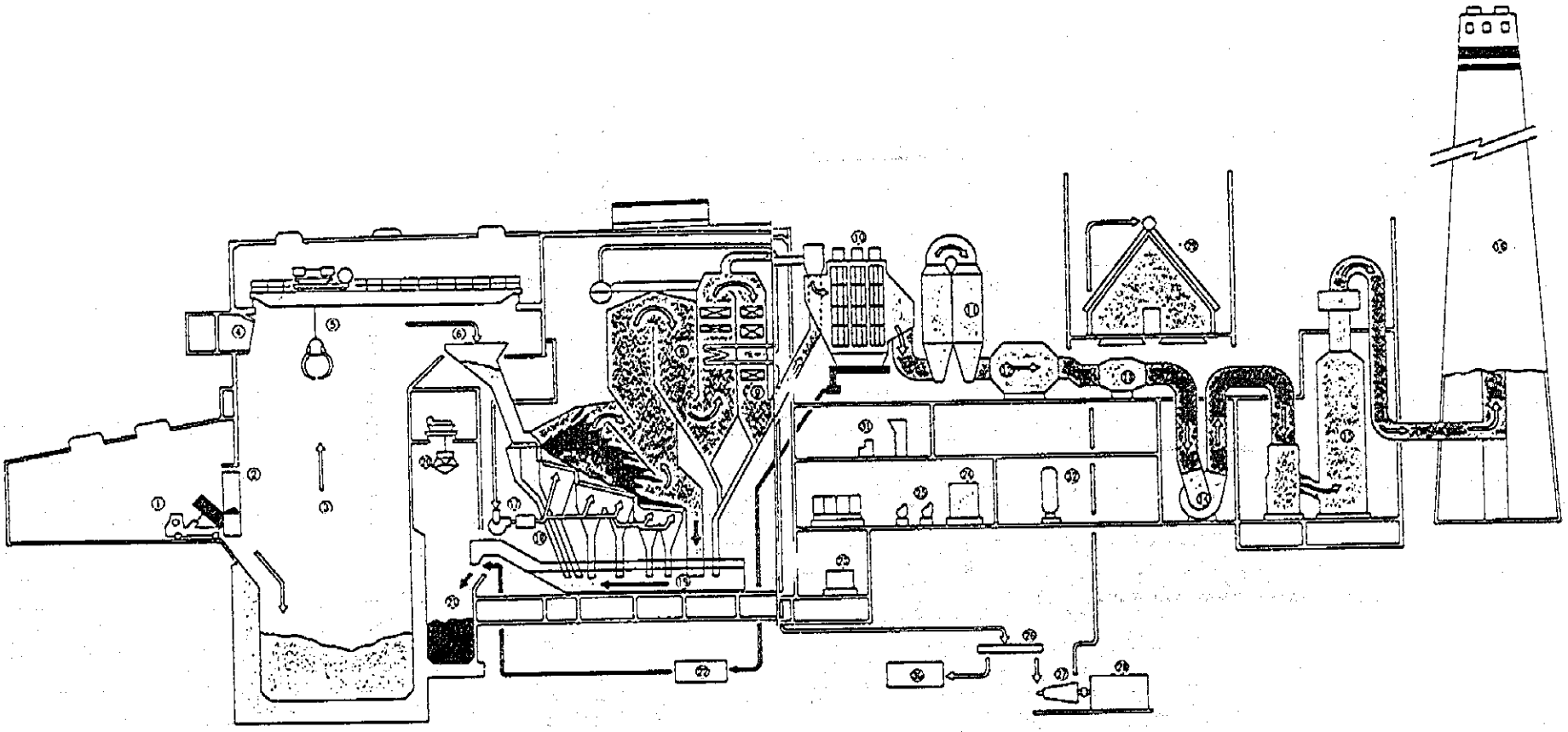


Fig. 4-1 Incineration Process



①プラットホーム Platform
②Refuse bunker gate
③Refuse bunker
④Refuse crane operating room
⑤Refuse crane
⑥Refuse hopper
⑦Incinerator
⑧Boiler
⑨High temperature economizer
⑩Electrostatic precipitator
⑪DeNOx reactor
⑫Middle temperature economizer
⑬Low temperature economizer
⑭Induced draft fan
⑮Dehydrochlorination system
⑯Stack
⑰Forced draft fan
⑱Steam air heater
⑲Ash conveyor
⑳Ash crane
㉑Ash bunker
㉒Fly ash treatment system
㉓Air compressor room
㉔Condensate water tank
㉕Pump room
㉖Steam header
㉗Steam turbine
㉘Steam turbine generator
㉙Steam condenser
㉚Surplus heat utilization facilities
㉛Central control room
㉜Waste water treatment system

Refuse flow
Ash flow
Air flow
Gas flow
Steam flow

Fig. 4-2 Teatment Flow

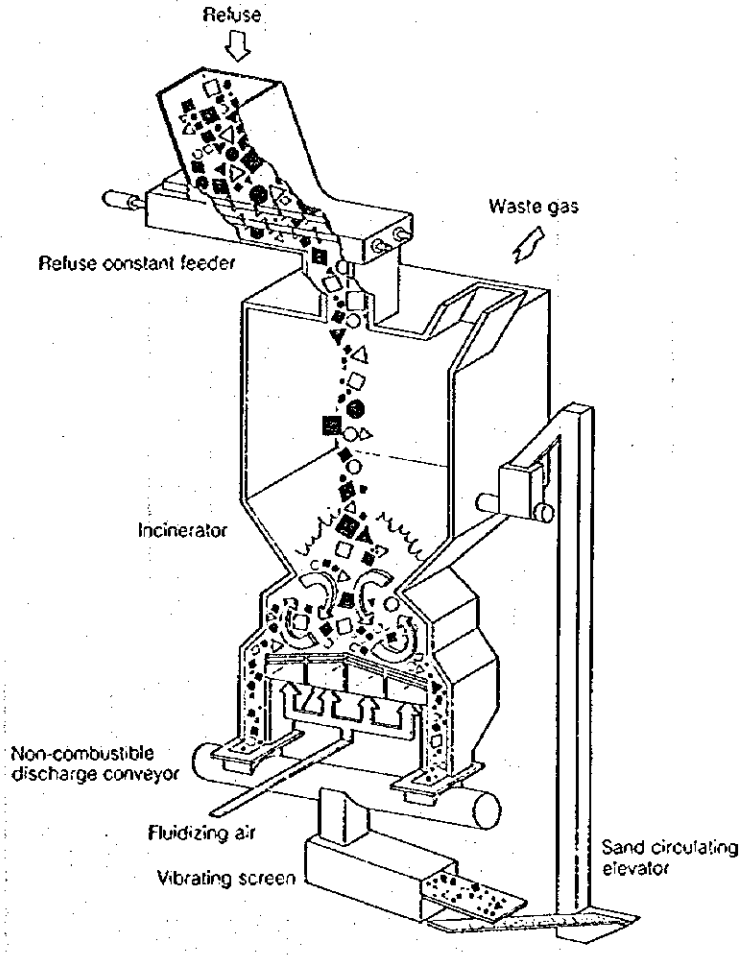


Fig. 4-3 Incineration Process

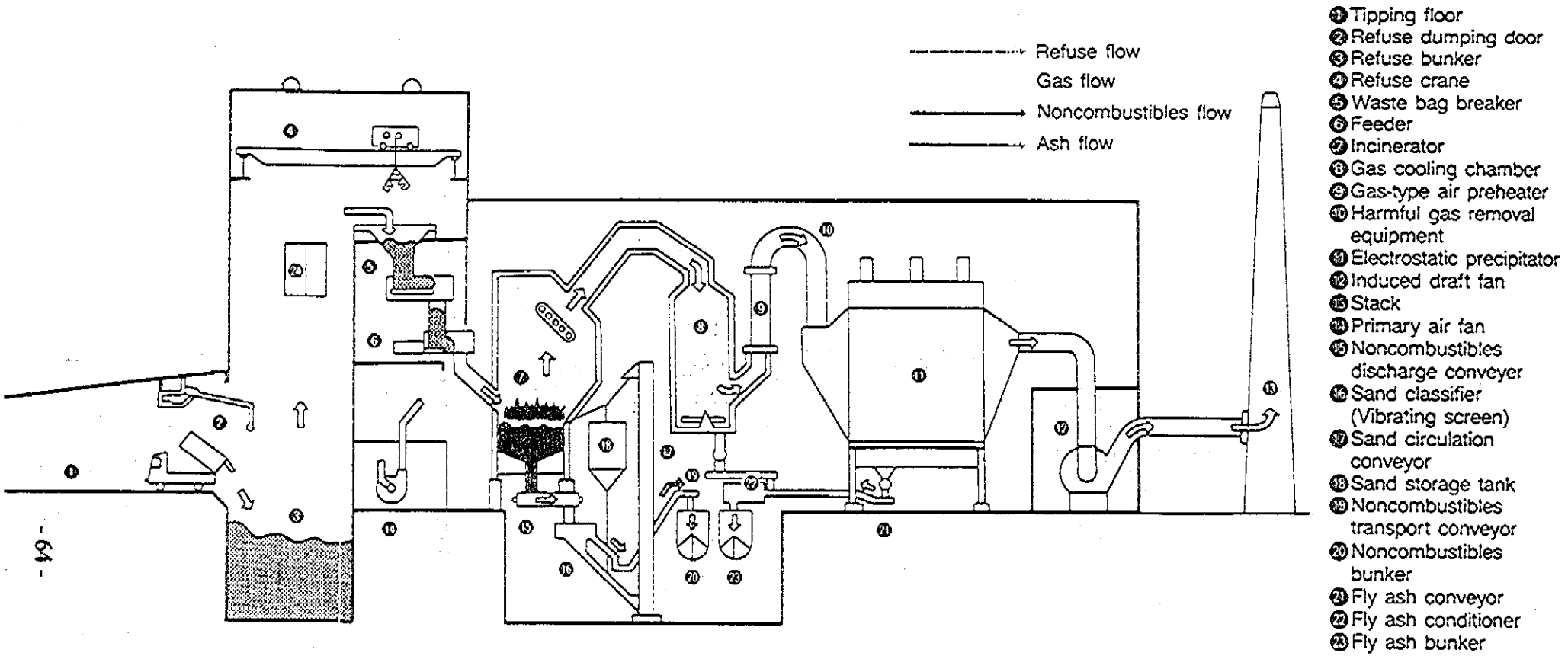


Fig. 4-4 Incineration Flow

Chapter 5
Feasibility of Composting in Bucharest

CHAPTER 5 FEASIBILITY OF COMPOSTING IN BUCHAREST

5.1 Introduction

Recently in European countries, organic treatment of waste is argued from the environmental point of view. Anaerobic fermentation of waste on the landfill site is proposed, the purpose of which is to stabilize waste on site. This is considered as the treatment and disposal method. However, composting, though it is also one of organic treatment, is not only a treatment method but it produces compost which can be used as fertilizer or soil stabilizer in agricultural fields. Use of compost for agricultural purpose is recommendable to avoid ground water pollution by overuse of nitrogen fertilizer. Thus, the composting can be reviewed and highly evaluated.

However, in the Master Plan of solid waste management in Bucharest, it is concluded that composting of the municipal waste in Bucharest is not feasible, because farmers' demand for the compost can not be expected due to its high price which resulted from high cost of composting. Even if the municipality subsidize to make the price low enough to induce the farmer's demand, the large amount of finance is required. It is not recommendable. Besides, quality control of compost made of the municipal waste is difficult.

In spite of these difficulties, composting has been argued repeatedly as it seems interesting. In the following section, it is presented that how the composting is, and why composting was not chosen in the Master Plan.

5.2 Purpose of Composting

Compost is used to keep the productivity of agricultural field by supplying organic substances to soil. If there is no demand for compost for agricultural purpose, it is no use to produce it. The demand for the compost is a necessary condition of composting of waste. There are many cases of failure of composting in the world for waste treatment without surveying the demand.

Why waste is made into compost to put it back to the agricultural field. Elimination of toxic substance and easy handling are the main reasons. Elimination of toxic substances includes the following three points.

a. Decomposition of unstable organic matter
b. Improvement of C/N ratio
c. Inactivation of bacteria, vermin and seeds of weeds

"a. Decomposition of unstable organic matter" is aimed to stabilize the waste by composting to avoid harms on plants due to the consumption of oxygen by waste.

"b. Improvement of C/N ratio" means the reduction of C/N ratio of the waste by composting in order to avoid over consumption of nitrogen in soil as an important nutrition. Because Carbon in organic waste of high C/N ratio reacts with nitrogen in soil and consume it.

"c. Inactivation of bacteria, vermin and seeds of weeds" is to inactivate them by heat at 50 to 65 degree Cercius in composting process.

5.3 Biochemical Process of Composting

Fundamental composting process is as follows:

a. Reacting with oxygen, carbohydrate in organic matter decomposes into carbon dioxide and water,
b. Protein and fat decomposes into the substances with smaller molecular weight and then into carbon, water and ammonia, and
c. Digestion of the waste by microorganisms and their autolysis by consuming up their foodstuffs makes the decomposed organic substances more stable.

Compost contains humic acid of humus and corpses of microorganisms, but cellulose remains in immatured compost because its decomposition is slow.

5.4 Composting System of the Municipal Waste

Schematic flow of the composting process of the municipal waste is as follows:

Municipal Waste
↓
Pulverizing
↓
Primary Separation

Fermentation
↓
Secondary Separation
↓
Post Fermentation
↓
Tertiary Selection

In this process, there are two ways. One is Windrow System in an open-air yard and another is High Speed System using a mechanical fermentation tank. The latter can be further classified into Rotary-kiln System, Multi-step System, Silo System and Bottle System.

Windrow System is the cheapest, but problems of odor, necessity of large land and seasonal fluctuation occur because it is treated in the open-air yard. High-Speed System can solve these problems but the disadvantage is its high cost.

The following process should be notices in these process.
- Desirable water content in waste as compost material is 50 to 60 %.
- Deodorizing process in required because odor substances such as ammonia, methyl-mercaptan or methyl sulfide is generated in the fermentation.
- Refused (not suitable for composting) must be treated in other way.

5. Material Balance in Composting

Products rate is a most significant factor in composting. The products rate depends on the waste input as its material. As the low production rate makes a price of the compost high, waste as the material with high production rate is desirable.

An example of the material balance in composting the municipal waste in Japan is shown below. The products rate is as low as 13.4 % while the rate of refused is 36.1 %.

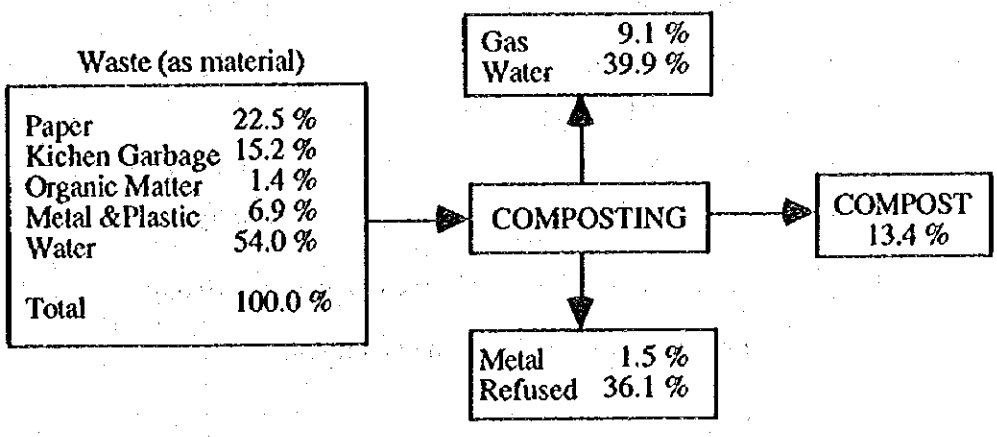


Figure 5.5-1 Material Balance in Composting (An Example in Japan)

20 % of products rate can b expected in Bucharest since the waste in Bucharest seems to contain much more organic substances than those in Tokyo. When waste quality changes along with the economic growth, the products rate decreases.

5.6 Cost of Composting

About 10 years ago in Alexandria in Egypt, unit cost of compost plant of the Windrow System, the capacity of which is 300 tons/day, costs 30,000 US$/ton of waste incoming. The cost in Bucharest is estimated based on this example. A price increase considered, current unit cost of construction is assumed to be 50,000 US$/ton. 40 % of this is construction cost and 60 % is equipment cost. The capacity of the plant is 100 tons (of incoming waste)/day. These assumption is shown in the table 5.6-1. Table 5.6-2 shows annual cost and benefit of a compost plant. The table 5.6-3 presents the unit cost of treating waste by composting. The unit cost of waste treatment by composting is 34.8 US$/ton of waste. Although this is cheaper than incineration cost of 42 US$/ton, it is still 7 times higher than that of the sanitary landfilling.

Table 5.6-1 Construction Cost and Capacity of a Compost Plant (100 ton/day)

A	Construction Cost	
	A.1 Machinery	$3,000,000
	A.2 Building	$2,000,000
	A.3 Total (1.1 +1.2)	$5,000,000
B	Waste Processing Capacity	
	B.1 Daily capacity	100 t/day
	B.2 Annual capacity	31,000 t/year
C	Compost Production Capacity	
	C.1 Daily production	20 t/day
	C.2 Annual production	6,200 t/year

Note:
1. It is assumed that the number of operation days is 310 day per year.
2. Eventually, 40% of waste incoming is refused.

Table 5.6-2 Annual cost and Benefits of a Compost Plant (100 ton/day)

1.	Total Cost	$679,000/year
1.1	Annual Depreciation {1) + 2)}	$399,000/year
	1) Machinery	$66,000/year
	2) Build	$333,000/year
1.2	Operation and Maintenance {1) + 2) + 3)}	$280,000/year
	1) Utilities	$60,000/year
	2) Operation & maintenance	$60,000/year
	3) Emolument (salary)	$160,000/year
2.	Total Benefit	$31,000/year
2.1	Compost sales (Direct benefit) ($5/t x 6,200 t/year)	$31,000/year
3.	Net Cost (1. -- 2.)	$648,000/year

Table 5.6-3 Unit Cost of Waste Treatment by Composting

1.	Net Cost of Composting	$ 648,000 /year
2.	Quantity of Waste treated by Composting $31,000 (incoming waste) x 60 % =	186,000 ton/year
3.	Unit Cost of Composting $ 648,000/186,000 tons/year =	$ 34.9/ton

5.7 Quality of Compost

Maturity of compost, content of toxic substances and impurities are critical problem in quality control of compost. If the compost contains much impurities, even fully-matured compost is not accepted by users. If the safety form toxic substances is not guaranteed, the user avoid to use it. These quality problems can be obstacles in use as well as the high cost. Impurities can be eliminated fairly much by intensive separation, but it costs very high.

Toxic substances are the most serious problem in composting of the municipality waste, because it cannot be predicted what kind of toxic substances are incoming. Therefore, only sampling test cannot guarantee the safety of all products. Its quality is

fluctuating and the possibility of disqualification cannot be denied. If the compost is disqualified, composting activity will be damaged. The possibility to be filed to the court by the users exists.

Quality standard of compost provided by European Union. is shown in the table 5.7-1 (a) to (c).

Table 5.7-1 Quality Standard of Compost by EU

(a) Nature

Class	Mesh Diameter [mm]	Glass Content at Maximum [dry wt %]		Plastic Content at Maximum [dry wt %]		Water Content Maximum [%]	Biodegradable Content at Maximum [dry wt %]	
	A	B	A	B	A - B	A	B	A
Finest	8	1	0.1	0.4	0.2	30	20	30
Fine	16	2	1	0.8	0.4	35	25	35
Middle	24	4	2	1.6	0.8	40	30	40
Crude	40	6	3	3.5	1.6	50	35	45

Note: A: Current Standard B: Target in Future

(b) Ingredient

Ingredient	N	P_2O_6	K_2O	CaO	$CaCO_3$	MgO
Conc at Minimum [dry wt %]	0.6	0.5	0.3	2.0	3.0	0.3

(c) Heavy Metal Content

Metal	Maximum Conc in Compost [mg/kg-dry wt]			Annual Usage at Maximum [kg/ha]		Maximum Quantity in Soil [mg/kg-dry wt]	
	Standard Collection		Separate Collection				
	R	M		R	M	R	M
Zn	1000	1500	240	25.0	30.0	150	300
Pb	750	1000	160	10.0	15.0	50	100
Cu	300	500	40	10.0	12.0	50	100
Cr	150	200	30	10.30	-	50	-
Ni	50	100	10	2.0	3.0	30	50
As	-	-	-	0.35	-	20	-
Hg	5	5	0.5	0.40	-	2	-
Cd	5	5	1	0.10	0.15	1	3

Note: R: Recommended M: Mandatory

5.8 Distribution of Compost

Distribution of produced compost is difficult. Farmers do not always demand for the compost. Compost is demanded during fallow of the field, especially just before the beginning of next cultivation. Therefore, the compost must be stored at the compost plant until it is demanded. It is necessary to secure space for storing, otherwise stable operation is impossible.

It is not economical that the compost plant has its own delivery route. It is desirable that farmers come to take compost by their own cars. In this case farmers must bear transportation cost.

Although the demand for compost around Bucharest is not clear, the price of the compost should be less than 5 US$/ton when examples in the other countries are considered. Other wise, it cannot be sold. Farmers may use the compost if the compost is offered at free of charge, but the compost plant cannot be run.

5.9 Feasibility of Composting in Bucharest

If composting is promoted in Bucharest, the successful conditions are as follows:

a. Farmers' demand apparently exists around Bucharest
b. Purchase at fairly high price can be expected.
c. Benefit of composting is approved due to the increasing cost of landfilling.
d. Quality of the compost is guaranteed.

Quality control is difficult if the compost plant accept all kind of the municipal waste. It is desirable to limit the acceptable waste to kitchen garbage and market waste. Use can use the compost reliably if the compost is made of waste of stable quality. Cost condition might be satisfied when in future the waste must be transported to a much far disposal site after the planning period of the Master Plan.

5.10 Conclusion

As discussed above, the composting is not recommendable for the waste treatment method in Bucharest. The reasons can be summarized as follows:

- Composting cost much higher then landfilling
- Demand for the compost can not be confirmed
- Quality control of compost is difficult.
- Risk as business activity is high.

It is worthwhile, however, to examine the feasibility of composting in a small scale in a small farm village, and is recommendable from the view point of promoting organic farming.

Appendices

APPENDIX 1. TECHNICAL ASSISTANCE STUDIES

1.1 Draft Terms of Reference for Technical Assistance for Strengthening Bucharest Municipality's Contract Management Capability

1.1.1 Introduction and Background

This technical assistance assignment concerns the provision of technical assistance to the Municipality of Bucharest to enable the Municipality to implement an effective contract management capability for its municipal service contracts including arrangements for monitoring the delivery of services. The technical assistance should be provided with particular reference to municipal solid waste services since the Municipality is poised to contract out its solid waste collection and haulage services.

By contract management is meant the system and procedures which control and manage contracts from the initial preparation of the contract specification to contract award and post contract award monitoring of service delivery. For the purposes of this report contract management is also defined to include the procedures and systems to monitor the delivery of services.

The Municipality has had very little experience of contracting out municipal services and has not established contract management arrangements. There also is an absence of governmental legislation and guidance on how to tender and manage municipal service contracts.

As a result the Municipality lacks a framework by which it can define and formulate contracting procedures. MB recognises this and is committed to implementing arrangements which will ensure effective, efficient and economic contracting.

Municipal services are provided either by the Municipality itself or by public service enterprises called Regie Autonomes. In practice, most of Bucharest's municipal services are provided by the Regii Autonomes. In Bucharest there are 5 Regii which provide services for solid waste (RASUB), water and sewerage (RGAB), public transportation (RATB), district heating (RADET) and for roads (DRUPO).

Although the Municipality is primarily responsible for all municipal services, including those provided by the Regii, the Regii are quite independent of the Municipality and there is considerable ambiguity over their legal and institutional status.

The Municipality intends to establish municipal service contracts with the Regii and also for municipal services which will be contracted to the private sector. In both cases robust contract management arrangements are required to manage municipal service contracts.

1.1.2 Objectives of the Technical Assistance Assignment

The objective of the technical assistance is to enable the Municipality to implement an effective contract management capability for municipal services which are contracted to the private sector. This TA does not address contract management for services provided by RGAB, RADET and RASUB, which will be covered through a separate piece of TA.

In particular, the technical assistance should aim to implement arrangements which will ensure that contracts are carried out efficiently and effectively, that both parties fulfil their obligations, and that best Value For Money (VFM) is achieved for the Municipality.

1.1.3 Scope of Work

The scope of the TA should cover the whole system of contract management, addressing, in turn, each of the main stages of the pre contract award and post contract award activities. This should include the procedures and systems to monitor the delivery of services.

The TA would be primarily focused on the Public Services Department and also the Legal Department. Other departments would be involved as appropriate.

The TA should be undertaken in two parts:

a. Part 1 - Diagnosis and recommendations for suitable contract management arrangements; and

b. Part 2 - Implementation of proposed contract management arrangements.

Part 2 should involve MB's staff in the job training and skills transfer.

The consultant should propose practical arrangements taking into consideration the Municipality's capabilities and resource constraints.

An important feature of the TA is to advise on the most appropriate contract pricing structures for a solid waste management contract.

1.1.4 Detailed Scope of Work

It is proposed that one international consultant would be responsible for providing the TA. Counterparts should be selected from the Public Services Department and the Legal Department in the Municipality to work with the international consultant in the design and implementation of the contracting systems.

The detailed scope of work for the consultant is set out below:

a Evaluate the Municipality's existing and proposed contracting arrangements. Any relevant legislation should be considered.

The Consultant should make use of the JICA Study Team's preliminary diagnosis of the Municipality's proposed contract management arrangements;

b Identify and recommend suitable contract management arrangements;

c Assist the Municipality to implement the recommended arrangements in two aspects:

1. setting up appropriate contract management procedures; and
2. developing the counterparts' and other personnel's contract management skills;

The focus of the TA should be to involve the Municipality's staff and to develop their skills. The counterparts should be trained in the new system by being involved at each stage of its design and implementation, i.e. they are **trained on the job.**

Pre contract award activities include the preparation of the specification, contract planning, setting tender evaluation criteria, prequalification, tender documentation,

tender invitation, evaluation and selection procedures, post tender negotiation and award of the contract.

Post contract award activities involve arrangements to monitor service delivery including the institutional arrangements, to monitor for compliance with contract terms and conditions, procedures to manage change to contract requirements or terms and conditions, and carrying out VFM assessment.

The consultant should also consider holding one or two seminars on specific topics and should invite the counterparts to identify suitable topics.

1.1.5 Activity Coordination and Reporting Requirements

The work of the consultant will be coordinated by the Director of Public Services at the Municipality, and its results jointly reviewed and evaluated by the World Bank and the Municipality, as well as any other Romanian authority possibly concerned by the matter.

1.1.6 Timetable and Outputs

The proposed timing of the consulting assignment would be as set out below:

Request for Proposals	1995
Select and Appoint Consultant	1995
Mobilisation of the Assignment	1995
Completion of the Assignment	1995

The consultant shall mobilise and initiate work within ....days of receiving the Notice to Proceed.

At the completion of Part 1 the consultant should prepare a short report covering the evaluation and recommendations for implementation.

At the completion of Part 2 the consultant should prepare a short report covering the results of the implementation.

1.1.7 Comments

The consultant is requested to make any comments and suggestions for improvements to the terms of reference in his technical proposal. The financial implications, if any, of these suggestions and comments should be shown separately in the proposal.

1.2 Draft Terms of Reference for Technical Assistance for Strengthening Bucharest Municipality's Capacity to Set and Implement a Waste Tax

1.2.1 Introduction and Background

This technical assistance assignment deals with the provision of technical assistance (TA) to the Municipality of Bucharest to enable it to set and implement a waste tax which will finance its municipal solid waste services. By municipal solid waste services is meant collection and haulage, disposal and street sweeping.

The Municipality is empowered to levy the tax under Law 27, 1994. It is proposed that a household waste tax and a business waste tax is introduced. Both are per capita taxes. The household tax will be levied on the number of household occupants and the business tax will be levied on the number of employees. The Municipality intends that the per capita business tax will be set at the same amount as the per capita household tax.

The Municipality is introducing the tax as part of its institutional and financial restructuring of municipal solid waste services. It is intended that the current service providers, RASUB (collection and disposal) and RGR (collection) will no longer collect tariffs but instead will be remunerated under fixed price municipal service contracts. It is also proposed that street sweeping, currently provided by the ADP's and financed out of general taxation, will be remunerated in the same way.

Under the proposed institutional restructuring, the Municipality is required to close down RASUB under GoR Ordnance No 69 and intends to split RASUB's collection and disposal activities. RASUB's collection services will be provided by a new commercial enterprise (CC). It is intended that disposal will subsumed as an Administration under the Municipality.

However, until this happens the Municipality intends to contract with RASUB to provide collection, disposal services and also street sweeping, which will be transferred to RASUB from the ADPs.

It is the Municipality's objective that all the operating costs of collection, street sweeping and disposal, as well as, the capital costs of collection and street sweeping are

recovered from the waste tax revenues. It is unlikely that the capital costs of disposal will be recoverable from the proposed tax.

Initially, however, MB considers that full cost recovery will not be possible because the waste tax would have to be set at a level much higher than the current waste tariffs. This position is supported by a recent survey which indicates that householders are willing to pay a higher tariff but on the condition of service improvements.

The Municipality has not carried out any financial modelling of waste tax revenues and costs to ascertain the level at which waste taxes need to be set to ensure full cost recovery.

In part this is due to the MB's inexperience of financial modelling. Furthermore, it has carried out an affordability study.

1.2.2 Objectives of the Technical Assistance Assignment

The primary objective of the technical assistance is to assist the Municipality to set and implement a waste tax which will ensure that waste management costs are recoverable and which is affordable.

Another objective of the technical assistance is to identify ways of improving the collection of the waste tax.

1.2.3 Scope of Work

The scope of the TA covers setting and implementing the waste tax and recommending ways to improve tax collection.

The TA would be primarily focused on the Public Services Department and the Economics Department.

It is proposed that one international consultant would be responsible for providing the TA. Counterparts would be selected from the Public Services Department and the Economics Department to work with the international consultant in the design and implementation of the tax.

The preparation of the waste tax should include an:

a Evaluation of the Municipality's proposals for introducing the waste tax and relevant fiscal legislation;

b Formulation of appropriate tax structures for the household waste tax and the business waste tax;

c Financial modelling of the waste tax to ascertain the level which will assure full cost recovery. The waste taxes should then be set taking households' and businesses' affordability into consideration. Ways to index the tax should also be considered; and

d Assisting the Municipality to prepare an implementation plan.

The Consultant should make use of the JICA Study Team's preliminary diagnosis of the Municipality's proposed waste tax.

The improvement of tax collection should include:

a recommending an appropriate method of collecting the waste tax so as to improve the rate of collection; and

b considering the sanctions available for non payment.

The focus of the TA should be to involve the Municipality's staff and to develop their skills. The counterparts should be trained in the setting and implementation of the waste tax by being involved at each stage of its design and implementation, i.e. they are **trained on the job.**

The consultant should also consider holding a seminar on specific topics and invite the counterparts to identify suitable topics.

1.2.4 Activity Coordination and Reporting Requirements

The work of the consultant will be coordinated by the Director of Public Services at the Municipality, and its results jointly reviewed and evaluated by the World Bank and the Municipality, as well as any other Romanian authority possibly concerned by the matter.

1.2.5 Timetable and Outputs

The proposed timing of the consulting assignment would be as set out below:

Request for Proposals	1995
Select and Appoint Consultant	1995
Mobilisation of the Assignment	1995
Completion of the Assignment	1995

The consultant shall mobilise and initiate work within ....days of receiving the Notice to Proceed.

At the completion of Part 1 the consultant should prepare a short report covering the evaluation and recommendations for implementation.

At the completion of Part 2 the consultant should prepare a short report covering the results of the implementation.

1.2.6 Comments

The consultant is requested to make any comments and suggestions for improvements to the terms of reference in his technical proposal. The financial implications, if any, of these suggestions and comments should be shown separately in the proposal.