

COLLECTION OF **MUNICIPAL SOLID WASTE**

Key issues for Decision-makers in Developing Countries

UN HABITAT
FOR A BETTER URBAN FUTURE

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INTRODUCTION

The collection of municipal solid waste is a public service that has important impacts on public health and the appearance of towns and cities. Unfortunately many urban administrations seem to be losing the battle of coping with the ever-increasing quantities of waste. The challenge is made greater by the diversity of materials in the waste, which is no longer mainly food waste and ash, but includes more and more plastic packaging, paper and discarded electronic equipment.

The booklet is written for decision-makers in the fields of local politics, management and technical issues and who are concerned to upgrade the solid waste collection service for which they are responsible.

This booklet serves as an introduction to a much larger book, also published by UN-Habitat, which is entitled "Collection of Municipal Solid Waste in Developing Countries", and which can be found on the CD accompanying this booklet, as well as being available in printed form. (In this booklet it is referred to simply as "the book"). The ideas and suggestions in this booklet are discussed and illustrated in much more detail in the book, and the reader of this booklet is encouraged to refer to the book for more information.

Solid waste collection faces a range of challenges, and the difficulties faced by one city can be very different from those experienced by another. The aim of this booklet is to assist the reader to find help for particular challenges. The first chapter presents some basic principles of good solid waste collection. Chapter 2 summarises the challenges

that commonly face decision-makers, and suggests strategies for improving the effectiveness, efficiency and acceptability of solid waste collection services. Chapter 3 suggests key points on decision-making.

Short answers to the following questions can be found in this booklet, together with links to more comprehensive information in the book.

- Why are we experiencing problems with our existing waste collection vehicles?
- How can we extend the coverage of our waste collection service to more of the urban population?
- How should the method and frequency of collection be decided?
- What information is needed to set up a reliable waste collection system?
- Where should public storage containers be located?
- How can we get the waste off our streets?
- Why do some modern collection trucks give disappointing results?
- What are the benefits of designing particular systems for particular cities?
- When is it necessary to install transfer stations?
- What can be done to ensure that the waste collection service is reliable and value for money?
- How can we involve the private sector so that we get a good service at reasonable cost?
- What should be done with informal waste pickers and recyclers?

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“The collection of municipal solid waste is a public service that has important impacts on public health and the appearance of towns and cities.”



1 BASIC PRINCIPLES

1.1 LOCAL FACTORS HAVE A MAJOR IMPACT

The failure to consider important parameters of each particular location has led to many failed systems and the wastage of huge sums of money. In many cases, collection vehicles and containers have been purchased in large numbers but they have not been effective and have been operational for only short periods that are much less than their expected design lives. In some cases unsuitable equipment has been purchased because of corruption, but in many cases the fault lies with the assumption that the same type of waste collection equipment will work effectively in any situation.

It is not difficult to understand how such mistakes are made. Sometimes decision-makers visit cities in industrialised countries that use sophisticated compaction vehicles, and often these cities are very clean. The visitor assumes that the cleanliness is the result of using complex vehicles and so he or she determines to purchase similar vehicles in the expectation that the same results will be achieved. Unfortunately the assumption is wrong, the vehicles are unable to provide the necessary service and the condition of the city deteriorates. In other cases the vehicles may be selected on the basis of advertising or following the visit of a persuasive salesman.

Because this is such an important factor it is worthwhile to consider the relevant local factors carefully. The sequence in which they are listed below is not significant. A more detailed discussion of these points can be found in Chapter 2 of the book.

a. **Expectations and attitudes of the citizens:** In some cities the residents expect that their waste will be collected from each house every day. In contrast, in northern Europe, citizens accept that their waste must be placed in street containers or collected from their houses once every week or even less frequently. Different requirements need different systems. Large compactor trucks are suitable only if relatively large volumes of waste are picked up at each stop. In some countries street containers are very unsuitable because waste is scattered around them, and residents will not accept to have a street bin located in front of their house. The distance that residents are prepared to carry their wastes is affected by cultural factors; in some cases residents find it unacceptable to be seen carrying their wastes in the street any distance at all. If children are sent to carry waste to a street container, the container must be of a size and type that allows children to use it.

   The level of concern for the environment varies considerably from one place to another. It is not uncommon for residents who keep the interiors of their houses immaculately clean to have no concern for the condition of the street outside the house. Many people seem to regard drains as acceptable places for dumping wastes, apparently unaware of the risks of flooding and mosquito-borne disease.

   Law enforcement officers and the courts are sometimes very reluctant to take effective action to prevent misuse of containers and careless dumping of waste.

   The design of storage and collection systems should take these attitudes and beliefs into consideration. It may be possible to change some attitudes with a concerted campaign of public education, but usually such changes take years rather than months and so it might be wise to design current systems for current attitudes.

b. **Climate:** Biodegradable waste (such as food waste) decomposes much faster at higher temperatures, and so, in a hot climate, to avoid the production of unpleasant smells it is necessary to collect the waste more frequently than in a cold climate. Flies, which are a major cause of infectious diseases, breed more rapidly at higher temperatures, again requiring more frequent collection. Large vehicles are not suited to frequent collections of small amounts of waste. Heavy rainfall may influence the type of storage container that is used.

c. **Type of waste:** There are huge differences in the nature of domestic solid waste from one region to another, and even between different parts of the same city. In some industrialised countries, the waste has a very low density[1] because it consists largely of paper and packaging; in other industrialised countries the residual waste after segregation of recyclables might be much heavier. In arid countries where yards and internal floors are not paved but bare earth, there may be a large quantity of soil in the waste, making it dense and abrasive. In tropical countries where fresh food is plentiful and canned food expensive, there may be large quantities of fruit and vegetable peelings and spoiled food, making the waste dense, wet and corrosive. In coastal areas where large quantities of fish are consumed, more frequent collection of waste may be necessary because of the smell. If wood, coal or charcoal are used for cooking or heating, the waste is dense, dry and abrasive, and storage containers must be made of material that is not damaged by hot ashes. If foliage is mixed with the waste, the resulting overall density is likely to be low, and if construction wastes and street sweepings are mixed in, the overall density may be high.

[1] Low density waste could be referred to as "light" waste. To illustrate density, consider a 200 litre oil drum filled with waste. If the waste has a low density, one man could lift and empty the drum. If the waste density is high, even three men might have difficulty in lifting the full drum.

Low-density organic waste



High-density organic waste





Low-density packaging and paper waste



High-density waste with street sweepings

Waste in business districts and expensive housing developments may be similar to the waste from industrialised countries, whereas the waste from informal shanty housing may be very different in nature.

Modern compactor trucks are designed to handle low-density waste that is relatively dry and not abrasive. Other kinds of waste require a different type of vehicle.

Chapter 3 in the book discusses the importance of waste characteristics in more detail.

d. **Architecture and infrastructure:** Dwellings with courtyards may have space for storing waste for several days, but compact housing with no space for storage may necessitate that some waste is taken outside the property as soon as it is generated. Narrow streets may not have space for locating storage containers and may be so narrow, tortuous or irregular that motorised collection vehicles cannot be used. Houses that are considerable distances from the nearest motorable road pose particular problems.

e. **Animals:** Waste storage containers in areas where there are domestic animals (dogs, cats, goats, etc) must take this into account and be fitted with lids, so that the waste is not scattered by these animals.

f. **Economic factors:** The balance between the cost of operating vehicles and the wages paid to waste collectors is an important factor to consider when deciding on the type of vehicle to use. Compactor trucks with small crews are used when wage costs are high compared to vehicle costs, but in low- and middle-income countries it is more economical to use larger crews and smaller, simpler vehicles. Solid waste management has often been used as an opportunity for generating employment in low-income countries, and in many cases this has resulted in excessive numbers of workers and low productivity. A more useful way of generating employment is to facilitate recycling by the private sector. The salaries of technical and managerial staff in the public sector are often lower than in the private sector, encouraging a drift of staff towards the private sector.

g. **Legislation:** There may be laws to prevent littering and to require households to have and use suitable containers for their waste, but often these laws need to be revised and the amounts

of the penalties increased. Employment laws may make it difficult to reduce the size of the workforce. Municipal laws may exclude the private sector from the provision of municipal services or prevent any form of integration of informal sector[2] waste collectors. There may also be a restriction on collecting waste from informal housing areas that do not pay local taxes.

h. **Financial planning and purchasing:** In many local government administrations there is little scope for financial planning in connection with solid waste management, because funds are received according to availability and at the decision of the mayor or another senior administrator. In some countries vehicles are provided by central government with no reference to the type of vehicle that the recipient authority wishes to have. The procurement of spare parts from abroad can be a slow and frustrating process, and in such cases it is essential to use types of vehicle that are in common use in the local area and for which spare parts are readily available.

It is hoped that this detailed discussion of factors that vary from place to place has persuaded the reader that local conditions have a very important influence on the selection and design of collection systems, and that it is very unwise to copy systems that are used in other places without a careful investigation of the local situation. More about this principle can be found in Chapter 2 of the book, and applications of this principle are found throughout the book.

1.2 INVOLVE THE PUBLIC

Experience has shown repeatedly that it is necessary not only to inform the public of arrangements for waste collection, and to

educate them regarding the correct ways of dealing with waste, but

[2] Informal sector waste workers are self-employed and are not officially registered for tax purposes. They do not receive a salary from any organisation but derive their income from selling what they pick from the waste or from informal payments from individual households.

that it is also important to involve the public in the planning of issues that affect them, such as the type of collection service, the frequency of collection, the provision and location of storage containers and the charges that must be paid for various levels of service. (See also Section 11.1.5 in the book).

1.3 OBSERVE AND LISTEN

In many cases the efficiency and effectiveness of existing equipment and systems can be improved by making adjustments that are not costly. By observing the ways that equipment is used and how team members work together it is often possible to identify improvements that result in higher productivity or safer working. Often the labourers themselves have useful suggestions for improving productivity, but is anyone in authority ready to listen to them?



It is important to listen to the views and ideas of the users of the waste collection system.



A well designed handcart can be a very efficient tool for primary collection of household waste

When manufacturing new types of equipment, designs and specifications are rarely optimised in the first item that is manufactured (the prototype). Usually there are details that need to be improved according to experience gained in using the prototype. A simple example is the handcarts used for collection of waste. Often the initial designs are not improved before large numbers are made, and so labourers are obliged to use handcarts that are too small or not sufficiently strong or too difficult to push or manoeuvre. The service would be more efficient if the operation of the prototype equipment is observed, the comments of the employees using it are considered and improvements to the design or method of use are made.

1.4 MEASURE AND MONITOR

Consultants and researchers are usually keen to sort and weigh waste to determine its composition, but other measurements which may be even more useful are often neglected. It is very useful to measure the productivity[3] of labourers and machines, and to calculate the unit costs[4] for different crews or different types of vehicle. Such information can be used to compare, to note the effects of adjustments and to estimate the benefits that would be expected from a proposed improvement. (Annex 3 in the book gives an example of unit cost calculations). The mathematics is not complicated but the input data must be sufficiently reliable and the analysis performed carefully. There is a saying heard in management circles: "If it cannot be measured it cannot be managed". Too often decisions are based on inadequate information. Annex A1 in the book discusses this further.

[3] Productivity is a measure of the output of a worker or a machine such as the number of houses served by a vehicle in an hour or the weight of waste collected by one primary collection worker in one shift.

[4] A unit cost is the cost per unit of output, such as the cost per ton of waste collected or the cost per house served.

2 PROBLEMS AND STRATEGIES

In this section some common problems with solid waste collection are described and strategies for responding to these problems are suggested.

2.1 SHORTAGE OF FUNDS

Lack of money is commonly cited as a major problem. The shortage may restrict operational expenditure – such as salaries, fuel and maintenance, or there may be a lack of capital for purchasing new equipment and vehicles. Problems may be also be caused by the administrative procedures that are followed to approve expenditure on purchases of spare parts and other capital equipment. Some of the following points may be useful in developing a strategy for improving the situation regarding finances:

Increasing the available financial resources by:

- increasing local taxes or increasing tariffs. This may be opposed by political leaders because of its unpopularity with the electorate. It may be possible to increase the charges paid by some users of the service (such as commercial and high-cost residential properties) and so cross-subsidise the service that is provided to low-income users. If improvements to the service are being planned it may be acceptable to the users to link an increase in the fees to this improvement. Some surveys that investigate residents' willingness to pay

for waste management have shown that even low-income groups are willing to pay for waste collection, and some have shown that the citizens may be prepared to pay more for an improved service.

- increasing the proportion of users who pay the local taxes or charges. This may be done in many ways, including
  - * linking payment for waste management to a service for which there is a high demand, such as electricity or the granting of business licences;
  - * increasing the motivation of fee collectors, by paying them a proportion of what they collect as a commission;
  - * increasing the service coverage so that the additional households that receive the waste collection service can be charged for this service;
  - * surveying new residential areas to check whether all properties that receive a waste collection service are paying for it.
- increasing the share of general municipal income that is allocated to solid waste management. There is usually considerable competition for municipal funds, and so a very persuasive case may need to be made to increase the proportion that is made available for solid waste management. If revenue collected as the solid waste management fee is paid into a general municipal fund, it may be useful to argue that all of it should be used for solid waste management.

It is sometimes said that recycling can generate additional income for municipal administrations, but this is very unlikely to be the case. If all costs are taken into account it is very rare for local government to make a profit from recycling.

The alternative method of improving the financial situation is to reduce costs. Recurrent (operation) costs are usually managed differently from capital costs. It is generally necessary to collect financial and operational data and calculate unit costs in order to determine whether any particular proposal will result in reduced expenditure. In many municipalities expenditures for solid waste management are not known because the various cost components are listed under different budget headings, such as salaries, administration and transport. In order to investigate the potential for cost savings it may be necessary to combine all these expenditures to arrive at the total recurrent expenditure on solid waste collection. If a new collection system is being proposed and its costs are to be estimated, it is beneficial to operate the system on a pilot basis to obtain realistic values for operational parameters.

Some types of waste collection vehicles are not efficient, because of the location factors discussed in Section 1.1 above, and Section 2.4 below. This is discussed in more detail in the book. However many municipal administrations in low-income countries have little influence over the type of vehicles that they use because they are provided either by donors or by central government.

Some municipal payrolls include significant numbers of ghost workers – they appear as names on the payroll and are paid wages but they do not exist or do not work. A careful check of the actual workforce can reveal the seriousness of this problem.

It is often the case that costs can be reduced by spending more on maintenance. Vehicles that are not operational because of neglect or delays in maintenance or repairs represent a cost because other vehicles are required to replace them in order to provide the required service. Improved maintenance (including keeping planned and monitored stocks of spare parts) can improve the efficiency of the vehicle fleet, which is a major capital investment.

Financial aspects of solid waste collection are discussed further in Chapter 10 of the book.

2.2 INABILITY TO PROVIDE FULL COVERAGE

Many cities are growing rapidly, in terms of both population and area. This growth places increasing strain on waste collection services, and often housing areas with difficult access or areas that have been recently developed receive no service. If a city is not able to serve all its citizens, the number of households paying the fee is less than it might be and the responsible administration may be regarded as incompetent.

More efficient use of manpower and equipment (for example, working two shifts each day) enables more waste to be collected with the same resources. Improved maintenance may lead to wider coverage, as more vehicles are on the road.

The private sector can be engaged to cover the shortfall in services. One option is to invite contractors or franchisees to take responsibility for collecting the waste from certain parts of the city and delivering it to the disposal site. Another option is to share the work so that private enterprises collect the waste from houses and shops and bring it to a transfer area (primary collection) and municipal vehicles pick up the waste from there and take it to the disposal site. Micro- and small enterprises can be very effective in primary collection from housing areas with difficult access because they use labour-intensive methods and simple equipment.

2.3 LITTERING AND ILLEGAL DUMPING

There are many reasons why citizens drop or scatter waste in streets, open areas and watercourses. In many cases improved enforcement and public education campaigns have a positive impact, but it is useful also to consider why wastes are not put in the designated containers and how wastes come to be scattered in public places. Some of

the reasons for this form of pollution are listed below, together with suggestions for improving each particular situation.

a. **Unsatisfactory street containers:** If street containers are inconvenient to use, people may drop their waste beside a container rather than in it. Users who come later do not wish to walk over the dumped waste to reach the container so they also deposit their waste outside it. This scattered waste takes more time to load into the collection vehicle than the waste that is in the container, resulting in lower vehicle productivity. Unsatisfactory features of the containers include a height that prevents children using them and lids which are difficult for children to open or considered to be dirty so that users do not want to touch them. (Foot-operated mechanisms for opening lids are useful for this reason, but often they are quickly broken.) Many cities in India are changing from the use of shared street bins to house-to-house collection because of their experiences with street bins. If street bins are being misused



This new street container is too high for children to use. The lid may be difficult to open even for adults.

for no apparent reason it would be useful to observe residents depositing their waste and to ask them why they do what they do. Chapter 5 in the book discusses bins and containers that are used to store waste ready for collection.

b. **Overflowing street containers:** If shared waste bins are overflowing, more capacity should be provided or they should be emptied more often. If portable containers are used capacity can be increased by adding another container. Some shared street containers that are intended for domestic waste are quickly filled by commercial waste – such as cardboard boxes from shops or process wastes from small factories. (In such cases examination of the waste should indicate its source and the shop or factory that has used the container should be warned first, and prosecuted if this behaviour continues. The adequacy of the collection of commercial waste should also be reviewed.) There should be a mechanism by which overflowing bins are reported by collection crews or their supervisors, in order to cope with this problem and demonstrate to the citizens that the waste collection service is alert and responsive.

   If bins are not being emptied at the required or intended frequency, it may be helpful to improve the maintenance of the collection vehicles or to engage private sector vehicles to ensure the required frequency of emptying. If there is an excessive interval between collections, containers may overflow, and there may be a serious nuisance from smell, flies and scavenging animals. In such cases residents sometimes set fire to the waste, thereby polluting the surroundings with unpleasant and toxic smoke.

c. **Wrongly located street containers:** Shared street containers must be located in places that are accessible to collection vehicles and within easy walking distance of all the houses they are intended to serve, and should be kept at locations that are acceptable to local residents. (If local residents object

to the presence of a street bin they may remove it or damage it.) Residents may be unwilling to cross a busy road to reach a waste container. The opinions of local residents should be sought before the locations of shared waste containers are determined.

d. **Ignorance and careless behaviour:** In many cultures, people walking along streets or driving along in their cars think it quite normal to discard unwanted items on the street or along country roads. It is clearly dangerous to discard broken glass and other sharp items in this way; dog faeces are a health hazard, and chewing gum can be a considerable nuisance, but the impact of other types of waste is largely aesthetic. If opinion leaders and decision-makers are content to let littering with non-hazardous materials continue, there may be little purpose in trying to change behaviour and to enforce anti-litter laws. If, however, littering is considered anti-social, or there is a concern to reduce the costs of street sweeping, then it is necessary to mount a sustained education and awareness campaign and to develop a strategy for enforcing laws that include effective penalties. Many such campaigns use cartoon characters and make special efforts to influence schoolchildren. It is also important to ensure that the necessary litter bins are in place and emptied regularly so that it is convenient for pedestrians to handle their waste in a responsible way.

   Some cities ask residents to sweep the street in front of their houses, and organise clean-up days when everyone is supposed to clean the streets and open spaces. It is intended that such arrangements encourage citizens to be aware of the benefits of avoiding littering.

   It is important also to keep the areas around waste containers clean, because citizens are more likely to dump waste illegally if there is already some waste there, and are less likely to leave their wastes on a surface that is clean. It is therefore useful



Waste containers should not be located next to open drains. Here, waste from the bunker is blocking the drain.

to instruct sweepers to clean around container sites several times each day. Local residents or shopkeepers may be asked to report littering problems around street containers.

e. **Dumping waste in drains:** Many people seem to think that drains are a good place for waste. They probably imagine that the flowing water will flush all the waste away so that the waste will no longer be a nuisance. In fact, drains are the worst possible place for waste because the waste blocks them, providing stagnant stretches of water for mosquitoes to breed in and causing flooding. Removing waste from drains is often a difficult process because the waste is heavy and it may either lose its cohesion so that it can only be removed in small pieces, or it may combine with sand and grit to form cemented deposits. Open drains are often relatively deep and narrow so that cleaning requires special tools that conform to the shape and width of the drains, and cleaning of culverts and partially covered drains is laborious work. It is important to provide a

convenient alternative to dumping into drains – that is, bins that are carefully located and regularly emptied.

Solid wastes may be blown or washed into drains, and therefore storage containers and transfer areas should never be located next to open drains.

f. **Scattering of waste from official waste collection vehicles:** When waste collection vehicles are being loaded – either manually or mechanically – small amounts of waste may be dropped on the road and later scattered by passing vehicles or the wind. It is useful to co-ordinate the work of street sweepers and the collection crews so that any waste dropped in this way is quickly cleaned up. The waste in open collection vehicles should be covered by a tarpaulin or net except when the vehicle is moving slowly from one collection point to the next, to prevent wastes being scattered. Even if the actual quantities are small, it is important that the waste collection service sets a good example.

g. **Scattering by waste pickers:** In many countries waste pickers (also known as scavengers and waste recyclers) sort through waste in street containers, looking for items that they can sell for recycling. Sometimes they scatter – either around the containers or in a place where they sort what they have taken – waste that is not useful to them. Their recycling of materials that would otherwise be discarded has economic and environmental benefits, but the scattering of waste is not to be encouraged. The cleanliness of the area around a container can be controlled by giving particular waste pickers responsibility for particular containers, allowing them to take what they like but requiring them to ensure that the surroundings are kept clean. Providing spaces for them to sort what they collect without being harassed can also help to reduce the scattering of waste in the street. Section 11.3 in the book provides more information and ideas regarding the informal sector.

h. **Fly tipping:** Fly tipping is the illegal dumping of waste – usually truckloads of construction and demolition debris – in an unauthorised place in order to avoid the costs in time and fuel of transporting the waste to the disposal site, as well as the costs of disposal. Waste may also be dumped in unauthorised places by contractors who collect municipal waste. Close supervision of construction sites, good records of vehicles arriving at the official disposal site, and the co-operation of the public in reporting illegal dumping are all useful means of control.

   Chapter 6 in the book discusses in more detail about keeping streets and drains clean.

2.4 USE OF UNSUITABLE VEHICLES

Section 1.1 of this booklet emphasised in some detail the importance of taking local factors and peculiarities into consideration. This is particularly important in connection with the specification and design of the vehicles used for collecting waste. Chapter 4 in the book discusses collection systems as a whole and the largest chapter in the book – Chapter 7 – is concerned with the selection of waste collection vehicles.

In selecting vehicles for waste collection two errors are commonly made. One is to choose sophisticated compactor trucks when they are not suited to the local conditions – in particular the type of waste, the financial capacity of the operator, the standards of maintenance and the access roads. The other common error is to use vehicles which are designed for materials that have a much higher density than solid waste, so that the load-carrying capacity is too small and the productivity is low. A further problem with many vehicles used for collecting waste is that the waste must be lifted very high to get it into the vehicle and no suitable mechanism is provided to do this lifting, so it is done manually in an unhygienic and inefficient way.



Large, sophisticated compactor trucks work very well in some situations but not in others.



This vehicle used to be a compactor truck. When the compaction mechanism failed the rest of the truck was still operational, so the compacting mechanism was removed.

There is no single type of waste collection vehicle that is suited to all of the wide range of conditions and requirements. In addition to all the factors mentioned in Section 1.1 above, the distance to the disposal site and the time taken to get there must be taken into account. In many cases it is economical to transfer waste from small collection vehicles to large bulk transport vehicles which take the waste for most of the distance to the disposal site. Again, there is no universal rule about when such transfer is preferable, and so it is necessary to consider each specific situation and calculate the unit costs for the various alternatives. Chapter 8 in the book is concerned with the transfer of waste in this way.

A further consideration is recycling. Segregation at source for the purpose of recycling is pointless unless the wastes are kept separate when they are collected. Compaction of mixed waste degrades the quality of recycled materials that may later be removed by sorting.

It is important to consider the collection system – from the initial storage containers to the disposal site – as an integrated whole. It should be possible to load the waste in the storage containers into the collection vehicle in an efficient and hygienic way. If there are two stages in the collection of waste and its transport to the disposal site, they must be carefully co-ordinated in terms of technology and logistics. If collection vehicles are required to drive on landfilled waste, they should have appropriate design features such as good traction and sufficient ground clearance.

Chapters 4, 7 and 8 in the book present several collection systems that are suitable for low- and middle-income countries. Unfortunately some of the recommended types of vehicle are not in current production and so would need to be manufactured specially. If vehicles of a new or modified design are to be manufactured, it is necessary to first build a prototype and revise the design and manufacture details according to operating experience, before producing larger numbers. If the development costs are not covered by a grant from government or an international agency, the manufacturer must add



Small tipper trucks are easy to load. In some situations they are very suitable for primary collection.



These small trucks sometimes unload directly into a larger truck which takes the waste to the disposal site.

the costs of the development of the first prototype vehicle to the selling price of vehicles manufactured subsequently. If many vehicles are ordered this additional component on the price of each vehicle to pay for development will be small. Therefore there is a need for co-ordination between cities or development agencies to ensure a sufficient number of orders and an attractive price.

Many cities in China have very successful collection systems with small transfer stations located in densely populated urban areas. This system has many advantages that would make it very suitable in urban centres in other countries. It is described in Section 8.2.4 of the book.

It is hoped that the comments made here and the information in the book will convince decision-makers that the design of waste collection systems and the specification and selection of the vehicles requires careful planning and detailed evaluation of technical and financial information, and so should be based on inputs from a range of experts, instead of being made by the senior executive alone. The advice of international consultants should not be followed unless it is clearly based on careful evaluation of the local situation, needs and resources.

2.5 UNRELIABLE VEHICLES

Vehicles may be unreliable because they are not suited to the work they have to do or the conditions they work in, because they are driven carelessly or misused in other ways, or because they are not properly maintained. The reliability of vehicles can be measured in terms of their availability, which is the proportion of the time that they are available for service.

The first step in ensuring that vehicles are reliable is to select and specify them carefully. Special features may be needed for vehicles that spend much of the time starting and stopping and moving at low speeds or that work in hot or dusty conditions, or on bad roads. Their load-carrying capacities should be matched to the weights of waste that they will carry, so that they are not overloaded.

The time taken to obtain spare parts has a major impact on the reliability or availability of a vehicle. As discussed in Section 9.5 of the book, the procurement of spare parts may be delayed by bureaucratic hurdles as well as logistic requirements. It is therefore highly

recommended to use truck chassis that are widely used in the locality for other purposes – so that spare parts can be purchased from local dealers rather than requiring foreign exchange and importation – and that the load-carrying bodies should be made within the country so that repairs can be made quickly.

The tender specifications for vehicles should be prepared in a detailed and careful manner so that the selection of the cheapest offer does not result in the purchase of vehicles that are not capable of providing the required service.

In many cases the culture of maintenance needs to be changed. Waiting for breakdowns and making emergency repairs is an approach that results in low reliability. Preventive maintenance monitors the condition of each vehicle by means of routine checks, and aims to replace components before they fail. This preventive maintenance results in higher availability so a smaller fleet of vehicles is needed to achieve the required level of performance. Annex A2 provides the documentation needed to operate a preventive maintenance system.

Bad driving can cause rapid damage to clutches and tyres, as well as bodywork and other components. Records of all such damage can show which drivers need to be retrained or replaced.

Chapter 9 in the book discusses this important aspect of waste collection in more detail.

2.6 OUR SYSTEM IS OLD-FASHIONED AND WE ARE NOT RECYCLING

The important consideration with regard to a waste collection service is not whether it appears old fashioned or modern; what matters is whether the waste is being collected in an efficient, hygienic and reliable way. It is important to focus on the results and not the method. Each local situation has particular characteristics that require a waste collection service that has been designed to suit the

local characteristics. It is a mistake to think that there is one best system for any situation. In many cases collection methods that some would consider "old fashioned" provide much better results than equipment that is considered modern. In many cities manual methods, using handcarts or small vehicles, provide a much better service than what could be provided using large and sophisticated compactor trucks.

The same is true for recycling. Different methods are needed for different conditions. Recycling can have environmental and economic benefits if it is done in a sustainable way. The expensive methods used in industrialised countries are not generally needed in low- and middle-income countries because of the large numbers of informal sector workers who separate and sort mixed waste much more effectively than the semi-mechanised methods used in richer countries. Informal sector recycling costs local government nothing. Efforts are needed everywhere to encourage at-source segregation. Cities that have effective informal sector recycling should look for ways to assist the informal sector to improve its output rather than trying to replace informal recycling with municipal systems.

More information can be found in Annex A4.2 in the book.

2.7 EXPERIENCE WITH CONTRACTORS HAS BEEN DISAPPOINTING

Private sector companies – working as contractors, franchisees or in open competition – can offer significant advantages in providing solid waste collection services and in maintaining vehicles, because of their specialised expertise and their low level of bureaucracy. If the waste collection service is contracted out, the required municipal expenditure is clear and capital costs are absorbed into monthly charges. Other advantages of private sector participation are discussed in many books and papers, including those listed in the references in Annex A6 of the book. Section 11.2 in the book also

discusses private sector involvement.

However, experience has often been disappointing. In many cases this has been because the responsible local government officials have not been sufficiently prepared, so that contracts and expectations have been inappropriate, tendering and selection procedures inadequate and monitoring and management have been ineffective. Even when services are provided by the private sector, considerable responsibility remains with the public sector. Officials must beware of monopolies and respond to the threat of corruption in a wise and balanced[5] way.

2.8 TOO MANY COMPLAINTS

Municipal managers should welcome complaints for two reasons:

- Complaints are a means of monitoring the service. Waste collection workers are active all over an urban area, and it is difficult to supervise them and monitor their activities over such a wide area. Complaints from residents and shopkeepers are a useful source of information about how the waste collection service is being provided, indicating where the planning has been inadequate, where workers have not followed instructions and where extra resources are needed. (Sometimes shopkeepers and residents are enlisted as voluntary or part-time inspectors.) This is not to say that all complaints are useful, since some may be unreasonable or result from citizens not understanding their own responsibilities. Records of incidences of complaints can be a useful indicator of performance and proof of progress.

- Complaints are a point of contact with users of the service. Complaints should be responded to in a professional

5 In some cases the fear of being accused of corruption causes municipal officials to behave in some very undesirable ways towards contractors, to demonstrate that they are not taking bribes. Therefore the two dangers of corruption and fear of accusation must be considered in a balanced way.

manner by a municipal official who listens carefully, is able to influence the way the service is provided and who reports back to the person who made the complaint on the action that has been taken. Such opportunities for contact between municipal officials and the general public can be used to "win friends" – to develop appreciation and understanding of the waste collection service.

2.9 LACK OF PUBLIC CO-OPERATION

Solid waste collection is a service that requires the co-operation and participation of a large proportion of the citizens. If the level of this co-operation is considered to be inadequate, one or more of the following suggestions may help to improve the situation:

Do the members of the public understand what they are required to do? It is often necessary to provide information in several different ways before it is received and understood by the majority of the population. A short survey based on samples of the various socio-economic groupings in a city may be sufficient to indicate if the citizens understand what they are requested to do with their waste.

Do the citizens understand enough about the waste management service that they can understand why it is necessary to charge them for the service or to increase the charges? It may be necessary to explain how the revenue is used, and that it is not sufficient to simply engage someone to collect the waste and dump it around the corner. Transparent accounting and opportunities for members of the public to learn more about the solid waste management system may be helpful in explaining the need for payment of charges.

Has the public been consulted? If citizens have been asked to do something that is unacceptable to them, it is understandable that they do not co-operate in that aspect. Consultation with users should be part of process of the planning of aspects of the service that affect them directly. Neighbourhood committees may be a

useful mechanism for learning about the priorities and requirements of residents.

If this two-way flow of information is not effective, it is necessary to resort to an enforcement system that includes a clear presentation of the required behaviour and the penalties for non-compliance, as well as effective implementation of these penalties when necessary.

To summarise this booklet, the following guidelines are suggested for use when decisions regarding solid waste collection are to be made:



Tractor trailed bins can simplify problems of door to door waste collection.

3 SOLID WASTE COLLECTION – MAKING DECISIONS

- Involve heads of the transport and operations sections in discussions relating to the selection of new equipment, so that available technical advice is considered and their sense of responsibility and ownership is increased.
- Always keep in mind the objective of providing an economical and reliable service and select options that can best reach this objective in the particular local conditions. Remember that, in many situations, simple vehicles perform much better than large, complex compactor trucks.
- Do not attach much importance to the recommendations of international consultants unless they show that they have a good understanding of local conditions and can explain how they have taken local conditions into account.
- Listen to the views of employees at all levels, and to the public, before deciding on issues for which they have particular knowledge or interests.
- Encourage the collection and use of local data, particularly on costs and operations, so that unit cost data can be used when making decisions and the progress of the service can be monitored using performance data collected at regular intervals.

- Be open to the involvement of the private sector, but do not expect miracles. Before involving the private sector ensure that the municipal staff who will be involved are well trained.
- Look for ways of working with the informal sector waste workers so that increased quantities of waste are recycled, the streets are cleaner and their working conditions are improved.



Collection of municipal solid waste
Key issues for Decision-makers in Developing Countries

This booklet is concerned with the collection of garbage and other types of solid waste from houses, shops and other commercial premises, and with the sweeping of streets and public areas.

It has been written for two purposes.

The first purpose is to provide suggestions to guide decision-makers when they are considering changes in waste collection equipment or in the way that a waste collection service is provided or managed. Because decision-makers often have little time for reading, it is written in a concise form and avoids details. It begins by introducing four basic principles and then discusses common problems or challenges and possible ways of managing them.

The second purpose is to introduce a comprehensive new book, also published by UN-Habitat, and also on the topic of municipal solid waste collection. This book provides a wealth of explanations, examples and practical information on how to make waste collection systems economical, reliable and sustainable. This book can be found on a CD that is included with this booklet.

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