

Non-Governmental Refuse Collection in Low-Income Urban Areas

Lessons Learned from Selected Schemes in Asia, Africa and Latin America



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March 1996

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Preface

Inadequate waste collection coverage of the population to be served has been identified by SANDEC (formerly IRCWD) in 1992 as one of the most important problem areas of Solid Waste Management (SWM) in low and middle-income countries. Although municipal authorities in these countries increasingly acknowledge the importance of adequate solid waste collection and disposal, it is mostly beyond their resources to collect the growing amount of solid waste generated by the expanding cities. Consequently, refuse is indiscriminately dumped on roads and into open drains, thus leading to serious health risks and to a general degradation of the (living) environment for millions of people. The problem is most acute in low-income peri-urban areas where access with collection trucks is difficult and/or the population cannot afford the conventional door-to-door service.

The only realistic approach to improve this situation is for the population of low-income areas to assume the responsibilities of the municipality with regard to the handling of its waste, and to set up a system appropriate to its economic standing. This can take different forms; i.e., schemes operated and managed at community-level by community organisations or small private enterprises. Such types of non-governmental refuse collection systems have been initiated and tested over the past years by several organisations in different cities in Latin America, Africa and Asia. Owing to the limited literature on the experience gained so far, and to the great number of people and institutions looking for alternatives to improve solid waste collection in low-income urban areas, SANDEC decided to review a number of selected cases and publish a synthesis of the most important lessons learned.

It is clear that such a report, which is mostly based on information and experience gained by others, could only be prepared with the commitment and collaboration of a great number of individuals. SANDEC is especially grateful to the numerous organisations and individuals who have been involved in developing the described non-governmental refuse collection schemes and who have shared their experience with us. Many of them are mentioned in Annex 3 of this report. On this occasion, SANDEC would like to apologise to all those individuals and/or organisations who might feel that their contribution to the described schemes has not been given due credit. This is unfortunately quite often the case with a report of this nature as it is very difficult for an outsider to establish objectively and in the limited time available the specific contribution of each of those involved, especially if only a few written documents are available. Please bear in mind that the purpose of this report is to learn as much as possible from the experience gained so far with alternative refuse collection schemes, and to share it with those who are eager to improve the environment in low income areas.

The authors wish to thank all those specifically involved in the evaluation of the selected schemes and in the preparation of the report. We wish to acknowledge in particular the work of Werner Meyer, who compiled most of the case study material and who evaluated some of the schemes. Peter Hawkins prepared a first summary of the community-based studies and thus greatly facilitated reviewing of the different material. We also highly appreciate the work of the NGO Dian Desa which evaluated most of the schemes in Indonesia, and of Tore Roy Semb who conducted the studies in China. Finally, we wish to thank Ricardo Giesecke for sharing his knowledge and experience on micro-enterprises in Latin America.

A draft of this document was sent for review to several resource persons who assisted us in complementing the information contained in this report. In particular we wish to thank Dr Graham Alabaster (Kenya), Dr Carl Bartone (USA), Ato Brown (Switzerland), Dr Ousseynou Diop (Senegal), Peter Hawkins (Brazil), and Tore R. Semb (Norway) for their valuable contributions.

Finally, we should like to express our thanks to Lydia Zweifel for the illustrations, Sylvie Peter for her linguistic revision and Brigitte Hauser for script processing.

Duebendorf, March 1996

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Acronyms, Abbreviations and Currency Equivalents

CBO	Community-Based Organisation
CP	Communal Collection Point
DS	Disposal Site
ESA	External Support Agency
ME	Micro-Enterprise
NC	Neighbourhood Committee
NGO	Non-Governmental Organisation
SW	Solid Waste
SWM	Solid Waste Management
TP	Transfer Point

cap	capita
coll.hr	collector hour
d	day
ha	hectare
hh	households
hr(s)	hour(s)
inh	inhabitants
km	kilometre(s)
m	metre(s)

Currency Equivalents to US\$ 1:

Indonesia:	2,000 Rupiah (1993)
China:	5.5 RMB (1992)
Ivory Coast:	267 CFA (1993)
Burkina Faso:	267 CFA (1993)
Peru:	2.14 Soles (1994)
Colombia:	800 Pesos (1994)

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Introduction

Background

In recent years, Solid Waste Management (SWM) has become an important issue with urban governments of low and middle-income countries. However, although respective municipal institutions have been commissioned to deal with solid waste and considerable financial resources have been allocated, most administrations still fail to provide the basic public service of refuse collection to a large section of the population.

The main reason for this situation, and for many other actual problems in urban areas of low and middle-income countries, is the rapid and unregulated urban growth. Local authorities have difficulties in keeping pace with this development and in meeting the growing demand for infrastructure and public services such as refuse collection. Although most governments increasingly acknowledge solid waste as a source of immediate and serious problems, political priority related to waste and social prestige of people dealing with SWM are still very low and limit rapid and sustainable improvements in this sector. Other reasons for the inadequate service coverage include operational deficiencies and use of inappropriate technologies which lead to an inefficient use of time and resources. Furthermore, since municipal authorities tend to allocate the remaining resources and services to the richer areas of higher tax yields where citizens dispose of the required political pressure, mainly low-income peri-urban areas and squatter settlements remain underserved (Figure 1).

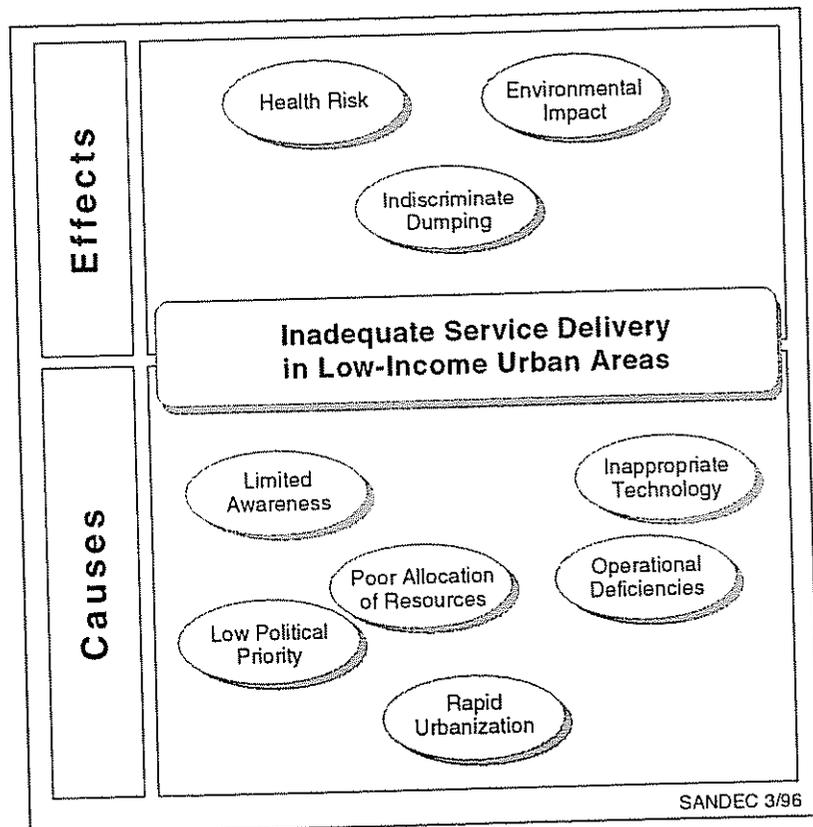


Figure 1:
Causes and effects of
inadequate service
delivery in low-
income urban areas

As a result of the insufficient service coverage, the uncollected refuse, which is often mixed with human and animal excreta, is dumped in drainage systems, rivers and surrounding areas, or is locally burnt. These practices pose a serious health risk to the population and lead to a considerable environmental degradation. Thereby, both effects impair in the long run not only the quality of life of the poorer communities but also affect the welfare of the entire urban population, with negative impacts on the national economies. Every municipal administration should thus be interested in solving its SWM problems, either by providing service delivery through its own enterprises or mandating and supporting communities and/or the private sector to carry out part of the SWM services.

Scope of the Report

This report aims at summarising some of the experience gained with non-governmental refuse collection in low-income urban areas; i.e., with schemes which are operated and managed at community level by community-based organisations or small private enterprises. It also reveals the most critical operational and managerial aspects of alternative collection services and assesses the basic conditions for establishing successful schemes. The report addresses mainly professionals from municipal institutions, non-governmental organisations (NGOs) or external support agencies (ESAs) which are aware of the urgent need for improvement in this sector and willing to support appropriate options. Written as a summary of lessons learned, it is to hope that the report and following discussions will further help to find appropriate solutions for increased service coverage.

Focus is given on the collection of domestic refuse as generated in households and commercial premises. Other relevant features of the solid waste cycle, such as reuse, recycling, transport, treatment, and final disposal, are only dealt with in so far as collection is influenced. It is clear that a collection scheme cannot be viewed separately but as a component part of the overall SWM system. Management of hazardous and toxic hospital and industrial wastes is not within the scope of this report. As a basic rule it can be stated that management of hazardous wastes lies within the responsibility of the producing industries which have to collect and dispose of these wastes separately. The presence of industrial wastes in the domestic waste stream must be avoided at all costs.

Data and information have been collected during visits by or on behalf of SANDEC to selected schemes in different cities in Asia, Africa and Latin America (Figure 2). The different types of approaches used range from community-based schemes in Indonesia, China and in some parts of Africa, to schemes in Peru and Colombia operated and managed by small private enterprises. In addition to these main studied cases which are summarised in Annex 3, the lessons learned are also based on visits to schemes in Accra (Ghana), Karachi (Pakistan), La Paz (Bolivia) and Lima (Peru). Despite the considerable cultural differences prevailing between the different countries and even between cities within the same country, the studied schemes revealed some generic findings.

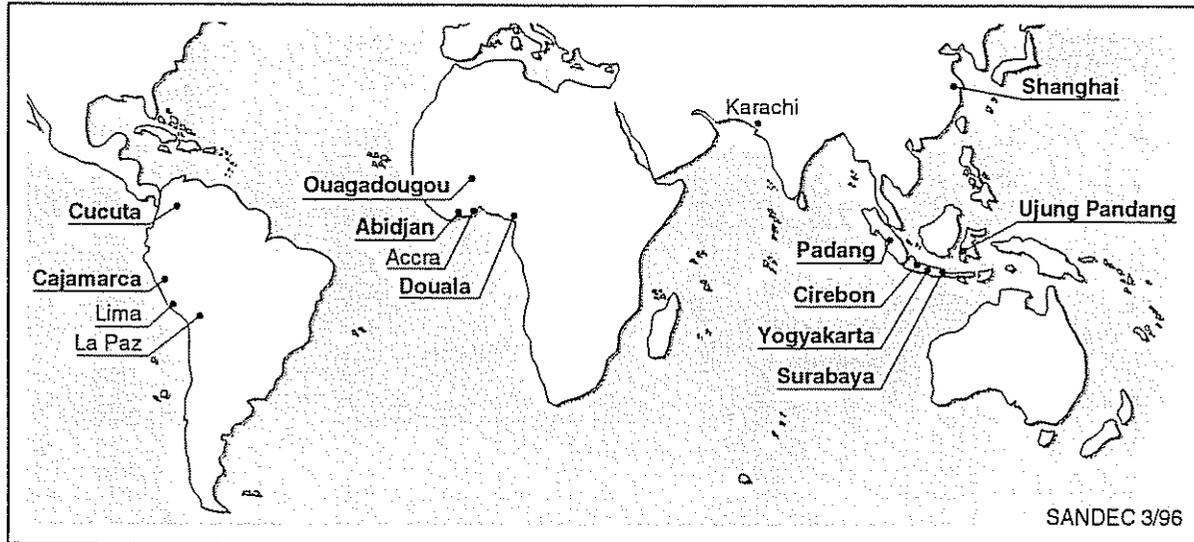


Figure 2: Location of selected and evaluated schemes

The report is subdivided into three sections describing the most important features associated with refuse collection schemes: Technical and Operational Aspects (Chapter 1), Organisation and Management (Chapter 2), and Service Costs and Financing (Chapter 3). These main chapters are followed by a Summary of Conclusions and Open Questions. Relevant documents and publications reviewed for this report are listed in the References. The Annexes comprise a Preliminary Check List for Appropriate Collection Schemes (Annex 1), a Model Contract between Public Authorities and Small Private Enterprises (Annex 2) and a Description of the Evaluated Cases (Annex 3).

Chapter 1

Technical and Operational Aspects

Although technical and operational aspects are regarded as the easiest part of implementation, technical design is of prime importance. Establishment of the collection perimeter, design and selection of equipment, definition of the operational pattern and technical coordination with the overall SWM system are factors that significantly influence efficiency and sustainability. Most of the studied cases have revealed shortcomings as regards collection of basic information and technical design which have often led to operational deficiencies or to a total break down of operation. Some of the main issues to be considered and lessons learned are summarised hereafter. An illustrated overview of the basic technical options relating to the studied cases is given in Figure 7.

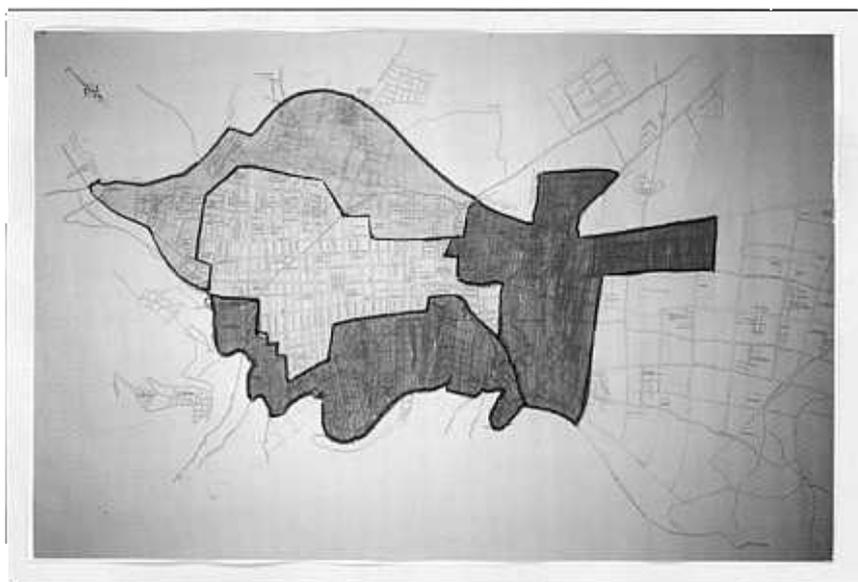
Assessment of the Situation

Information on the prevailing conditions
and needs helps to avoid mistakes

One of the first steps in planning a scheme is to define the most suitable service perimeter and to collect basic information on the area and on the potential beneficiaries to be served. Careful analysis of the situation may greatly help to avoid mistakes which are difficult to correct at a later date. Assessment of the needs and priorities of the households to be served and their ability and willingness to contribute to a scheme are thereby key factors.

A viable collection perimeter

Apart from technical aspects, such as geographic conditions and topography, social, ethnological and economic characteristics of the communities, as well as existing (e.g. historical)



In the Andean town of Cajamarca (Peru), the municipal agency serves the central (business) perimeter whereas a contracted small private enterprise is responsible for service delivery in the surrounding low-income areas. With the collection frequency of twice a week, the enterprise's perimeter is divided into three parts.
(Photo: SANDEC)

boundaries and the influence of strong community organisations should be taken into consideration when defining a collection perimeter. Prospects of internal cross-subsidies for lower income areas by richer households and special charges for commercial premises are other issues of concern. Furthermore, information is required on existing SWM practises (e.g. recycling), and on the available infrastructure (e.g. roads and storage facilities). Finally, integration of the primary collection schemes into the city-wide or even regional SWM system is of utmost importance, particularly with regard to siting of communal collection points, interface with secondary collection and availability of landfill sites.

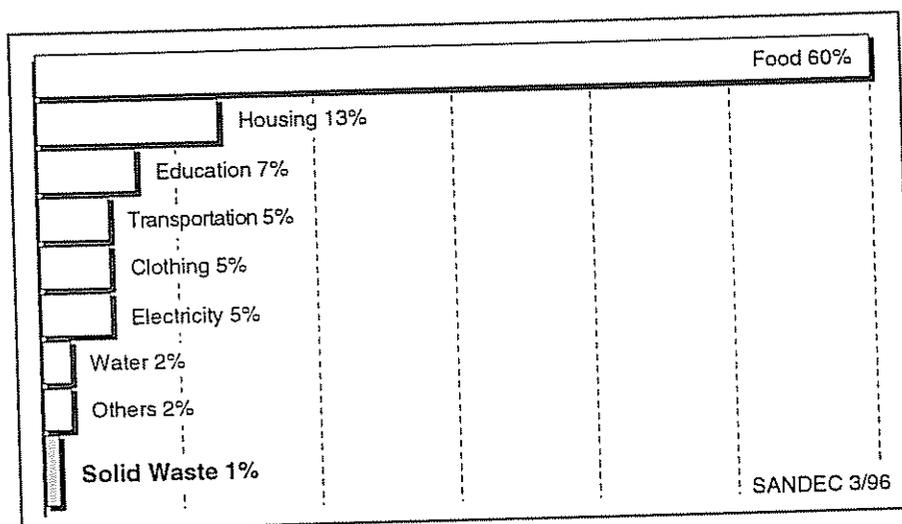


Figure 3:
Typical distribution
of expenditure and
the setting of
priorities in a low-
income urban
household.

Needs and priorities of the users

Adapting the scheme to the perceived needs of a community and involvement of the future users in decision-making; i.e., choosing a system, is a pre-condition for broad acceptance. Thereby it has to be taken into consideration that solid waste will certainly not receive highest priority in a low-income household. As exemplified in Figure 3 with survey results from Yogyakarta (Indonesia), expenditure such as on food (which typically accounts for 50-80 % of household incomes), housing, clothing, electricity and education receives evidently higher priority [10]. Although the obtained data originate from only one specific area, it can be assumed that the presented distribution of priorities and expenditure is typical for low-income areas. Apart from the fact that solid waste ranks at the very end of priorities, it has been observed that households have a different perception of refuse collection than planners and decision-makers. **While decision-makers are likely to focus on aspects of environmental protection and public health, the average user reportedly perceives refuse collection more in terms of convenience and aesthetics.** Consequently, promotion for a collection scheme should focus on these identified perceived needs of a community rather than on idealistic arguments. However, to achieve a sustainable improvement in the long run, it is nevertheless important to adequately inform the users about the negative impacts of inappropriate solid waste handling.

Ability and willingness to contribute

Compared to other municipal infrastructure services, refuse collection schemes, and in particular alternative approaches, require considerable participation from the users (e.g. storage in households, carrying the waste to the roadside or communal containers, paying through user fees). Capacity and willingness of the households to contribute to the service is therefore a limiting factor to be analysed prior to establishing a new scheme. In general, the majority of the population in squatter settlements lives in poverty and the ability to contribute in cash is thus very limited. Assuming that an average household income in the focused areas amounts to about US\$ 150, the theoretical ability to pay for a refuse collection scheme - according to the aforementioned list of priorities - is around US\$ 1.5 per household and month. **Low-cost solutions consequently are a pre-condition for approaches to be successful, and contributions in kind, such as carrying the refuse directly to a communal container, an option to be seriously considered.** Besides the ability of the households their willingness to contribute is, however, also a limiting factor which is dependent on the felt need of the population for solid waste collection. Once the need for solid waste removal is recognised, the residents are more likely to contribute to a collection service in cash or in kind, depending on their actual financial situation. Strengthening awareness with regard to environmental health risks will therefore enhance people's willingness to contribute.

Basic Data Requirements

Reliable data on waste generation and characteristics are decisive factors for technical and operational design

Per capita waste generation rates and average densities are essential key parameters for determining the number of vehicles and personnel required, as well as for selecting the appropriate equipment. A careful assessment of amount and characteristics of refuse within the selected collection area is thus decisive for a good service performance.

Waste generation and composition

Rates and composition of household waste vary considerably in place and time. Besides cultural traditions (e.g. food habits), mainly socio-economic characteristics influence the nature of refuse in a certain area [17]. The higher the income, the greater the generation rate and the proportional content of paper, plastic, glass, and metal. The percentage of compostable waste and waste density values will thus decline with increasing income. This clearly suggests that it is not possible to adopt a generalised view with regard to refuse generation and characteristics. **Available data from one area should therefore only be applied to another if the socio-economic, cultural and religious conditions are very similar.** Table 1 presents some of the relevant data from case studies and shows the significant variations which exist even between comparable low-income areas of different cities. The generation rates range from very low values of around 0.17 kg/cap.day in Panaji (India) to 0.54 kg/cap.day in Ouagadougou (Burkina Faso), with density values between 0.35 t/m³ and 0.85 t/m³.

Table 1: Waste generation rates and characteristics

Generation [kg/cap.day]	Density [t/m ³]	Compo-stable [%]	City, Country	Ref.
0.17	–	70	Panaji, India	[32]
0.20	0.35	68	Receife, Brazil	[21]
0.35	0.40	–	Cajamarca, Peru	[20]
0.50	0.46	–	Shanghai, China	[9]
0.54	0.85	21	Ouagadougou, Burkina F.	[16]

The observed variations are, however, unlikely to be caused only by differences in socio-economic characteristics. The main problem with reported data is that analytical methods and particularly selected sampling points may not be identical, and therefore lead to results which cannot be compared. It is important to know whether the available data reflect waste characteristics at the household level or at communal storage bins where the waste is subject to changes in weight and composition; i.e., biodegradation, scavenger activities, rainfall and street sweepings. The surprisingly high waste density value in Ouagadougou (which seems in contradiction to the low compostable fraction), may for instance be caused by the addition of sand from street sweeping to the storage bin, and lead to a considerable change in weight and composition of the analysed waste. Hence, available data have to be judged very carefully. If reliable data are not available and no detailed analysis has been carried out, a **first approximation of average domestic waste generation in a low-income community can be estimated at 0.5 kg/cap.day, with refuse densities of about 450 kg/m³ [15].** In any case, it is recommended to carry out individual analyses for each area to be served, based on the chosen collection method, at the point of loading the collection vehicles.

Pilot study for engineering parameters

Regarding waste characteristics, it is sufficient for collection purposes to assess the generated waste quantity (kg/hh.day) and density (kg/m³) of a representative number of households over a period of about one week. A reliable average of the expected waste characteristics may be obtained by taking daily samples of the generated refuse of about 1% of the households in the selected area (minimum = 20 hh). Besides investigating the waste generation rates and densities, a pilot study allows to acquire knowledge on other basic engineering parameters. The most relevant aspects to be roughly analysed include average number of inhabitants per household, number of households within the collection area, existing storage facilities at household level, length of blocks, and estimates of required staff and collection time.

Equipment and Personnel

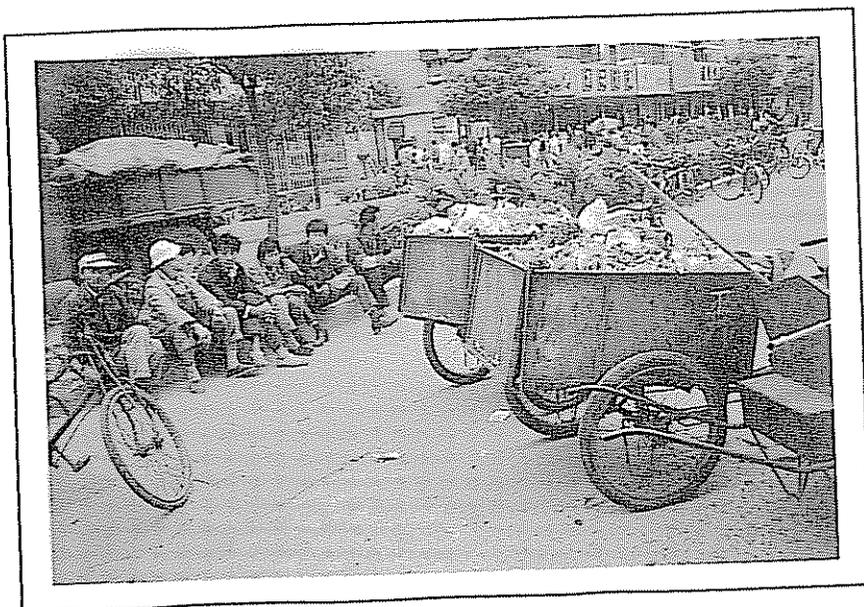
Choice of equipment and personnel influences productivity and sustainability

Where collection vehicles are required, productivity and efficiency of a scheme are significantly influenced by the selection of the appropriate type. Depending on the chosen collection method and operational pattern, the vehicles have to be selected on the basis of such factors as loading capacity, number of required crew, investment and running costs, operation and maintenance aspects, and on accessibility of the service area.

Handcarts, pushcarts and tricycles

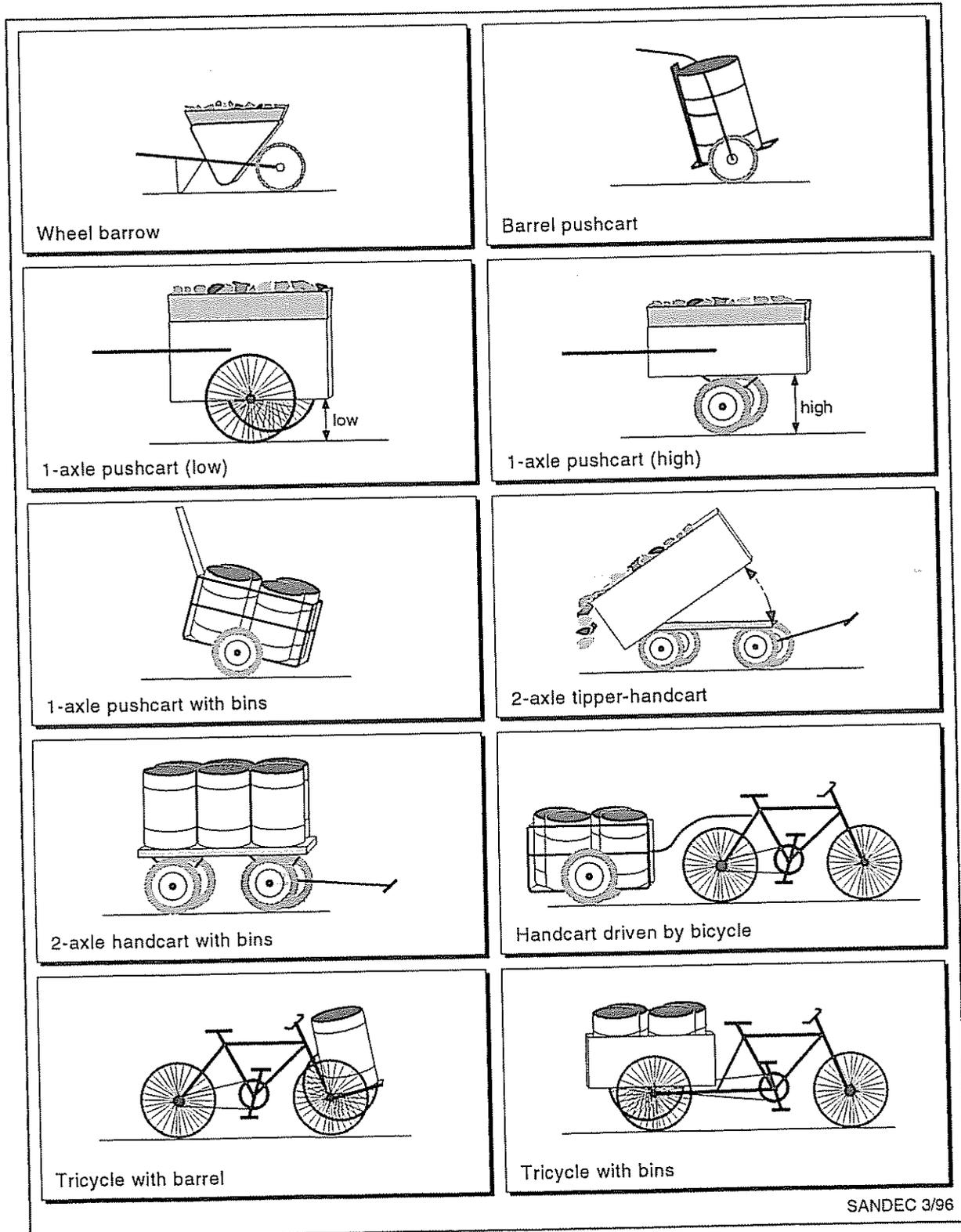
Although the service range of manually operated handcarts and pushcarts or tricycles is limited to about 1 km, and the effective speed very low (< 3 km/hr), they are generally best suited for the conditions prevailing in low-income areas, such as narrow streets, low waste generation rates, high waste and population density, and low wages [17]. **Manually operated carts are - apart from being non-polluting - cheap in manufacture and operation, quite simple in design, as well as produced and maintained locally; all of which are important prerequisites for a sustainable, low-cost technology.** As the vehicle must be adapted to the local characteristics; i.e., topography, accessibility, user habits, availability of material and spares, the specific design is dependent on the prevailing conditions and skills of the local manufacturers. Consequently, a great variety of suitable collection carts exists as exemplified in Figure 4 (based on examples of case studies).

In the evaluated schemes, mainly handcarts and pushcarts are utilised whereas the usage of tricycles and donkey carts is limited to very few cases. Particular attention should be paid to easy handling as the loaded carts have to be moved by manpower (or animals), thereby limiting the suitable loading capacity. It is recommended to operate the carts in a team of two collectors. An appropriate cart volume thereby ranges between 0.5 and 1.5 m³, and its upper weight limit to be pushed by collectors is around 500 kg. Appropriate handling in steeper areas and on difficult underground requires the use of smaller handcarts.



Labour-intensive collection systems, as exemplified with this scene in Shanghai (China), are more likely to be adopted to the characteristics of low-income areas. However, although the collectors play a key role in such schemes, their social status is usually very low and the activity generally performed by those with few other job alternatives. (Photo: SANDEC)

Figure 4:
Examples of handcarts and tricycles



One of the most significant factors to be considered in the design of collection carts is the loading and unloading procedure. The frequently observed dumping of the waste on the ground for transfer to a larger transport vehicle or to a transfer point should be avoided since it is messy, tiring, inefficient, and exposes the operators unnecessarily to health risks. Where households may be convinced to use plastic bags for storage, the problem is less significant. Another cheap and suitable solution to overcome the handling problem is the use of containers (bins, large bags, barrels) within the carts which can be lifted out for transfer and/or unloading. However, there is often a conflict between an efficient and safe transfer procedure and the recycling activities of the waste pickers (see also "technical interfaces").

Motorised vehicles

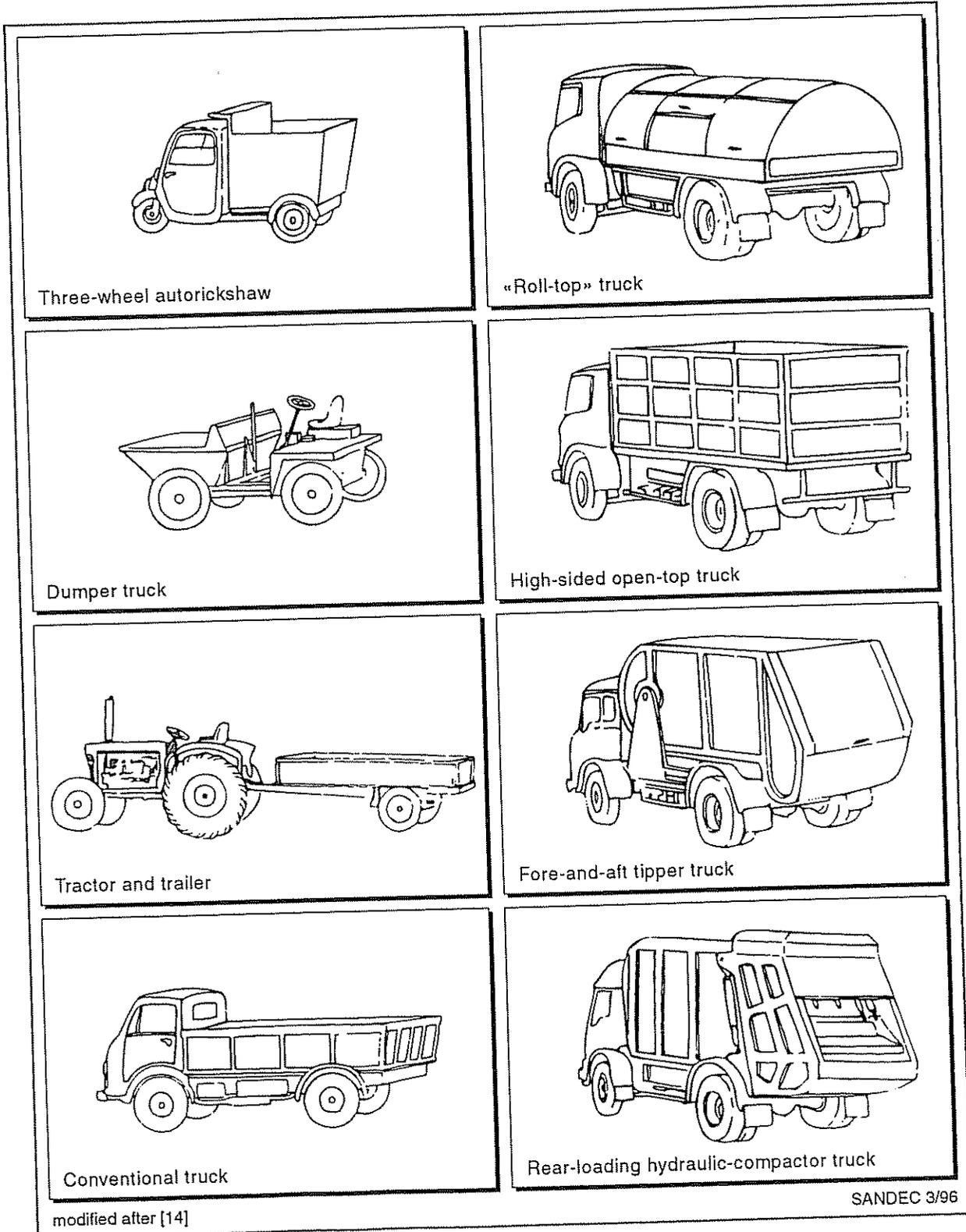
Motorised vehicles may be required where productivity of human-powered vehicles is considerably reduced, such as in long transport distances. However, in densely populated low-income areas with their often inadequate access roads, use of motorised vehicles may cause problems or prove impossible. Physical conditions within a settlement, such as road quality or observed waste characteristics, should thus be examined carefully before selecting a vehicle. **Besides high purchase costs, sophisticated vehicles produce considerable annual operation and maintenance costs - a factor which must also be taken into account.** The most important prerequisite when selecting a vehicle is to favour those vehicles which are either manufactured locally or already used for other purposes within the municipality. Standardisation of the fleet contributes to reducing vehicle down-time as mechanics become familiar with maintenance. Figure 5 presents a wide range of different types of motorised vehicles [14, 12].

In many instances, the combination of agricultural tractors and trailers has proved to be a suitable choice. **The tractor, which is available in almost every city, offers a simple motorised means of transport for larger refuse volumes at comparatively low capital costs** (unless it comprises too many hydraulic tools designed for agricultural purposes). It is a very robust vehicle that can also be used on difficult roads. Together with trailers of around 6 m³ payload, the tractor is especially useful where transport to a transfer station or a landfill



Handcarts of 0.5 m³ capacity as vehicles for primary collection, trailers of around 6 m³ payload as intermediate storage units and a tractor for hauling the loaded trailers to the municipal landfill: the case of a small private enterprise in Cucuta (Colombia) serving 50,000 inhabitants. (Photo: SANDEC)

Figure 5:
Examples of motorised vehicles



pertains to the duties of an enterprise - as in the case of the smaller towns of Cucuta (Colombia) and Cajamarca (Peru). Thereby, three to four trailers served by handcarts may be used as temporary storage units which can then be hauled by one tractor. Sufficient tractive power to haul the loaded trailers (>50 hp) should be guaranteed and the trailer wheel axles carefully designed. Tractor transport is, however, comparatively slow (≈ 20 km/hr) and becomes inefficient with longer distances and increasing loads. Use of other motorised vehicles, such as e.g. open-top or roll-top trucks, roll-on/roll-off trucks in combination with containers, tipper or compactor trucks, may then be more favourable. **With regard to detailed design, the loading height, which should not exceed 1.6 m, is particularly crucial for efficient operation.** Furthermore, it should be borne in mind that improvement of the technical vehicle standards, such as sophisticated and expensive compacting mechanisms, will increase operation and maintenance costs.

Additional equipment

Rakes, brooms and shovels are helpful and cheap tools. Protective clothing, such as boots and gloves, must form part of the basic equipment since the operators have to handle hazardous material such as glass, metals or even faecal matter. Uniforms, which is a less essential but still very useful piece of clothing, can strengthen the team spirit of the collectors, increase their prestige in society and ease their identification among the beneficiaries of the service.

Personnel and productivity

The staff required to perform such a collection activity is dependent on the chosen vehicle and operational pattern. Where the use of sophisticated and motorised equipment cannot be considered due to its high costs and difficult operation and maintenance - as is mainly the case in low-income areas - labour-intensive systems are more likely to be adopted and manual labour therefore becomes more important. From an operational point of view, the collectors thus play a key role in manually operated schemes. However, since the social status of garbage collectors is usually very low, the activity is generally performed by those with few other job alternatives. In most cases, their salary (including informal income from recycling) is not sufficient to support a family. As a result, many of the collectors reportedly perceive their job as a temporary source of income and most of them would immediately change it if given a better opportunity [10]. **Minimum requirements for sustainable schemes therefore include adequate salaries for the collectors as incentive to do a good and reliable job, as well as a basic "on the job" training.** Analysed data indicate that collectors' productivity does not greatly depend on the technology used or on the area size, but seems influenced rather by other factors such as topography and income of the collectors [1]. Productivity values for the studied cases expressed as served inhabitants per collector hour are presented in Figure 6. The overall correlation is surprisingly good and the data obtained provide a rough estimate of productivity. **On the average, around one daily collector hour is necessary to serve about 200 inhabitants.** This seems a reasonable value and may be used to estimate labour requirements in a collection scheme.

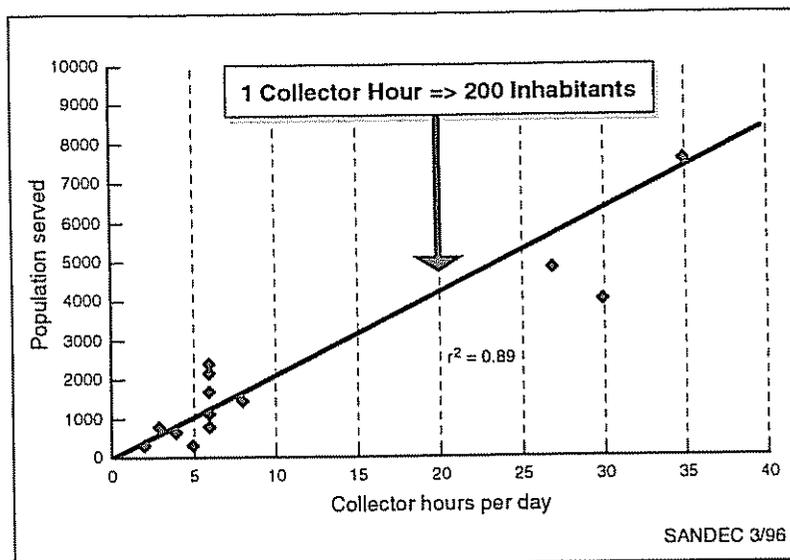


Figure 6:
Estimates of collectors' productivity

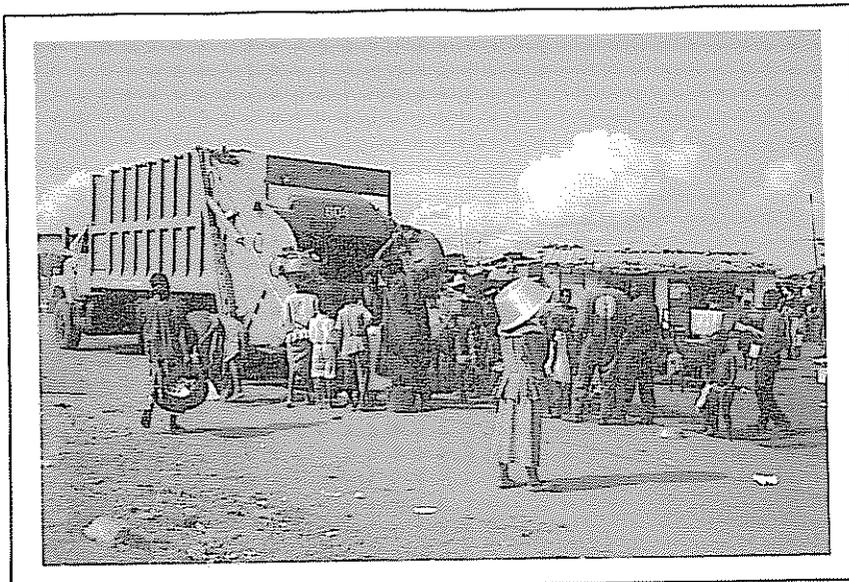
Operational Design

Collection points and transfer stations are the most critical technical interfaces

The most appropriate service level is dependent on factors such as willingness and ability of the households to contribute and on their available financial resources. Whichever system is chosen for primary collection, the interfaces to secondary collection (or transport) generally seem to be the most critical points in collection schemes.

Collection frequency and methods

The removal/collection frequency is determined mainly by the waste decomposition rate and the resulting offensive odour emissions. In tropical cities, since waste may already start to decompose within one or two days, removal/collection is required in most cases on a daily basis or at least on alternate days. In colder climates, such as in many Andean cities for instance, semi-weekly collection may be sufficient. The different collection systems basically include: i) communal storage (bring-system), where people carry their refuse directly to communal collection points; ii) block collection ("mobile" collection point) where residents carry their waste at prescribed days, time and place to a passing collection vehicle which stops at major intersections only; and iii) house-to-house collection, including kerbside (residents carry their waste to the road) and door-to-door collection (collectors enter the courtyard). Depending on the selected or available vehicles and on the transfer system and facilities, a wide range of different collection combinations is possible. Some of the main technical options with regard to primary collection and communal storage facilities observed in the studied cases are described hereafter and illustrated in Figure 7.



In some areas of Abidjan (Ivory Coast) mainly women and children carry the refuse over (too) long distances of up to 250 m to a passing compactor truck. This type of collection not only requires considerable contributory effort from the households but also a rather exact schedule in order to be efficient. (Photo: SANDEC)

I Communal storage

Where the households are willing to bring their waste to a communal storage point (e.g. roll-on steel containers, concrete enclosures), communal collection is certainly the cheapest alternative in terms of cash requirements as households contribute in kind for the service. Furthermore, as no fees for primary collection are involved, communal storage is a rather simple and institutionally uncomplicated system. However, the communal storage points have to be sited within a reasonable distance from the households to be accepted by the users. People may otherwise throw their waste elsewhere. **Observations in China and Africa have shown that most beneficiaries seem prepared to carry the waste 50 - 100 m to a communal storage point but not 250 m [2, 9].**

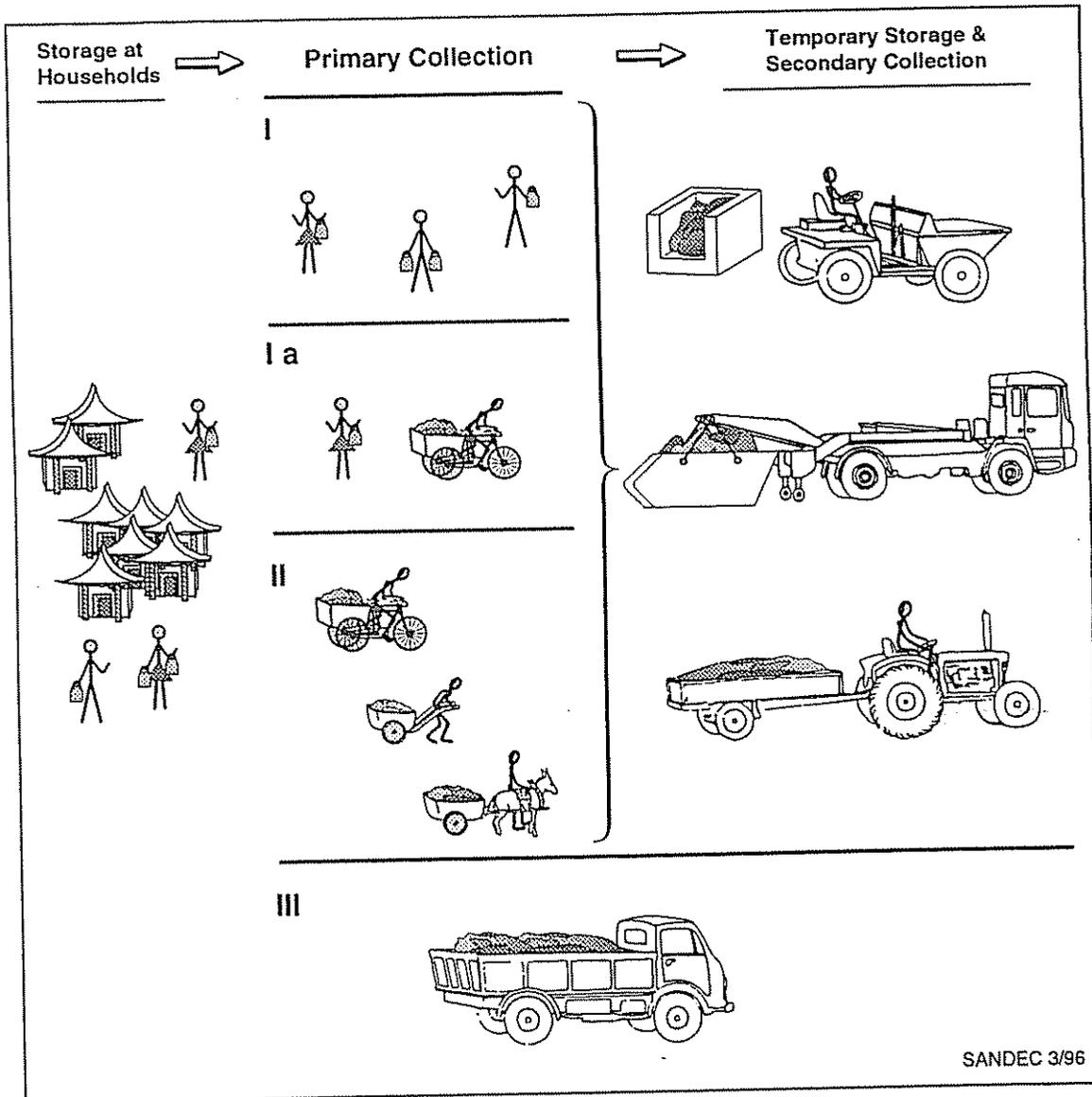
Ia Mobile collection points

A variation of the communal storage system has been observed in Shanghai (China); i.e., there the households carry the refuse about 50 m to a "mobile" collection point consisting of a tricycle or handcart. This system had to be introduced as larger communal storage facilities are used (steel containers of around 10 m³) to reduce the number of required collection points. However, this increased the average distance from the households to more than 100 m. **"Mobile" collection points therefore offer a type of collection facility within reach of the households.**

II House-to-house collection with handcarts, tricycles or donkey carts

The most costly and the most reliable system is the house-to-house collection as it serves every household. Door-to-door or kerbside collection with manually operated vehicles is the most widespread collection method in the studied cases. The household contribution is minimal and limited to carrying the refuse to the roadside. The waste is then collected by handcarts, tricycles (Padang, Indonesia) or donkey carts (Ouagadougou, Burkina Faso) and brought to

Figure 7:
Technical options for collection and the generally most crucial
interfaces between primary and secondary collection/transport



collection points for transfer to larger transport vehicles. As the service range of manually operated collection carts is around 1 km, collection points have to be located within this distance. Households close to collection/transfer points are thereby likely to carry the waste directly to the containers instead of paying collection fees.

III House-to-house collection with trucks

Where access roads are adequate, house-to-house collection with trucks of more than 5 m³ payload may be more efficient than manually operated carts. The main advantage of this system, observed only in Padang (Indonesia), is that the waste can be transferred directly to disposal sites (unless transport distances are too long), thereby avoiding the difficult interface with the secondary collection system. However, collectors may have to walk considerable distances to pick up the refuse from houses of difficult access.



Access ramps for transfer from handcarts to SECOL vehicles or containers, as exemplified by this station in Yogyakarta (Indonesia), are a basically suitable arrangement to avoid the messy and inefficient manual lifting of the refuse. However, ramps should be designed for easy use (< 1:10), and the establishment of a truck collection schedule must be ensured. (Photo: SANDEC)

Technical interfaces

Primary and secondary collection are interdependent and do not function properly as single components (as shown in Figure 7). The studied cases indicate, however, that the interfaces between (community-level) primary collection and (municipal) secondary collection/transport are very critical elements in most schemes. The primary collected waste is often not picked up regularly at the collection or transfer sites by the secondary collection system. As residents or collectors are supposed to dump the waste directly into containers or trucks, delayed container collection or lack of truck journeys often results in full containers or queues. Although interface problems may occur independently of the chosen collection method or transfer facilities, use of trucks as transfer points has proved to be the least appropriate option. Delays force the collectors either to waste their time in waiting for the truck or to dump the collected refuse elsewhere. Waste accumulation and the resulting mess at the collection points discourage residents and collectors from using the primary collection system. Cooperation between the involved actors as regards timing of container collection or emptying of storage facilities is therefore a most important pre-condition for successful interfaces (see also Chapter 2). An option to be seriously considered in order to avoid interface problems, is to include transport to a landfill in the duties of the operating enterprise or CBO. This is only feasible, however, where transport distances are short as in the case of small municipalities.

The activities of waste pickers or scavengers which often interfere with the collection and transfer process is another widespread source of problems at collection points. Waste pickers looking for inorganic recyclable material such as cardboard, glass, metal, and plastic in the waste stream are a component part of SWM systems in most urban areas of low and middle-income countries [19, 27]. Waste is retrieved for recycling and selling purposes at all stages of a SWM system; i.e., from the source of waste generation to the ultimate disposal sites, and even within the collection vehicles. This material recovery which is usually conducted by the informal sector may be highly organised, despite the casual working manner of the waste

pickers. The recycling activities have undoubtedly important advantages as valuable resources are recovered, waste quantities to be transported and disposed of reduced, and income for the poorest generated. However, a **potential conflict exists between the scavenger activities at the collection points and an efficient and safe collection and transfer process.** An interesting approach with regard to solving this problem has been observed in some parts of Indonesia. There the waste pickers have to lift the waste into the containers and are allowed to continue their activities only if they keep the transfer points clean.



At a collection point in Cirebon (Indonesia), the collectors of a primary collection system dump the waste on the ground for waste pickers to sort out recyclable material. Although these recycling activities are a valuable contribution, a potential conflict exists with regard to an efficient and safe collection and transfer process. (Photo: SANDEC)

Chapter 2

Organisation and Management

Appropriate organisation and management is one of the key aspects in establishing successful collection schemes. As the different actors involved in the provision of this service may have varied interests and potential for contribution, definition of their roles and coordination of their activities are crucial elements in organising a scheme. With regard to the case studies, lack of appropriate institutional arrangement and little cooperation between the involved actors have been identified as the major problems encountered with the establishment of new schemes and, particularly, with the delivery of the service. The potential role of the different actors is addressed in general and possible institutional arrangements presented hereafter.

Key Actors

The role of the different actors has to be defined according to their potential

Apart from the involved community/group of households and community-level organisations, the main actors are municipal authorities and agencies, non-governmental organisations, and the formal as well as the informal private sector. Furthermore, external support agencies and financial institutions, such as banks, may also play an important role.

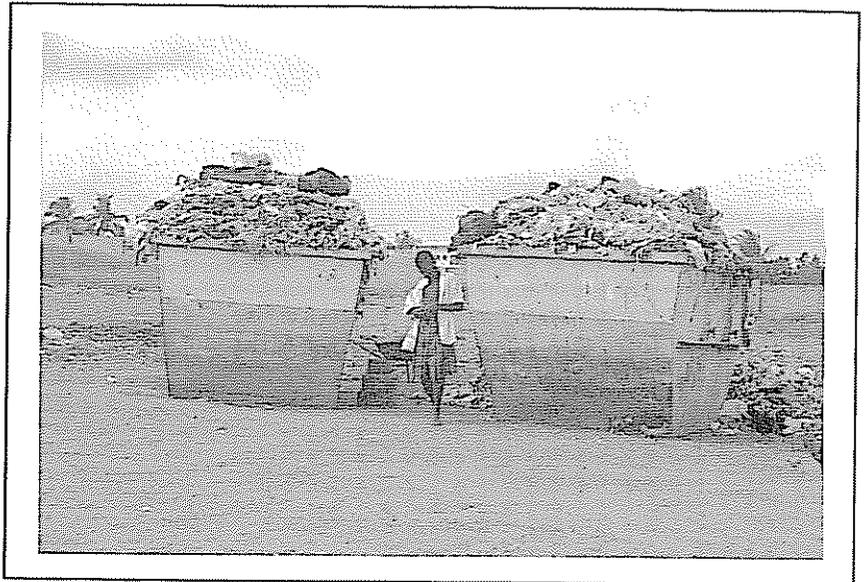
The community and community-based organisations

The most important group of actors are the future users of the system. However, the potential role of the beneficiaries has to be seen within the context of their general living conditions which are often characterised by high unemployment and incomes below the poverty line, high illiteracy rates, low legal and social status, and very limited political influence. The perceived needs of the communities for collection and especially for safe disposal are usually low (see also Chapter 1). Furthermore, it should be borne in mind that communities are often a very heterogeneous group of people with different opinions and preferences. Reference to such a group as entity is therefore rather delicate [33]. Communities are, however, usually organised in different groups and community-based organisations, such as neighbourhood committees, youth and women groups, religious organisations and political parties, all of which are potential partners in planning and decision-making processes. Individual actors, such as local community leaders, have also proved to be important key persons in most of the evaluated schemes, in contrast to isolated efforts of single individuals which are unlikely to lead to sustainable solutions. Some groups within the community may see a potential for income generation in primary collection schemes combined with recycling activities. Strong community organisations may be able to provide the service themselves in a self-help approach, or to contract private enterprises or individual collectors to perform the service. **However, direct participation of the community is generally limited to primary collection of domestic refuse.** Secondary collection, transport and final disposal are beyond the scope and potential of most communities.

Cooperation between the involved actors, with regard to e.g. establishing a container collection or emptying storage facilities schedule, is crucial for providing a sustainable collection scheme.

Overfilled storage units, as exemplified by these containers in Accra (Ghana), discourage both residents and collectors from using the primary collection system.

(Photo: SANDEC)



The local government

Solid waste management is a public service and local governments or respective municipal agencies are basically made responsible for its delivery. It is thereby decisive that municipal authorities remain in charge of this task to achieve an overall consistent SWM system on a city-wide and regional level. However, this does not mean that government authorities have to deliver the actual collection service themselves. In fact, private enterprises or community-based organisations can, under appropriate conditions, provide solid waste collection, transfer, transport, and disposal services more efficiently and at lower costs than the public sector. **In case of "outsourcing" the service, the government's role of service provider shifts to that of facilitator and supervisor of the service.** It is undeniable that every collection scheme, including non-governmental approaches, require some support from the municipal authorities to achieve sustainability. Hence, municipal enterprises and organisations must be included whenever possible in the planning of such schemes. The municipality itself should provide considerable organisational and financial support to community-based organisations and to implementing agencies, especially during the initial phase. Therefore, the mere distribution of handcarts to the community falls far short of sufficiently enhancing and guiding community-based activities.

Non-governmental organisations

NGOs are widely accepted as suitable actors when it comes to working with communities as they are often more closely linked to the residents than municipal institutions. They may thus play a key role as intermediate agencies between users and municipal authorities. Intensifying awareness among the beneficiaries, social mobilisation, provision of technical and financial know-how, as well as strengthening of community-based organisations may be some of the vital contributory services which can be provided by NGOs.

The formal private sector

Since private enterprises work by definition according to business management principles, they are highly qualified to perform a given task efficiently. However, refuse collection is a basic service which should reach every household in any area at affordable costs. Where provision of such a service is commercially uninteresting, the private sector does not enter the market - a fact that clearly indicates the need for public sector involvement. **Private sector initiative may contribute to increasing service coverage, however, private sector involvement does not in itself guarantee efficiency and - even less - full service coverage.** The preconditions for successful private sector involvement include [30]: competitive bidding, existence of enterprises with adequate technical and organisational capacity, effective regulation of the partnership arrangements and adequate management of the private partners through clear job specifications, monitoring and control.

The informal private sector

Informal actors include particularly scavengers or waste pickers in search of inorganic recyclable waste at almost every stage of the SWM system [27, 19]. **Waste pickers which are a component part of SWM schemes in most urban areas play an important role in reducing the amount of waste and in recycling valuable resources.** Apart from waste pickers, collectors, traders, and dealers, manufacturers and even municipal staff may be involved in such systems. All of these actors should be regarded as potential partners when establishing a collection scheme.

Financial institutions

Banks, external support agencies (ESAs) and other donors may be particularly important when it comes to providing financial backing to cover investment costs.



The different actors involved in the collection service may have varied interests and potential for contribution. Meetings of the concerned parties, community leaders and area representatives, as exemplified by this scene in Cirebon (Indonesia), can greatly contribute to defining the roles and coordinating activities. (Photo: SANDEC)

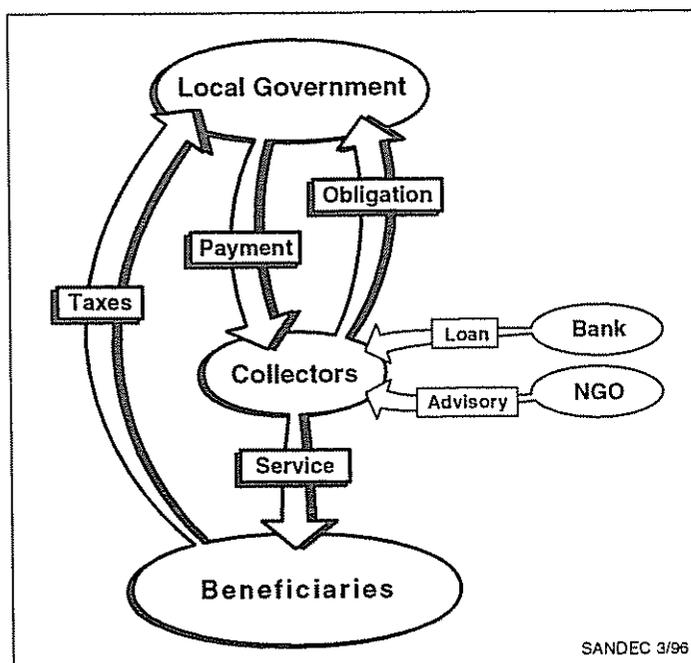
Institutional Arrangement

A simple and efficient organisational structure should establish a link between the involved actors

A simple organisational structure enabling some basic mechanisms, such as cost recovery, supervision and quality control, is necessary for primary collection schemes. The study has identified different institutional arrangements with inherent advantages and disadvantages. The potentials and limitations of two main case study models are summarised hereafter, followed by a short synthesis of both approaches.

Model 1: "Micro-enterprises"

The first model is based on the schemes in Cucuta (Colombia) and Cajamarca (Peru), which are characterised by a particular "micro-enterprise" approach that finds increasing application in Latin American cities [20, 22, 5]. Figure 8 presents the interrelations between the different actors, including cost recovery. The main actors involved are the beneficiaries, the collectors organised in the form of a small private enterprise, and the legally responsible municipal authority. Loans as well as technical and financial assistance are provided by a financial institution and an NGO. **The service, which is contracted out by the local government to the small private enterprise, is based on a written agreement defining the tasks and duties of both the operator and the municipality.** In the aforementioned cases, the small-scale enterprise is a legally constituted cooperative of about 12-16 collectors recruited from within the community. This cooperative offers its refuse collection service (and occasionally also transport to a landfill) within a specific municipal perimeter of around 50,000 inhabitants. The necessary starting capital for equipment and other expenditure is provided in the form of a loan by financial institutions or development funds. The operating costs, including amortisation and interest, are covered through taxes collected by the municipality (e.g. along with property tax). Support and consulting services in technical and financial matters are given by an NGO, particularly during the initial phase of the scheme and during the first few months of operation.



**Figure 8:
Model 1 - Collectors contracted
by the local government**

Potential and Limitation:

- Community involvement in the establishment and operation of these schemes is basically limited to: (a) selecting collectors through a free electoral procedure, (b) establishing the very basic task of the households as regards the carrying of the waste to the roadside on specific days, and (c) paying for the service through taxes. Since the appointed collectors are generally known by the beneficiaries, the micro-enterprise is accepted and participation in the scheme as well as achieved coverage are therefore likely to be high.
- Successful implementation of this model is dependent on the good cooperation between the small enterprise and the municipal authority. The approach is thus only applicable where the respective municipal institutions are willing to improve the situation. Key element of the arrangement is the contractual agreement between the municipality and the operating micro-enterprise. A suitable formulation of the written contract is thereby decisive for smooth operation of a scheme (compare model contract in Annex 2). Negotiations can be difficult as the newly established enterprise and the local authority still lack experience with private sector involvement. In most cases, the micro-enterprise is generally the weaker partner in this bidding process and may require some assistance. **The institutional link through the contract facilitates cooperation and dialogue between the actors and may have a positive impact on technical interfaces.**
- A clear advantage of this system is its commercial approach. The micro-enterprise is obliged to adopt a commercially-oriented behaviour that generally improves operational efficiency of the scheme. Moreover, such an approach guarantees highly motivated operators who benefit directly from the acquired profit. The cooperative structure of the enterprise allows responsibilities and gained profit to be equally shared by the collectors. The scheme is thus not very prone to corruption. **However, where business management principles are not yet well understood, the commercial approach will bear some risks, particularly for the investment agencies.** Hence, training of the operators and consulting services provided by a competent NGO may be necessary. Furthermore, acquiring a loan as a starting capital from financial institutions may prove difficult since banks request guarantees which are usually hard to obtain by inexperienced enterprises. Thus, aid agencies, NGOs or even ESAs and local industries may play an important role in providing assistance.
- Cost recovery for contractual payment; i.e., for covering operating expenditure, is the task of the municipality and is based on taxes. However, taxes are unlikely to be the best financing method as the centralised system may allocate the recovered financial resources for other purposes. Furthermore, beneficiaries do not exactly know for what they pay nor what they can expect from their financial contribution (see also Chapter 3).

Model 2: "Community-based"

The second model includes systems managed at community level by community organisations or individuals which are usually referred to as "community-based schemes". The existing arrangements vary according to the level of community involvement, motivation and types of organisations involved in initiation, operation and management of a service [4, 10]. The basic organisational structures, however, do not differ significantly. Most schemes comprise one of the following models applied quite successfully in Indonesia for several years and in some parts of Africa. Figures 9 and 10 thereby present two similar structures which differ basically only with regard to their financing system (fees paid to a community organisation or directly to the collectors). Both models involve the beneficiaries and refuse collectors as main actors. In most cases, the refuse collection scheme is also managed by a community member or organisation. Financial and managerial support is often provided by formal and informal community leaders who mainly work on a voluntary basis. The responsible municipality, which plays a minor role, is active only as initiator of a scheme and entrusted with the issuing of regulations, or as supporter in terms of providing access to handcarts or loans [10]. The service is supplied by individual collectors usually recruited from within the community itself. The area generally covers between 1,000 and 10,000 inhabitants which are usually served by a house-to-house collection. The collected waste is then transported to communal collection points or transfer stations for secondary collection by the municipal system. The required equipment is often financed by external funds either from individual community members or from the municipality. The operating costs, particularly the salaries of the refuse collectors, are covered by user charges or fees which are collected from the households by the management, special fee collectors or by the garbage collectors themselves.

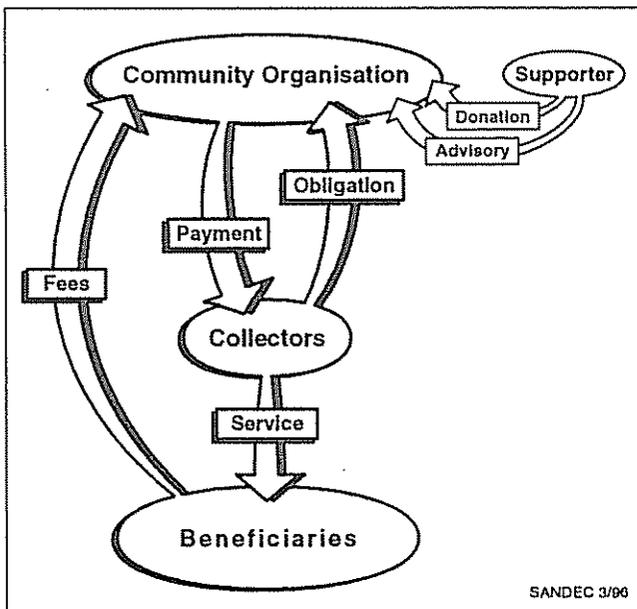


Figure 9:
Model 2a - Collectors managed and paid by community organisations

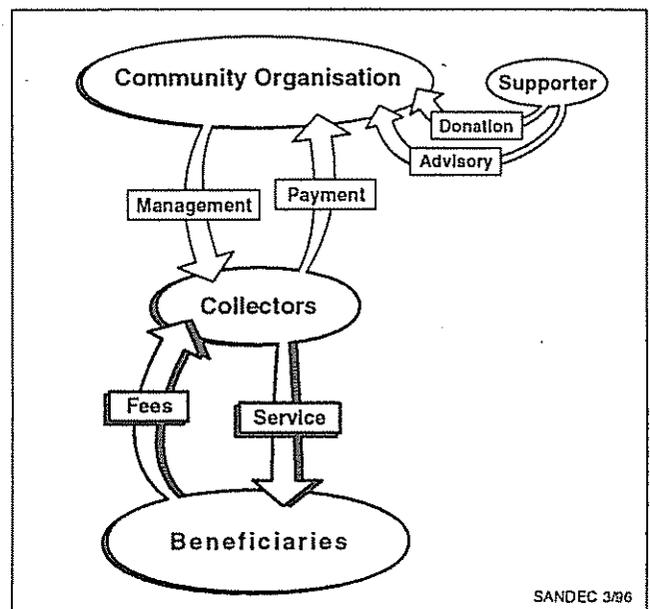


Figure 10:
Model 2b - Individual collectors paid directly by households

Potential and Limitation:

- Similar to the first model, community involvement is generally limited to recruiting collectors, paying for the service and carrying the refuse to the roadside (except in very few schemes where residents bring the refuse directly to collection points). As mentioned above, real community-based schemes involving the community not only in operation but also in management of the system, are not widely spread among the case studies. Most schemes are in fact operated by few appointed refuse collectors and managed either by the lowest administrative governmental unit or by local community leaders.
- The institutional links with the municipal authority are usually weak or non-existent, and support from the municipality is limited to the occasional provision of handcarts or loans. **Thus, the model is not entirely reliant on a cooperating municipality and might prove advantageous where authorities are unable or unwilling to contribute.** As mentioned earlier, cooperation with the legally responsible municipality and other governmental units is, however, decisive in establishing a consistent transport and disposal service of the collected waste on a municipal or regional level. Furthermore, management of these schemes is usually dependent on strong support and consulting activities as regards organisational, technical and financial issues.
- Management usually rests with a motivated community leader or with a community-level organisation, such as the smallest administrative unit, a youth group or an informal neighbourhood committee. **Where, as frequently observed, only one motivated individual is in charge of management, the scheme is vulnerable and may rapidly collapse if the competent person withdraws from its responsibilities.** The frequently regarded voluntary management is certainly a cheap option, however, a lack of formal control may lead to corruption and mismanagement of funds.
- Although financial performance is usually deficient and most schemes reliant on external assistance, the practised cost recovery system based on fees seems to be more advantageous than the taxing system. The beneficiaries pay directly for the service provided and generally on the basis of their income. This allows direct linkage between affordability and required level of service delivered, and guarantees some type of quality control. However, due to the limited amount of available financial resources of the communities, the salaries of the refuse collectors are generally below the means of subsistence of a family. Furthermore, the overall proceeds of these schemes are usually not sufficient to finance the subsequent SWM steps, such as secondary collection and transport or final disposal.

Synthesis

The models described refer to specific and, as in the cases of Cucuta (Colombia) or Yogyakarta (Indonesia), successfully operating schemes. **The study indicates, however, that the business management approach of the first model is likely to be advantageous with regard to providing an efficient and reliable service.** Community-level systems without a commercial approach and dependent on voluntary management or external assistance have failed or are bound to fail. A more commercial approach in managing community-level schemes - including loan financing of equipment instead of cheap donations - could lead to the required accountability and improved motivation of its actors. It is clear that both models may be combined, and that a wide spectrum of other approaches do exist such as for example micro-enterprises contracted not only by the local government but also by strong community organisations. The common denominator in most schemes is, however, the absence of an appropriate municipal framework which includes community organisations and micro-enterprises in the delivery of a refuse collection service.

Chapter 3

Service Costs and Financing

Solid waste collection is usually the most expensive step of SWM and a major burden to the municipal budget. Lack of funds is frequently one of the main reasons for not extending the collection service to the poorer areas. Hence, accurate cost accounting and recovery of the required financial resources are serious aspects to be considered. This particularly applies to those schemes which lack access to general funds from the municipality. Most of the studied systems reveal inadequate or total lack of cost assessment and insufficient cost recovery. This situation leads to a strong dependency on external financial assistance and may result in a collapse of operation. Two main aspects are of concern as regards financing of collection schemes: assessment of the expected costs and establishment of recovery mechanisms to obtain the required financial resources.

Cost Assessment

Exact cost assessment is the first step in establishing financially sustainable schemes

Quantitative cost estimates are not only required for the selection of the most suitable financing method, but affect almost every decision when developing a new scheme. Choice of service type and level, type and number of equipment, as well as selection of a suitable number of crew, are dependent on the incurred costs. It is therefore obvious that an accurate cost estimate is of utmost importance in setting up a collection scheme. A transparent cost structure should thereby split up the expected expenditure into investment and operating costs.

Investment costs

The investment costs in a collection scheme comprise not only expenditure for the necessary equipment, but also for consulting services from NGOs and for preliminary studies. Capital may be also required to cover rental (office) and clothing (uniforms) costs. Furthermore, a first month salary for refuse collectors should be foreseen in the budget in case of cost recovery delays. **Since most of the studied systems received capital and/or equipment in the form of grants from donors and municipal sources, the investment costs are generally not well determined.** Only the small private enterprise in Cajamarca (Peru) can produce a detailed assessment as shown in Table 2 [5]. However, since this scheme provides also transport to a landfill in addition to primary collection for around 50,000 inhabitants, the required investment costs are relatively high (US\$ 1.20 per inhabitant). Although this is not a very typical example as regards absolute cost figures, the table reveals a suitable structuring of expenditure as required in all schemes. The listing indicates moreover that capital can be further broken down into start-up expenses ($\approx 50\%$), e.g. for consultancy services, and investments which are subjected to depreciation ($\approx 50\%$), e.g. for equipment.

Table 2:
Cost structure of a scheme comprising collection and transport for around 50,000 inhabitants (in US \$)

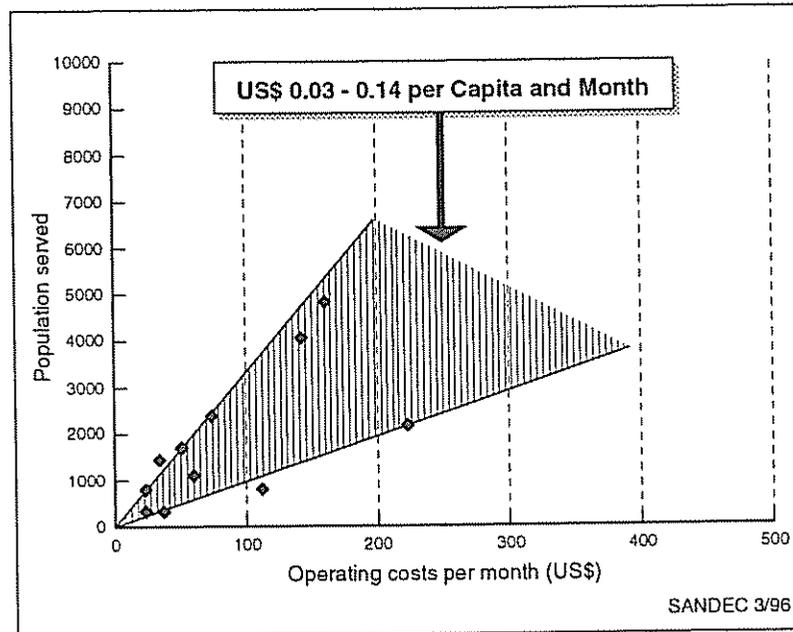
Investment Costs	- 8 Handcarts .. at 200.-	1,600.-
	- 3 Trailers at 5,600.-	16,800.-
	- 1 Tractor	11,800.-
	- Consultancy	14,700.-
	- Office, Uniforms	2,500.-
	- 1 Month of Salaries	3,400.-
	- Landfill Study	6,700.-
	- Unforeseen (5%)	2,500.-
		Σ = 60,000.-
Operating Costs	- Interest & Refund	1,650.-
	- 17 Salaries at 200.-	3,400.-
	- Handcarts Maintenance	22.-
	- Trailers Maintenance.....	210.-
	- Tractor Maintenance.....	148.-
	- Fuel/Oil Consumption.....	170.-
		Σ/month = 5,600.-

Operating costs

The operating costs generally include expenditure necessary for daily operation of the scheme and for maintenance of equipment. If a refundable loan is obtained to cover investments, capital costs (interests and refunds) also belong to the operating costs as indicated in Table 2. As for this small enterprise, the monthly operating costs for collection and transport amount to about US\$ 0.12 per inhabitant. The costs can thereby be divided into expenditure for staff ($\approx 60\%$), depreciation ($\approx 30\%$), as well as operation and maintenance of equipment ($\approx 10\%$). **In labour-intensive systems, salaries for collectors and, occasionally, for managerial staff typically account for the largest sum of operating costs.** In most of the studied schemes, however, the wages are very low and sometimes even below the basic means of subsistence of a family. The low wages certainly lead to low service costs, however, to reach long-term sustainability it would be more appropriate to pay the collectors suitable wages as incentive to perform a good and reliable job (see Chapter 1). Accordingly, costs for maintenance of equipment and management of the scheme are often only partially taken into account and therefore lead to a strong dependency on external financial assistance.

Figure 11 presents the operating costs per served inhabitants as identified in collection schemes operated with handcarts. The service costs range from US\$ 0.03 - 0.14 per capita and month. Since the cost structures of the studied schemes are not transparent enough (e.g. most of the presented sums do not include capital costs), the figures can only be rough approximations. Establishment of a general cost estimate is a delicate issue as the cost of living and prices differ from one place to another. However, **as a rule of thumb around US\$ 100.- are necessary to cover the monthly operating costs of a manually operated house-to-house collection service for 1,000 inhabitants (= US\$ 0.10 per capita and month).**

Figure 11:
Served inhabitants vs. operating costs per capita and month
(schemes operated with handcarts only)

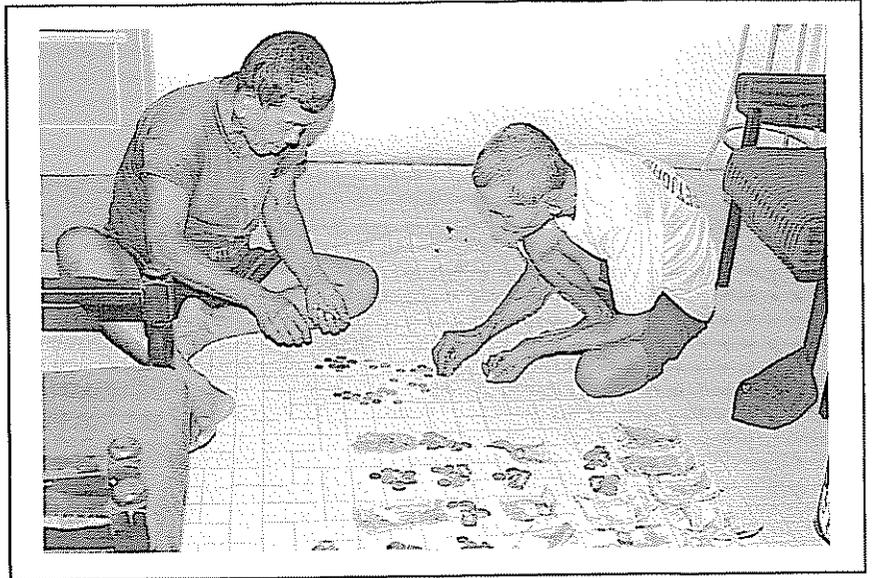


Cost Recovery

**Full cost recovery is a precondition
for long-term sustainability**

Collection schemes are not self-sustainable unless all the incurred and properly assessed costs are fully recovered in one way or another. Ideally, all the expenses for the different solid waste management services should be paid by the beneficiaries (polluter pays principle). This would mean that beneficiaries should also contribute financially to secondary collection and final disposal of the collected waste. However, in addition to the aforementioned lack of awareness with regard to the entire solid waste cycle, an important part of the urban population is just not able to pay due to its low cash income. Consequently, the covering of part of the expenditure with general municipal revenues (e.g. for secondary collection and disposal) or use of cross-subsidies from richer areas seems inevitable. For public health reasons, a clean environment and the removal of solid waste from low-income areas is in the interest of the entire population. Regarding primary collection, however, the beneficiaries should at least finance the operating costs themselves.

Accurate cost accounting and recovery of the financial resources is a pre-condition for sustainable schemes. In the case of a community-level collection system in Yogyakarta (Indonesia), the collectors, after counting their weekly income, give part of the receipts to the manager of the scheme. (Photo: Dian Desa)



Capital requirements

Although the capital required for manually operated collection schemes is usually low, obtaining the necessary financial backing may present a major obstacle in initiating a scheme. In most of the studied schemes, the initial investment capital is provided in the form of grants by donors and external support agencies. **Although donations can be a valuable contribution, especially during the initial phase of a scheme, donor dependency will not lead to a fully sustainable system.** In this case, operation and maintenance are likely to cease as soon as financial support is withdrawn. Since the fees usually do not cover the costs necessary for replacement of equipment, the scheme is also likely to collapse if equipment has to be replaced. Financing through loans, as practised in very few of the studied schemes, seems more advantageous. A commercial approach will most probably lead to a more careful financial management and to increased personal responsibility within the managing organisation. However, to obtain a loan from financial institutions may be rather difficult for inexperienced enterprises or community-based organisations as risk guarantees are generally requested.

Operating revenues

Various cost recovery models for operating revenues exist, however, the most appropriate system should always be adapted to the scheme in question. Nevertheless, two aspects are of utmost importance and must be taken into consideration in every recovery system: **collection charges should be calculated according to the actual costs, and the takings should be used exclusively for the intended purpose.** Moreover, cost accounting should be fully transparent for the beneficiaries to know what kind of service they are paying for and what they are entitled to receive. The users should also have the possibility to file complaints if the service they are paying for is not or insufficiently delivered. In any case, the selected cost recovery system should be as simple as possible to achieve highest participation from the beneficiaries. Basically, there are two options for generating revenues to cover the running costs of primary collection schemes: fees or municipal taxes.

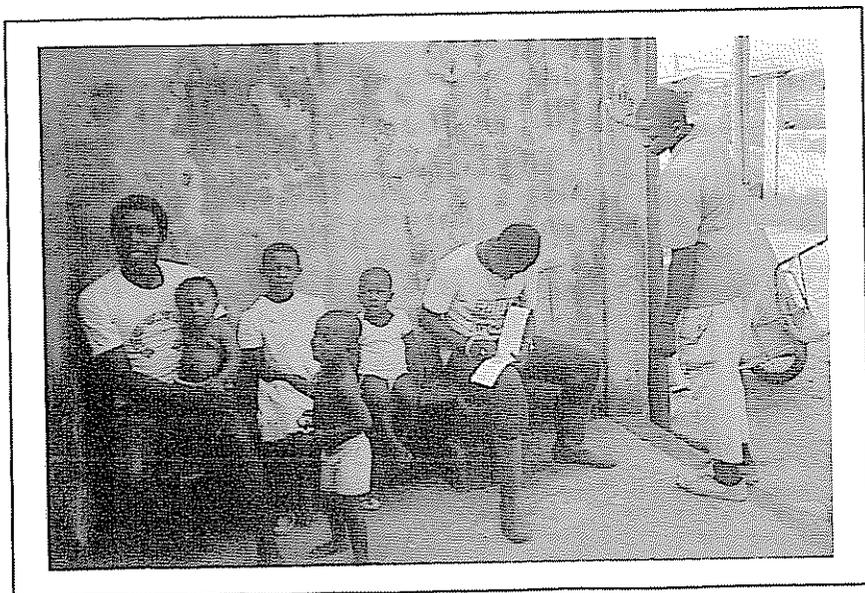
Fees

Fees can be collected on a monthly, weekly or daily basis, or by any other manner directly at the households either by the refuse collectors or by special fee collectors, or during neighbourhood meetings by the management. They can be managed and controlled efficiently, and linkage between management and users is therefore guaranteed. Quality control and enforcing of sanctions are thus feasible. Increased participation may be achieved through fees adapted to the financial standing of the different households. A fee system based on the generated amount of waste is, in contrast, not yet likely to succeed on a broad basis. However, major waste producers, such as restaurants, factories, schools, and markets, should be charged higher fees.

Taxes

Municipal taxes and utility bills, used in municipal recovery systems, are more centralised financing models. These systems are successful only where the community is not forced to establish a self-help primary collection scheme, and municipal cooperation is given. Accounting through general taxes, such as property tax, is likely to lead to insufficient cost recovery for the collection scheme since revenues might be used for other purposes within the municipality. Furthermore, sanctions are usually difficult to apply in illegal squatter settlements. Billing together with other utility services, such as electricity or water supply, is another option which may contribute to reducing administrative costs of the recovery system. The utility service could theoretically be discontinued if the fees for SWM are not paid. However, numerous institutional objections may be raised against such an arrangement.

Since income in squatter settlements is usually based on the informal economy and the available cash thus unlikely to be a monthly phenomenon, **service oriented fees seem to be a more advantageous form of cost recovery for primary collection schemes.** For secondary collection and final disposal, however, it might be necessary to cover part of the expenditure



As exemplified by this scene in the area of Nylon-Dibom in Douala (Cameroon), households pay service fees directly to the collectors on a monthly, weekly or daily basis. The amount to be paid by a certain family can be based on the financial standing of the contributory household. (Photo: SANDEC)

with general municipal revenues as low-income households are unlikely to understand the need for contribution.

Affordability

**The provided service must be
within the means of most beneficiaries**

To achieve highest participation in the collection scheme, the provided service must be within the means of the beneficiaries. Technical solutions should consequently be based on the financial standing of the users and on the potential of generating local revenues (see Chapter 1). A potential financial contribution is usually very limited in squatter settlements as the average monthly income level in these areas amounts to roughly US\$ 100 - 200 per household. **As described in this report, the calculated monthly service costs for manually operated primary collection schemes generally range between US\$ 0.15 and 0.75 per household - a charge which seems affordable.** However, several other needs within the households receive higher priority as aforementioned, and residents are rather reluctant to use their limited financial resources for solid waste services. Not only affordability, but also consumer's willingness to pay has to be taken into consideration. Willingness to contribute to the service thereby depends on the felt need of the population for solid waste management. Strengthening awareness with regard to environmental health risks, and involving future beneficiaries in decision-making are thus important activities to enhance willingness to pay. The provision of a reliable service is, however, the most important condition for people's willingness to pay.

Conclusions

This review of selected schemes in different cities clearly reveals that non-governmental primary refuse collection is basically a suitable approach to increasing service coverage in low-income urban areas. **Small private enterprises and community organisations have a great potential in easing the responsible public authorities of part of their burden.** Most schemes are, however, far from being self-sustainable and also face problems which can and do lead to a break down of operation. The conclusions drawn from the studied cases and the most important conditions to establish successful schemes are briefly summarised hereafter:

Collaboration between public authorities and non-governmental actors

A common denominator to most schemes is the absence of a municipal framework which adequately integrates community groups and/or the private sector in SWM services. A lack of cooperation between the actors involved results in serious operational difficulties, particularly at the interface between non-governmental primary collection and the municipal secondary collection; i.e., transfer of waste. Promising initiatives of motivated community organisations, NGOs and individuals in establishing collection schemes are bound to fail when activities are not supported by and coordinated with public authorities. The establishment of a service-oriented collaboration between public and non-governmental actors to enhance alternative approaches is therefore urgently needed.

Information of the users and their involvement in decision-making

Primary refuse collection schemes, particularly alternative approaches, require considerable participation of the households (e.g. storage in households, carrying to the roadside or to communal containers, payment via user fees). Besides involving the future users in decision-making; i.e., in the choice of a system, people's capacity and willingness to contribute in cash or kind are thus important factors to be considered. However, willingness to contribute is strongly dependent on the felt need of the population for solid waste collection, which is unfortunately often low. Enhancing awareness with regard to problems related to inappropriate solid waste handling, and providing information on possible improvements are consequently important activities.

Selection of an affordable and sustainable technology

Most of the inhabitants in squatter settlements are poor, and their ability to contribute in cash is very limited. Low-cost technical solutions are thus prerequisites for successful collection systems, and contributions in kind, such as carrying the refuse directly to communal containers, present an option requiring serious consideration. Where collection vehicles are necessary, manually operated handcarts or tricycles proved to be appropriate for the often poorly accessible areas. Apart from being non-polluting, these carts are cheap in manufacture

and operation and can be produced and maintained locally; all of which are preconditions for a sustainable technology. For easy transfer, it is thereby also important for the carts to be compatible with the secondary collection vehicles.

Assessment and transparent recovery of incurred costs

Lack of cost assessment and insufficient cost recovery lead to a strong dependence on external financial assistance. Although donations can be a valuable contribution, operation and maintenance are likely to cease as soon as financial support is withdrawn. Therefore, the calculated operating costs must be fully recovered from the beneficiaries through a simple fee collection system. The required investment capital can be financed through loans. Small private enterprises (micro-enterprise model) have proved the most efficient of all the evaluated schemes since they operate according to business management principles. Community-based schemes are, however, likely to reach a similar performance once they operate on a more commercial basis.

Open Questions

Several key issues and questions which seem to be vital in establishing and/or improving non-governmental collection schemes have not yet been addressed in detail. The following important questions require further clarification and additional research:

- **What is a suitable framework for a fruitful collaboration between public authorities and non-governmental actors?**
- **How can small private enterprises or community-based organisations overcome the difficulties in obtaining loans at reasonable conditions?**
- **What is a suitable approach for mobilising and motivating communities to participate in decision-making and operation of collection schemes?**
- **How can the design of transfer points be improved for easy and efficient transfer of collected refuse?**
- **How can waste pickers be effectively integrated into refuse collection schemes without jeopardising public health?**

* * *

Duebendorf, March 1996

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Annex 1: Check List

Some of the main issues to be considered for the establishment of non-governmental primary collection schemes in low-income urban areas are listed hereafter:

Definition of a viable collection perimeter

- Topography; social, ethnological, historical “boundaries”
- Influence of strong community organisations
- Prospects of internal cross-subsidies from richer areas
- Special charges for commercial premises and markets
- Integration into overall SWM system (secondary collection, disposal)

Collection of basic information

- Existing facilities and infrastructure (storage facilities, roads, drains)
- Existing practises (waste pickers; recycling)
- Decision-making structure (area representatives, opinion leaders)
- Communication channels for information of households
- Needs and priorities of households
- Ability and willingness to contribute in cash or kind

Collection of technical data

- Waste generation and characteristics (rates, density)
- Number of households and of inhabitants per household
- Existing storage facilities at households
- Length of blocks and distance to collection/transfer point
- Estimated number of required staff and vehicles

Selection of appropriate vehicles

- Accessibility of area
- Loading capacity and range
- Number of required crew (labour vs. equipment costs)
- Investment and running costs (affordability)
- Ease of handling (operation, loading and unloading)
- Maintenance and availability of spares

Design of operational pattern

- Required infrastructure and facilities (containers, bins)
- Frequency of collection (storage capacity; odour emissions)
- Exact routing for collection
- Point of collection (communal storage; house-to-house)
- Integration of waste pickers

Coordination with secondary collection

- Location of transfer stations (accessibility, distances)
- Ease of transfer to larger transport vehicles (ramps)
- Schedule for emptying storage facilities
- Cooperation with public authority

Organisation and management

- Roles and responsibilities of different actors
- Link and cooperation between main actors
- Supervisory and quality control mechanisms
- Complaints and sanctions

Cost assessment and financing

- Assessment of investment costs (equipment, office, uniforms)
- Assessment of running costs (salaries, maintenance)
- Loan or donation for investment capital
- Fee system to cover running expenditure

Annex 2: Model Contract

In a contractual agreement between public authorities and small private enterprises, all relevant elements of the service to be delivered have to be defined and agreed upon. The contract should address especially the following aspects:

- **Exact definition of the area to be served** (e.g. street names)
- **Description of the type of service** (e.g. collection of domestic refuse, street cleansing, transport to a landfill)
- **Frequency of the service** (e.g. twice a week)
- **Duration of the contract** (e.g. three years, annually renewable)
- **Contractual payment** (including depreciation)
- **Conditions relating to overdue payment** (e.g. cost increase due to bank charges)
- **Conditions for inadequate service delivery** (e.g. payment reduction, cancelling of contract)
- **Sub-contracting restrictives/conditions**
- **Establishment of a supervisory committee** (e.g. consisting of representatives of each party involved)
- **Legal aspects and conditions**
- ...
- ...

The following agreement may serve as a model for similar contracts. It is based on the existing contractual agreement between the Municipality of Cajamarca (Peru) and "Limdovesa", a small private enterprise contracted to collect domestic refuse of about 50 % of the urban-marginal population and to transport the collected waste to the municipal landfill [5, 20, 22]:

Contractual Agreement with the Public Cleansing Services

A contractual agreement with the Public Cleansing Services, which includes the following terms and conditions, is concluded between the Provincial Municipality of [] with registered office in [], represented by the Municipal Director Mr/Mrs [], duly identified by ID No. hereafter referred to as the municipality, and the Micro-Enterprise [] with registered office in [], represented by Mr/Mrs [], identified by ID No. [], hereafter referred to as THE MICRO-ENTERPRISE:

Art. 1: Legal Basis

The Municipality signs an agreement with the Micro-Enterprise in accordance with the duties, responsibilities and restrictions as stipulated by the Municipalities Law No. [], the Budget Law for the Public Sector No. [], including the

corresponding standards. If the requirements do not meet the limits and conditions foreseen by the aforementioned standards, the decisions will be taken in accordance with the latter.

Art. 2: Purpose

Based on the municipal resolution and by unanimous vote of the ruling parties, the Municipality establishes; “[] a [] % participation of the Micro-Enterprise in the Public Cleansing Service subject to the scope and conditions imposed by the Law []”.

Art. 3: Service to be delivered

As described in the enclosed Annex 1 (*detailed description of service to be delivered and service area*), which forms part of the present agreement, the competent municipal authorities have defined the scope of duties of the Domestic Waste Collection and Transport Services to be provided by the Micro-Enterprise. The service is contracted to work according to the “Clean Zone” system (including cleansing of streets if necessary) at a collection frequency of twice a week. The total population to be covered by the Micro-Enterprise amounts to max. [] inhabitants. If the difference between the estimated and the actual population varies more than [] %, the parties will decide on the increase or decrease of the total amount agreed upon in Article 6.

Art. 4: The Micro-Enterprise

The structure of the Micro-Enterprise was decided upon with the support of the Municipality through the Neighbouring Councils which guaranteed the presentation of eligible candidates for the micro-enterprise. The selection of candidates was carried out by an Evaluation Committee composed of the Mr/Mrs [] representing the Mayor of the Province, five neighbouring mayors, the head of the Environmental Sanitation Unit of the Municipal Province, the Deputy Director of the Basic Sanitation Area of Health, and a representative of the consulting NGO []. Annex II contains the documentation on the call for candidates and the selected micro-contractors.

Art. 5: Term of the Agreement

Without prejudice to what has been established in Art. 9, the present agreement is valid for [] years and can be renewed annually. Both parties agree to carry out a joint evaluation of the service at the end of the first year.

Art. 6: Contractual Payment

Both parties agree to a monthly payment for the rendered service amounting to US\$ [], this amount does not include taxes. This sum will be increased due to depreciation every month by [] % up to max. [] % annually.

Art. 7: Payment Conditions

The rendered public cleansing services, as stipulated in Art. 3, will be paid by the Municipality to the Micro-Enterprise not later than on the fifth day of every

month and at the end of one month service. The said payment will otherwise be increased by extra charges comprising payments of interests and negative bank interests.

Art. 8: Sub-Contracting

The Micro-Enterprise may not hand over or transfer totally or partially its contractual agreement to third parties, nor restructure, associate or subcontract the service in order to delegate its responsibility. In terms of costs, it may also not contract third party services payable by the Municipality.

Art. 9: Cancellation of the Agreement

The present agreement can only be cancelled by the Municipality if a non-performance of the contracted service is established in accordance with Art. 3 of the present agreement and bearing a notary authentication of half and one member of the Supervisory Neighbourhood Council of the Public Cleansing Service foreseen in Art. 10 of the present agreement of all the Neighbourhood Councils serviced by the Micro-Enterprise.

Art. 10: Quality Control

The "Supervisory Neighbourhood Committees of the Public Cleansing Service", which will have to be set up in each Neighbourhood Council where the Micro-Enterprise operates, is the Control Entity of the Public Cleansing Service operating within the radius of the Micro-Enterprise as established in Art. 3 of the present agreement. These Supervisory Neighbourhood Committees will be composed of: the Director of Ecology, Environment and Settlement of the Provincial Council or his representative, the Neighbourhood Mayor and the President of the Board of Directors of the Micro-Enterprise. In the event of any non-performance other than Acts of God, the Micro-Enterprise is liable for the solving of the said problem as quickly as possible. In the event of repeated non-fulfilment (more than three times), the Municipality is authorised to deduct ... % from the last monthly payment. Repeated non-fulfilment will be registered, certified and signed by the Neighbourhood Mayor in the area of jurisdiction of the unfulfilled service.

Art. 11: Renewal Terms

At the end of the contractual agreement of three years, both parties will evaluate the possibility of concluding a new contract or terminating it.

Art. 12: Miscellaneous

Since the parties fall under the jurisdiction of the judges and courts of the Municipality, the undersigned have to indicate their registered office at the beginning of the present agreement.

12.1

Fulfilment and execution of the present agreement is only valid if written notification is sent to the mentioned registered office.

- 12.2 Should a registered office of one of the parties involved change address, it will only be legally valid with regard to the other if the new address is located in the same city and attested by a notary. Meanwhile, notification forwarded to the registered office indicated in the present agreement remains in force.
- 12.3 All those aspects which have not been taken into consideration in the present agreement will be solved jointly between the contracting parties.

The contracting parties hereby declare that in honour of the present contractual agreement with the Public Cleansing Services they are not aware of any contributory negligence which would nullify or cancel it. The agreement is signed in good faith here in the Municipality of [].

Date: []/[]/[]

Mr/Mrs []
Municipal Director

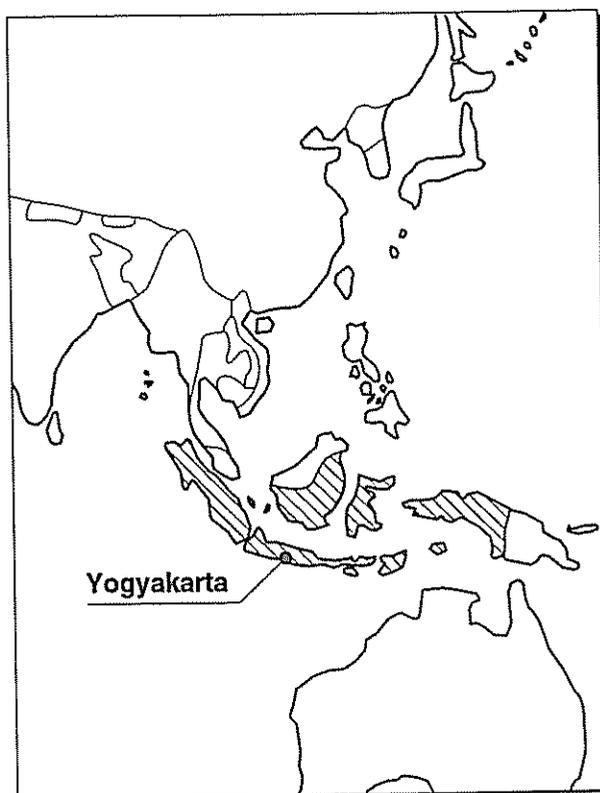
Mr/Mrs []
The Micro-Enterprise

Annex 3: Description of Selected Cases

Indonesia	Yogyakarta (2)
	1 Juminahan
	2 Pajeksan
	Padang (2)
	3 Parubuk Tabing
	4 Lapai
	Ujung Pandang (2)
	5 Bara-Baraya
	6 Baraya
	Surabaya (2)
	7 Pacar Keling
8 Sidotopo	
Cirebon (3)	9 Pekalipan
	10 Lemahwungkuk
	11 Melati
China	Shanghai (2)
	12 Pao Shang
	13 Yang Pu
Cameroon	Douala (1)
14 Nylon Dibom II	
Ivory Coast	Abidjan (-)
15 -	
Burkina Faso	Ouagadougou (1)
16 Wogodogo	
Colombia	Cucuta (1)
17 Los Patios	
Peru	Cajamarca (1)
18 <i>Marginal Areas</i>	

Yogyakarta, Indonesia

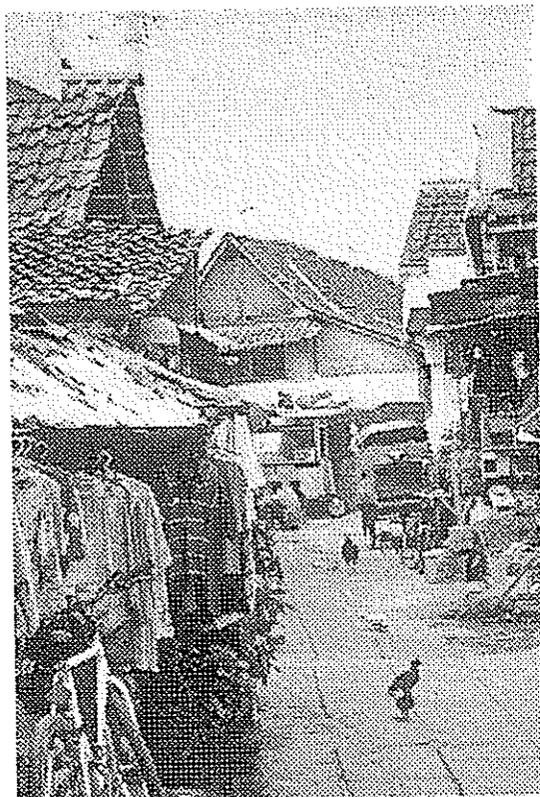
Source: Dian Desa (1993)



General Description

Yogyakarta is the capital of the Province of Yogyakarta, in the southern part of Jawa, and has a population of around 480,000 (1993). The climate is tropical with temperatures between 23 and 30°C and an annual rainfall of around 1,800 mm. Administratively, the city is divided into 13 districts (Kecamatans) and 45 sub-districts (Kelurahans) which consist of community (RW's) and neighbourhood (RT's) units. Overall responsibility for Solid Waste Management rests with the Municipal Cleansing Department (Dinas Kebersihan dan Pertamanan), which currently can manage only around 68% of the generated wastes. In the unserved or underserved areas, community participation is quite significant. It is estimated that, city-wide, around 360 collectors are employed by community based organisations to collect refuse from the households and bring it to communal collection points. To encourage these systems, the Municipal Department provided assistance in the form of distributing around 500 collection carts in various sub-districts. Two such community-based schemes of different low-income areas - Juminahan and Pajeksan - are described below:

1 Juminahan



(Photo: Dian Desa)

Organisation & Management

Introduced by: local government
 Established in: 1989
 Managed by: 1 manager, 1 secretary
 Supervised by: community committee
 Participation: bring to roadside

Main Problems: limited perception of SW handling (33% have no knowledge of the process), poor financial sustainability, poor salaries for collectors, dependent on a single individual, relying on outside assistance, messy and inefficient unloading at CP.

Characteristics of the Perimeter

Area: 8 ha
 Households: 329 hh
 Inhabitants: 1509 inh
 Density: 189 inh/ha
 Income Level: 70% < US\$ 80.-/hh.mth
 Access Roads: small, paved lanes
 Topography: flat

Technical & Operational Parameters

Equipment: 2 handcarts at 0.9 m³
 Others: fork, spade
 Personnel: 4 collectors
 Type of Service: door-to-door
 Distance to CP: 500 m
 Frequency: daily
 Working hrs: 3 hours/d
 Coverage: 72 %
 Productivity: 91 inh/coll.hr
 Recycling: households, collectors

Service Costs & Financing

Equipment: donation
 Personnel: US\$ 60.-/mth (6)
 Maintenance: US\$ 5.-/mth
 Others: none
 Financing: fees
 Frequency: monthly
 Fee Collection: directly by management
 Amount: US\$ 0.12 - 0.50/hh
 Total Income: US\$ 65.-/mth

2 Pajeksan



(Photo: SANDEC)

Organisation & Management

Initiated by: community member
 Established in: 1985
 Managed by: 1 manager (voluntary)
 Supervised by: -
 Participation: funding, bring to road

Main Problems: limited perception of SW handling (22% have no knowledge of the process), difficult access in narrow lanes, poor salaries for collectors, long distance to CP, slow and inefficient unloading due to queue (dumping in trucks) and scavenger activity, dependent on voluntary work of manager.

Characteristics of the Perimeter

Area: 8 ha
 Households: 459 hh
 Inhabitants: 1983 inh
 Density: 248 inh/ha
 Income Level: 50% < US\$ 80.-/hh.mth
 Access Roads: very small, paved lanes
 Topography: flat

Technical & Operational Parameters

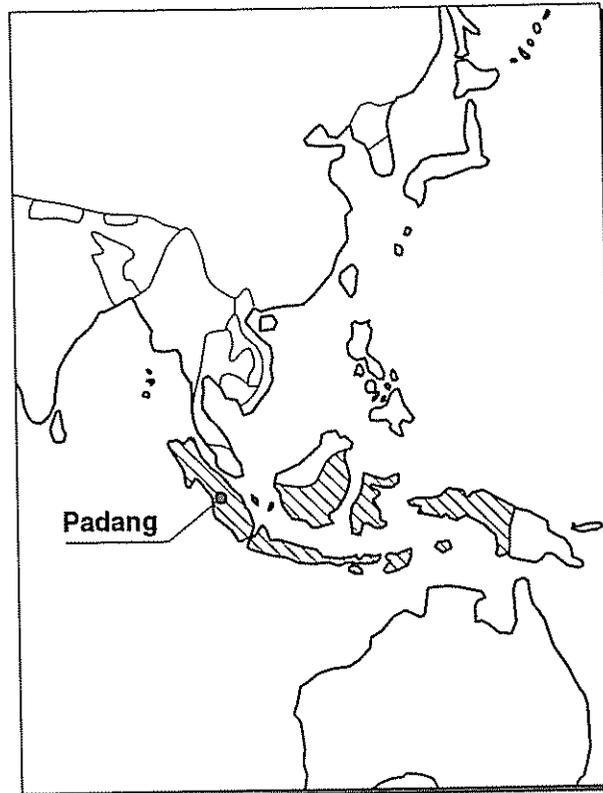
Equipment: 1 handcart at 1.5 m³
 Others: boots, raincoats, gloves
 Personnel: 3 collectors (in turn)
 Type of Service: door-to-door
 Distance to CP: 1,500 m
 Frequency: daily
 Working hrs: 3 hrs/d
 Coverage: 84 %
 Productivity: 92 inh/coll.hr
 Recycling: households, collectors

Service Costs & Financing

Equipment: community funding
 Personnel: US\$ 44.-/mth (3)
 Maintenance: US\$ 8.-/mth
 Others: US\$ 6.-/mth for SECOL
 Financing: fees
 Frequency: daily
 Fee Collection: directly by collectors
 Amount: US\$ 0.02 - 0.05/hh
 Total Income: US\$ 58.-/mth

Padang, Indonesia

Source: Dian Desa (1993)



General Description

The resident population of Padang, capital of West Sumatra Province, amounts to around 640,000 (1990). The climate is tropical, with average temperatures between 23 and 30°C, and the annual rainfall is around 4,500 mm. Administratively, the city is divided into 11 districts and 193 sub-districts divided into various community and neighbourhood units. The overall responsibility for SWM rests with the Municipal Cleansing Department (Dinas Pembersihan Kota), which is currently capable of managing only 75% of the total generated wastes. Part of the service is performed by 13 private enterprises sub-contracted by the department. In the underserved areas, around 8,000 people are estimated to participate actively in solid waste handling at community level. Two examples from different areas - Parupuk Tabing and Lapai - are described hereafter:

3 Parupuk Tabing



(Photo: Dian Desa)

Organisation & Management

Initiated by: local government
 Established in: 1988/1992
 Managed by: 1 manager, 5 staff (v)
 Supervised by: 1 control person
 Participation: bring to roadside

Main Problems: very limited perception of SW handling (46% have no knowledge, 30% have limited knowledge), poor salaries for collectors, long distance to dumping site, dependent on voluntary management.

Characteristics of the Perimeter

Area: 203 ha
 Households: 3,964 hh
 Inhabitants: 15,017 inh
 Density: 75 inh/ha
 Income Level: 20% < US\$ 87.-/hh.mth
 Access Roads: 55% paved
 Topography: hilly

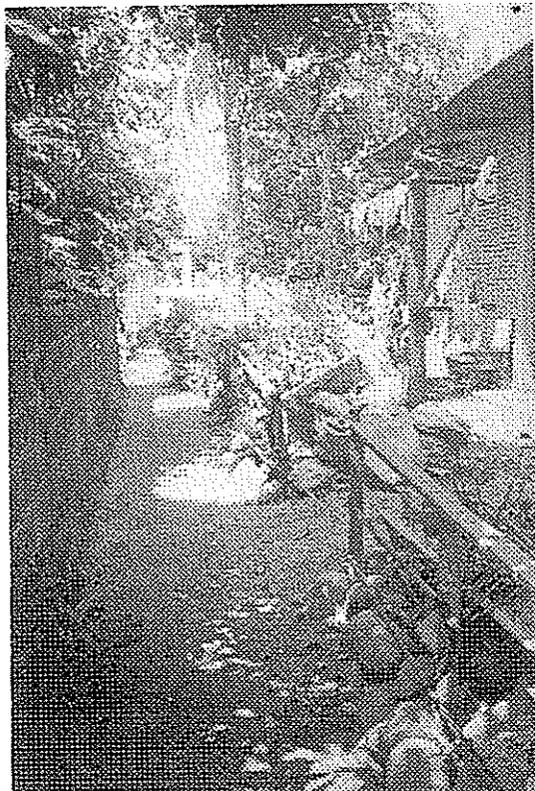
Technical & Operational Parameters

Equipment: 2 trucks at 5 m³
 Others: boots, gloves, raincoats
 Personnel: 6 collectors + 2 drivers
 Type of Service: door-to-door
 Distance to DS: 5000 m
 Frequency: alternate days
 Working hrs: 4-5 hrs/d
 Coverage: 50 %
 Productivity: 139 inh/coll.hr
 Recycling: households, collectors

Service Costs & Financing

Equipment: US\$ 500.-/mth (rented)
 Personnel: US\$ 520.-/mth (18)
 Maintenance: none
 Others: US\$ 480.-/mth SECOL
 Financing: fees
 Frequency: monthly
 Fee Collection: directly by fee collectors
 Amount: US\$ 0 - 0.75/hh
 Total Income: US\$ 1,500.-/mth

4 Lapai



(Photo: Dian Desa)

Organisation & Management

Initiated by: local government
 Established in: 1985
 Managed by: 1 manager, 1 secretary
 Supervised: community unit
 Participation: bring to roadside

Main Problems: limited perception of SW handling (20% have no knowledge, 30% have limited knowledge), low salaries for collectors, inefficient and messy unloading of the tricycles at the swampy dumping site.

Characteristics of the Perimeter

Area: 23 ha
 Households: 460 + 140 hh
 Inhabitants: 2,780 inh
 Density: 100 inh/ha
 Income Level: 20% < US\$ 86.-/hh.mth
 Access Roads: narrow lanes (unpaved)
 Topography: flat

Technical & Operational Parameters

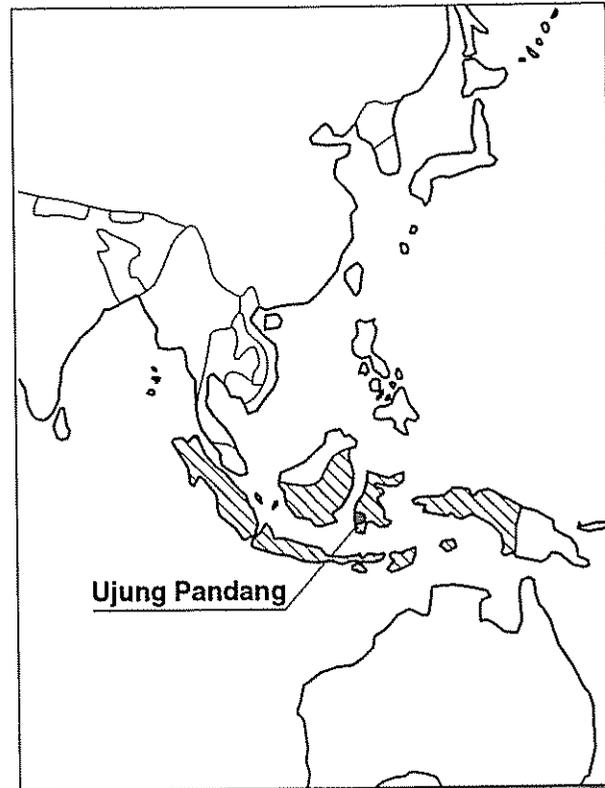
Equipment: 2 tricycles at 0.9 m³
 Others: protective clothing
 Personnel: 2 collectors
 Type of Service: door-to-door
 Distance to DS: 100 m
 Frequency: daily
 Working hrs: 3 hrs/d
 Coverage: 100 %
 Productivity: 370 (?) inh/coll.hr
 Recycling: households, collectors

Service Costs & Financing

Equipment: lent by individual
 Personnel: US\$ 187.-/mth (5)
 Maintenance: US\$ 265.-/mth (+fund)
 Others: US\$ 25.-/mth to SECOL
 Financing: fees
 Frequency: monthly
 Fee Collection: directly by fee collector
 Amount: US\$ 0.75/hh
 Total Income: US\$ 477.-/mth

Ujung Pandang, Indonesia

Source: Dian Desa (1993)



General Description

Ujung Pandang, the capital of South Sulawesi Province, has an estimated population of 843,000 (1990). The climate on the island of Celebes is tropical with average temperatures between 23 and 30°C and annual rainfall of around 2,800 mm. Administratively, the city is divided into 11 districts and 62 sub-districts divided into a number of community and neighbourhood units. The overall responsibility for SWM rests with the Municipal Cleansing Department which is currently capable of handling only around 65% of the generated wastes. In the course of a city-wide improvement programme, focus was placed on strengthening the role of community organisations with regard to refuse collection, wherefore the municipality distributed around 500 garbage carts in the lower income areas. However, no successful community level collection scheme exists up to date in Ujung Pandang. Nevertheless, two operating schemes - Bara-Baraya and Baraya - are described hereafter:

5 Bara-Baraya



(Photo: Dian Desa)

Organisation & Management

Initiated by: community/excollector
 Established in: 1993
 Managed by: collector
 Supervised by: -
 Participation: bring to roadside

Main Problems: very limited perception of SW handling (57% have no knowledge, 33% have limited knowledge), very informal system with poor support from municipal institutions, strongly dependent on one single individual, low salary for collector, inadequate and messy transfer and disposal site.

Characteristics of the Perimeter

Area: 19.5 ha
 Households: 263 hh
 Inhabitants: 1,162 inh
 Density: 60 inh/ha
 Income Level: 27% < US\$ 93.-/hh.mth
 Access Roads: paved lanes
 Topography: flat

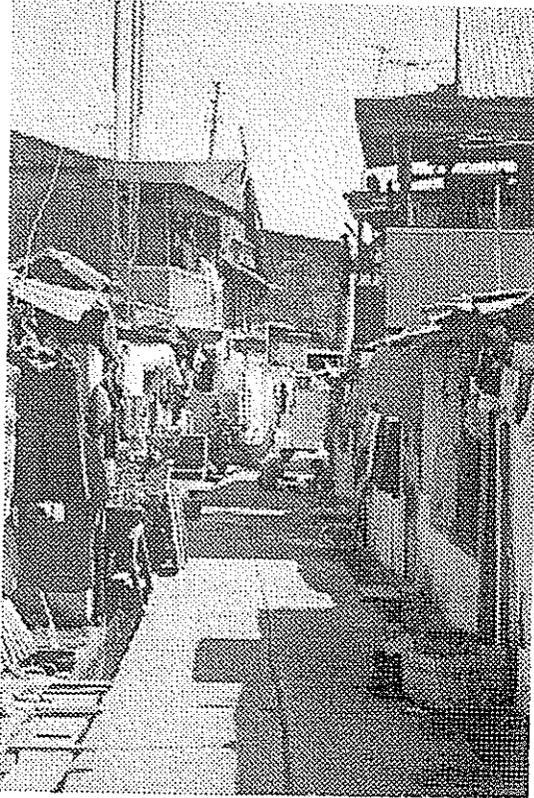
Technical & Operational Parameters

Equipment: 1 handcart
 Others: none
 Personnel: 1 collector
 Type of Service: door-to-door
 Distance to CP: -
 Frequency: daily/alternate days
 Working hrs: 5 hrs/d
 Coverage: 35 %
 Productivity: 81 inh/coll.hr
 Recycling: households

Service Costs & Financing

Equipment: US\$ 3.-/mth (repayment)
 Personnel: US\$ 35.-/mth (1)
 Maintenance: -
 Others: -
 Financing: fees/tips
 Frequency: monthly
 Fee Collection: directly by collector
 Amount: US\$ 0.38 - 0.75/hh
 Total Income: US\$ 38.-/mth

6 Baraya



(Photo: Dian Desa)

Organisation & Management

Initiated by: community/ex collector
 Established in: 1993
 Managed by: collector
 Supervised by: -
 Participation: bring to roadside

Main Problems: very limited perception of SW handling (33% have no knowledge, 52% partially know the process), very informal system with delivery upon request only, poor support from municipal institutions.

Characteristics of the Perimeter

Area: 21 ha
 Households: 997 hh
 Inhabitants: 5,867 inh
 Density: 279 inh/ha
 Income Level: 40% < US\$ 93.-/hh.mth
 Access Roads: small, paved alleys
 Topography: flat

Technical & Operational Parameters

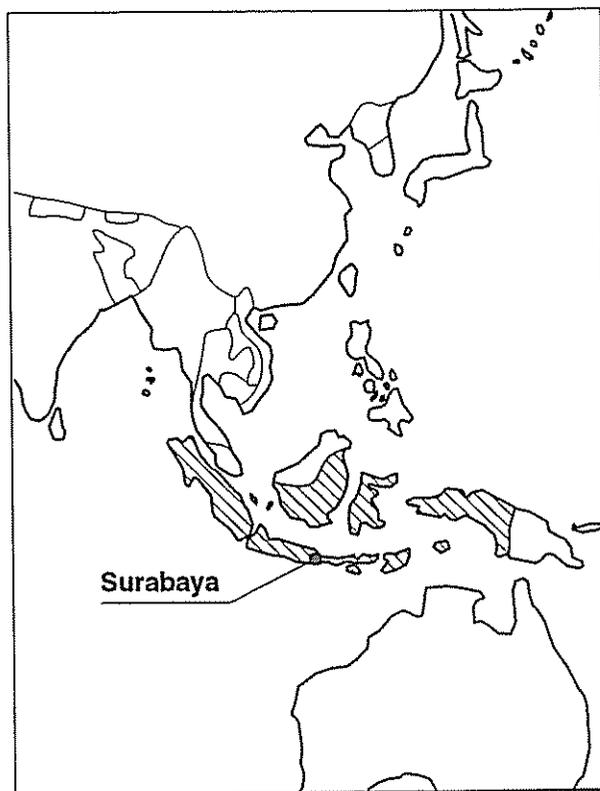
Equipment: 1 handcart
 Others: none
 Personnel: 1 collector
 Type of Service: door-to-door
 Distance to DS: -
 Frequency: irregular, upon request
 Working hrs: irregular
 Coverage: low
 Productivity: -
 Recycling: households

Service Costs & Financing

Equipment: municipal donation
 Personnel: -
 Maintenance: -
 Others: -
 Financing: fees/tips
 Frequency: daily
 Fee Collection: directly by collector
 Amount: US\$ 0.05/hh
 Total Income: US\$ 25.-/mth

Surabaya, Indonesia

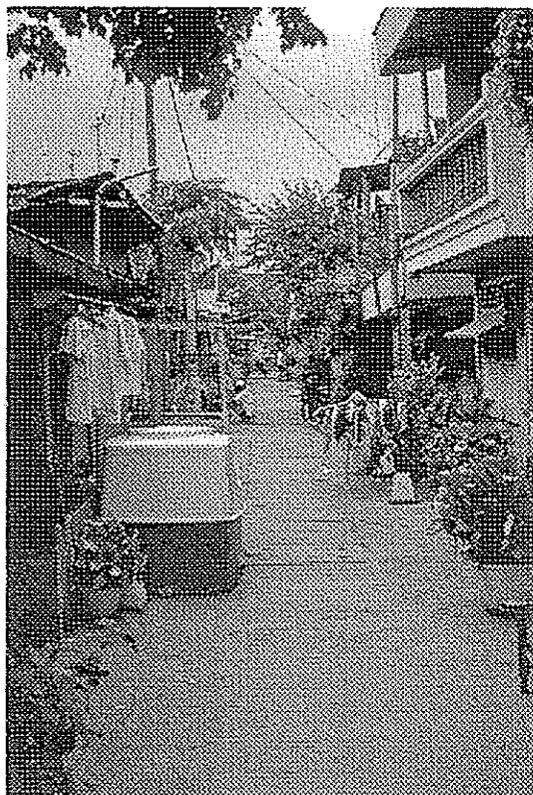
Source: Dian Desa (1993)



General Description

The estimated population of Surabaya, the capital of East Java Province, amounts to 2,500,000 (1990). The climate is tropical with average temperatures between 23 and 30°C and annual rainfall of around 1,300 mm. The city is divided into 5 major sub-areas headed by a deputy mayor. These areas are divided again into 19 districts and 163 sub-districts, each sub-divided into various community (RW) and neighbour-hood (RT) units. Overall responsibility for SWM rests with the Municipal Cleansing Department which can currently handle properly only about 69% of the generated wastes. It is estimated that 15% of the refuse are not collected at all. Besides the 1,722 people employed by the Municipal Department, some private enterprises are contracted for street sweeping and transfer to disposal sites and about 10,000 workers operate as refuse collectors at community level. Two examples of such community level activities in low-income areas - Pacar Keling and Sidotopo - are summarised in hereafter:

7 Pacar Keling (RW7)



(Photo: SANDEC)

Organisation & Management

Initiated by: local government
 Established in: 1982
 Managed by: neighbourhood units
 Supervised: neighbourhood units
 Participation: bring to roadside

Main Problems: limited perception of SW handling (10% have no knowledge, 70% partially understand), very low salaries for collectors.

Characteristics of the Perimeter

Area: 5 ha (approx.)
 Households: 1,000 hh (approx.)
 Inhabitants: 5,000 inh (approx.)
 Density: 900 (?) inh/ha
 Income Level: 31% < US\$ 86.-/hh.mth
 Access Roads: narrow, paved lanes
 Topography: flat

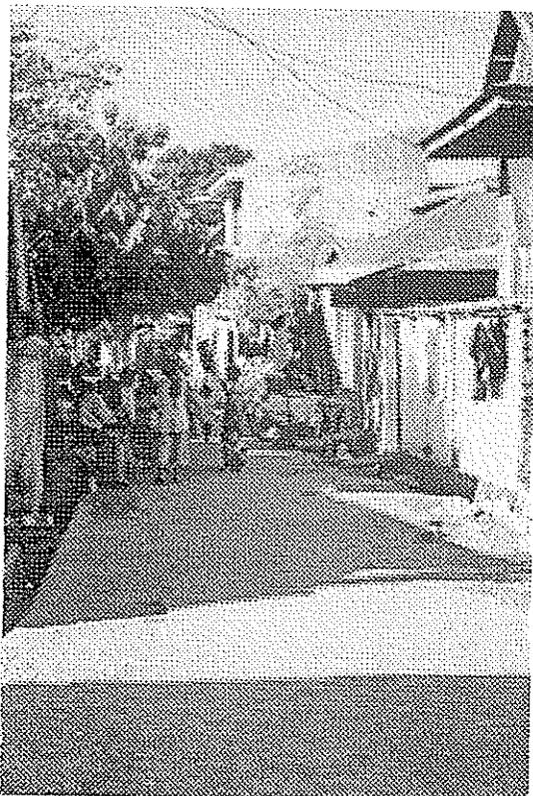
Technical & Operational Parameters

Equipment: 9 handcarts
 Others: protective clothing
 Personnel: 9 collectors
 Type of Service: door-to-door
 Distance to CP: -
 Frequency: daily
 Working hrs: 2 hrs/d
 Coverage: 90 %
 Productivity: 250 inh/coll.hr
 Recycling: households

Service Costs & Financing

Equipment: community funding
 Personnel: US\$ 135.-/mth (9)
 Maintenance: US\$ 9.-/mth
 Others: US\$ 126.-/mth to fund fees
 Financing: fees
 Frequency: monthly
 Fee Collection: on meetings by leaders
 Amount: > US\$ 0.25/hh
 Total Income: US\$ 270.-/mth

8 Sidotopo (RW8)



(Photo: Dian Desa)

Organisation & Management

Initiated by: community leaders
 Established in: 1980/89
 Managed by: community leader
 Supervised: community leader
 Participation: bring to roadside

Main Problems: limited perception of SW handling (10% have no knowledge, 58% partially understand), no maintenance of garbage carts, heavily dependent on the informal community leader.

Characteristics of the Perimeter

Area: 4 ha
 Households: 650 hh
 Inhabitants: 2,354 inh
 Density: 588 inh/ha
 Income Level: 36% < US\$ 86.-/hh.mth
 Access Roads: paved lanes
 Topography: flat

Technical & Operational Parameters

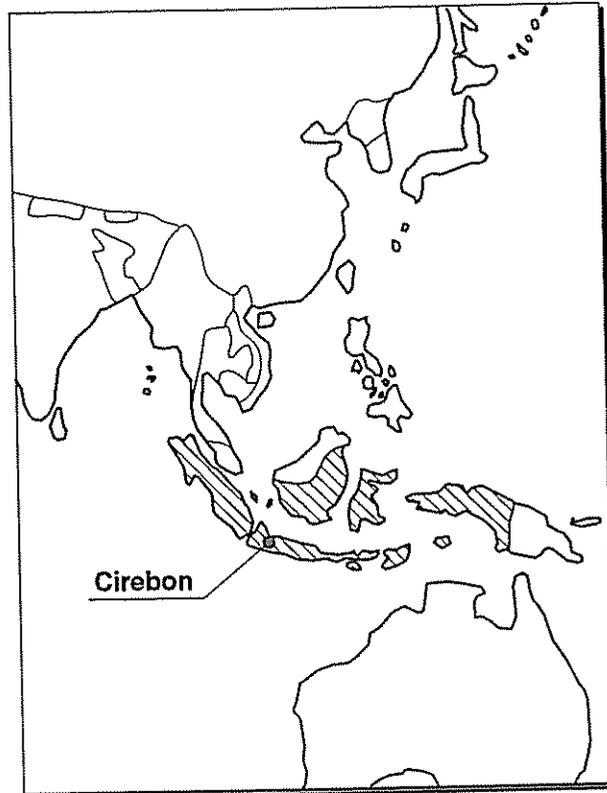
Equipment: 1 handcart
 Others: protective clothing
 Personnel: 2 collector
 Type of Service: door-to-door
 Distance to CP: 400 m
 Frequency: daily
 Working hrs: 3 hrs/d
 Coverage: 100 %
 Productivity: 392 inh/coll.hr
 Recycling: households

Service Costs & Financing

Equipment: municipal donation
 Personnel: US\$ 50.-/mth (2)
 Maintenance: fund/leader
 Others: fund/leader
 Financing: fees
 Frequency: monthly
 Fee Collection: at meetings by leaders
 Amount: > US\$ 0.25/hh
 Total Income: US\$ 150.-/mth

Cirebon, Indonesia

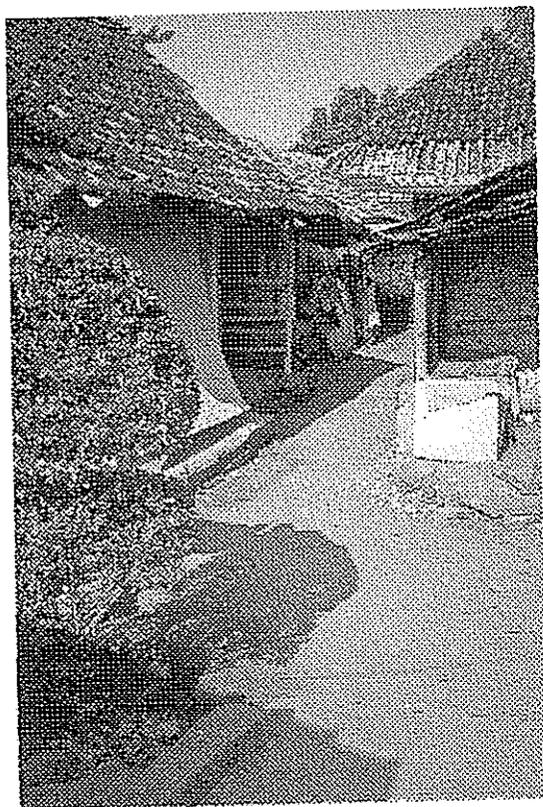
Source: Schertenleib and Meyer (1992)



General Description

Cirebon, which is located on the north coast of Java, has an estimated population of less than 1,000,000 (1992). The climate is tropical with average temperatures between 24 and 33 °C and annual rainfall of around 2,560 mm. As in other Indonesian cities (see above), several community-based primary collection schemes have been initiated and established in recent years. Three examples of such community and neighbourhood-level activities from different low-income areas - Pekalipan, Lemahwungkuk and Melati - and their respective data are summarised hereafter:

9 Pekalipan (RW6)



(Photo: SANDEC)

Organisation & Management

Initiated by: local government
 Established in: 1990
 Managed by: community unit
 Supervised by: community unit
 Participation: bring to roadside

Main Problems: container at communal collection point is often full and refuse then dumped along the seashore, dependent on external assistance.

Characteristics of the Perimeter

Area: 3 ha
 Households: 152 hh
 Inhabitants: 766 inh
 Density: 255 inh/ha
 Income Level: lower; mixed
 Access Roads: small (<2m), paved lanes
 Topography: flat

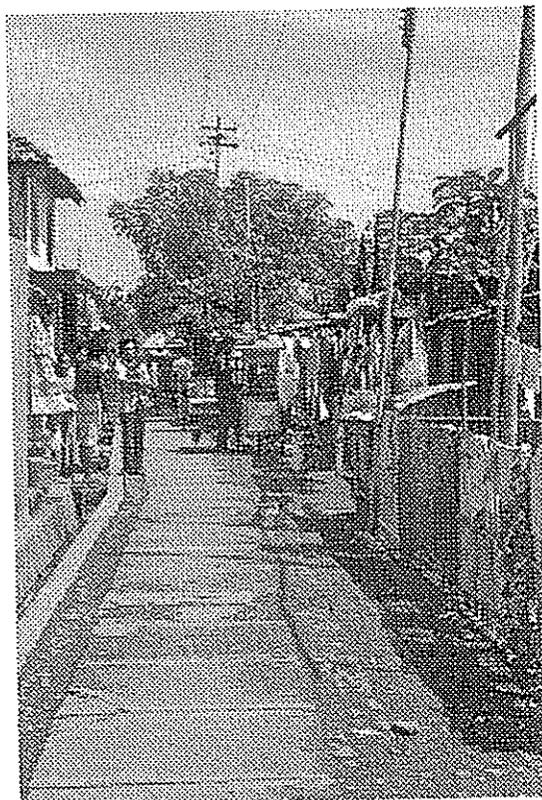
Technical & Operational Parameters

Equipment: 1 handcart at 1 m³
 Others: -
 Personnel: 1 collector
 Type of Service: door-to-door
 Distance to CP: 1,500 m
 Frequency: alternate days
 Working hrs: 3 hrs/d
 Coverage: 100 %
 Productivity: 128 inh/coll.hr
 Recycling: households, collector

Service Costs & Financing

Equipment: donation by richer inh.
 Personnel: US\$ 15.-/mth (1)
 Maintenance: US\$ 7.-/mth
 Others: US\$ 13.-/mth to SECOL
 Financing: fees
 Frequency: monthly
 Fee Collection: by community unit
 Amount: US\$ 0.12 - 0.50/hh
 Total Income: US\$ 35.-/mth

10 Lemahwungkuk (RW6)



(Photo: SANDEC)

Organisation & Management

Initiated by: local government
 Established in: 1990
 Managed by: community unit
 Supervised by: community unit
 Participation: bring to roadside

Main Problems: no financial resources to pay for secondary collection (SECOL),
 poor interface with SECOL.

Characteristics of the Perimeter

Area: 5,2 ha
 Households: 350 hh
 Inhabitants: 1,900 inh
 Density: 365 inh/ha
 Income Level: low
 Access Roads: <2m lanes
 Topography: flat

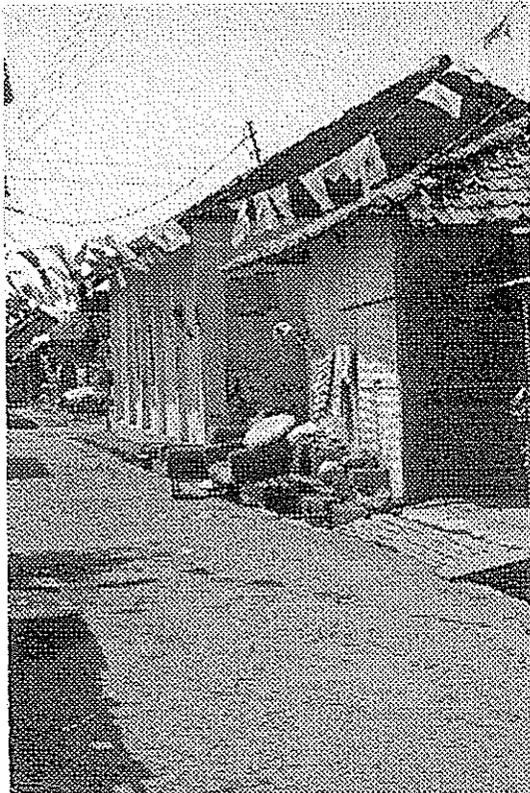
Technical & Operational Parameters

Equipment: 2 handcarts at 1 m³
 Others: none
 Personnel: 2 collectors
 Type of Service: door-to-door
 Distance to DS: 1,000 m
 Frequency: alternate days
 Working hrs: 4 hrs/d (estimated)
 Coverage: 100 %
 Productivity: 118 inh/coll.hr
 Recycling: households, collectors

Service Costs & Financing

Equipment: donation
 Personnel: US\$ 30.-/mth (2)
 Maintenance: by special collection
 Others: US\$ 5.-/mth (fee coll.)
 Financing: fees
 Frequency: monthly
 Fee Collection: by community unit
 Amount: US\$ 0.12 - 0.50 /hh
 Total Income: US\$ 35.-/mth

11 Melati



(Photo: SANDEC)

Organisation & Management

Initiated by: local government
 Established in: 1990
 Managed by: community unit
 Supervised by: community unit
 Participation: bring to roadside

Main Problems: no financial contribution to SECOL, no technical/financial external support to the system.

Characteristics of the Perimeter

Area: ? ha
 Households: 75 hh
 Inhabitants: 600 inh
 Density: low
 Income Level: upper middle, mixed
 Access Roads: <2,5 m lanes
 Topography: flat

Technical & Operational Parameters

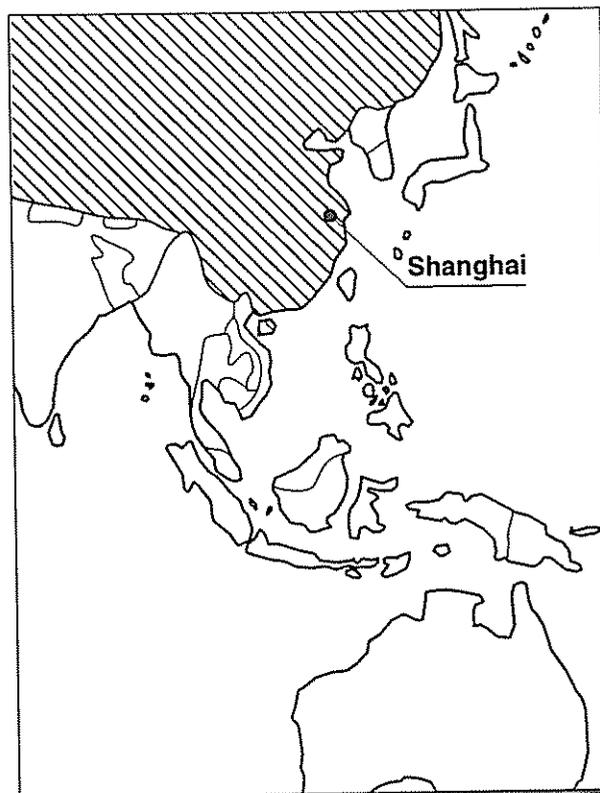
Equipment: 2 handcarts at 1.5 m3
 Others: none
 Personnel: 2 collectors
 Type of Service: door-to-door
 Distance to CP: 1500 m
 Frequency: daily
 Working hrs: 2 hrs/d
 Coverage: 100 %
 Productivity: 150 inh/coll.hr
 Recycling: none

Service Costs & Financing

Equipment: donation
 Personnel: US\$ 30.-/mth (2)
 Maintenance: US\$ 1.50/mth
 Others: US\$ 7.50/mth (manag.)
 Financing: fees
 Frequency: monthly
 Fee Collection: directly by fee collectors
 Amount: US\$ 0.12 - 1.75/hh
 Total Income: US\$ 39.-/mth

Shanghai, China

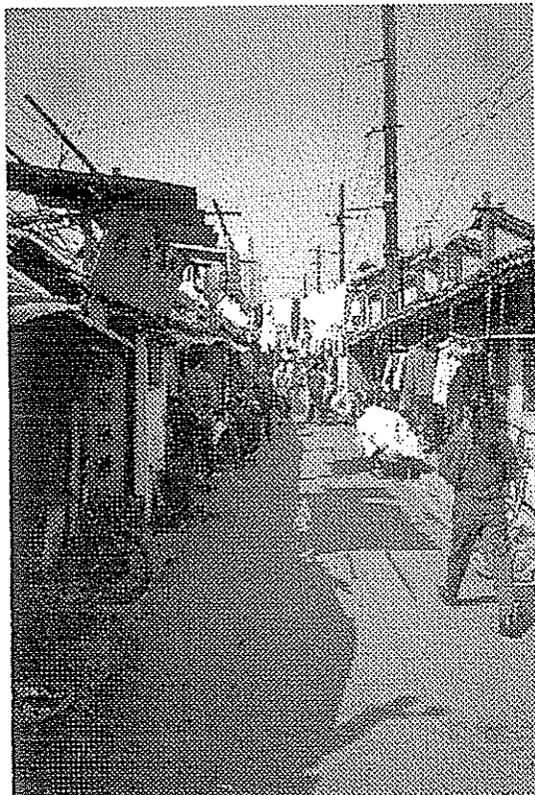
Source: Semb, Schertenleib (1992)



General Description

Shanghai City is China's most industrialised and largest municipality. The resident population within proper Shanghai is estimated at some 7,500,000 (1992), with an additional 5-6 million in the adjacent mixed urban and rural areas. Average temperatures range between 0 and 30°C and annual rainfall is around 1,200 mm. The overall responsibility for Solid Waste Management rests with the Shanghai Municipal Government, but over the last few years, responsibility has been increasingly decentralised to the 12 district governments. The Shanghai Environmental Sanitation Administration Bureaux (SESAB) are responsible for providing collection services, transport to transfer stations and operation of these stations. Around 60-70% of the generated wastes are currently managed by these bureaux, the rest is collected and disposed of uncontrolled. Most collection systems are largely dependent on the active participation of the households as they have to carry their waste from the houses to communal collection points operated and maintained by neighbourhood committees. Two examples of primary collection schemes with tricycles and handcarts as "mobile" collection points - Pao Shang and Yang Pu - are summarised hereafter:

12 Pao Shang



(Photo: SANDEC)

Organisation & Management

Initiated by: local government
 Established in: 1990
 Managed by: neighbourhood units
 Supervised by: n. units, district offices
 Participation: bring to tricycle (50 m)

Main Problems: -

Characteristics of the Perimeter

Area: 327 ha
 Households: 17,300 hh
 Inhabitants: 50,000 inh
 Density: 153 inh/ha
 Income Level: US\$ 110 - 130.-/mth
 Access Roads: paved roads
 Topography: flat

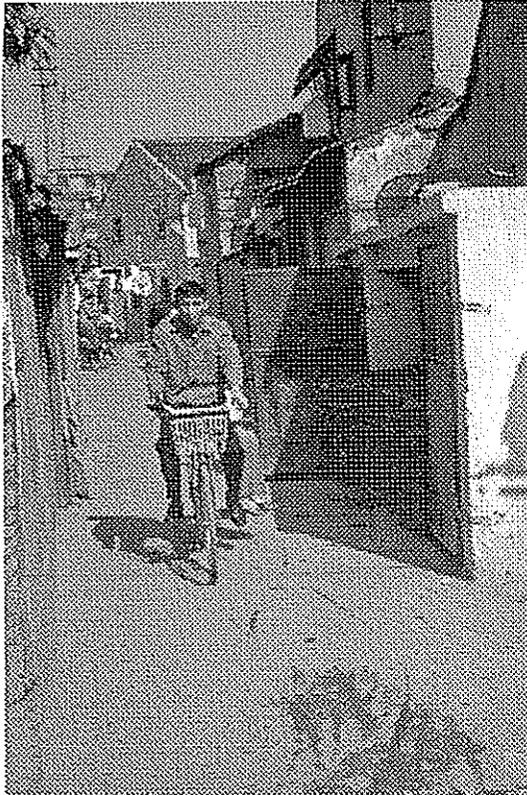
Technical & Operational Parameters

Equipment: 37 tricycles at 0.6 m³
 Others: -
 Personnel: 16 collectors
 Type of Service: "mobile" CP
 Distance to TP: 1000 m
 Frequency: daily
 Working hrs: 6 hrs/d
 Coverage: 100 %
 Productivity: 520 inh/coll.hr
 Recycling: -

Service Costs & Financing

Equipment: US\$ 6,000.- (NC, district)
 Personnel: US\$ 500.-/mth (16)
 Maintenance: -
 Others: -
 Financing: fees
 Frequency: monthly
 Fee Collection: direct to NC
 Amount: US\$ 0.07/hh
 Total Income: US\$ 1,260.-/mth

13 Yang Pu



(Photo: SANDEC)

Organisation & Management

Initiated by: NC, district office
 Established in: 1990
 Managed by: neighbourhood unit
 Supervised by: neighbourhood unit
 Participation: bring to handcart

Main Problems: very poor salaries for collectors, limited perception of SW handling, ramp (1:10) is too steep for unloading at transfer station.

Characteristics of the Perimeter

Area: 20 ha
 Households: 1,300 hh
 Inhabitants: 4,000 inh
 Density: 200 inh/ha
 Income Level: US\$ 60 - 100.-/hh.mth
 Access Roads: paved roads
 Topography: flat

Technical & Operational Parameters

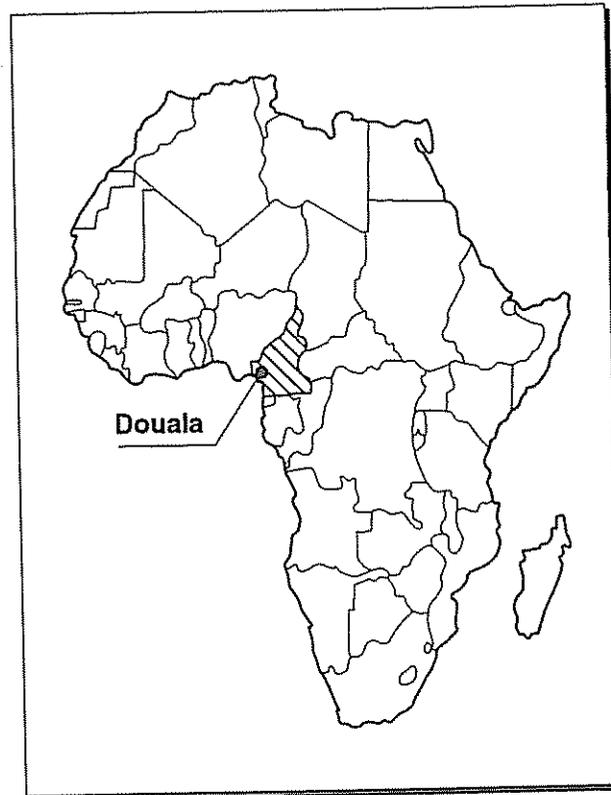
Equipment: 5 handcarts at 0.4 m³
 Others: -
 Personnel: 5 collectors
 Type of Service: "mobile" CP
 Distance to TP: 250 m
 Frequency: daily
 Working hrs: 6 hrs/d
 Coverage: 100 %
 Productivity: 133 inh/coll.hr
 Recycling: -

Service Costs & Financing

Equipment: donation (district)
 Personnel: US\$ 109.-/mth (5)
 Maintenance: US\$ 16.50/mth
 Others: -
 Financing: fees
 Frequency: monthly
 Fee Collection: directly to NCommitte
 Amount: US\$ 0.11/hh
 Total Income: US\$ 142.-/mth

Douala, Cameroon

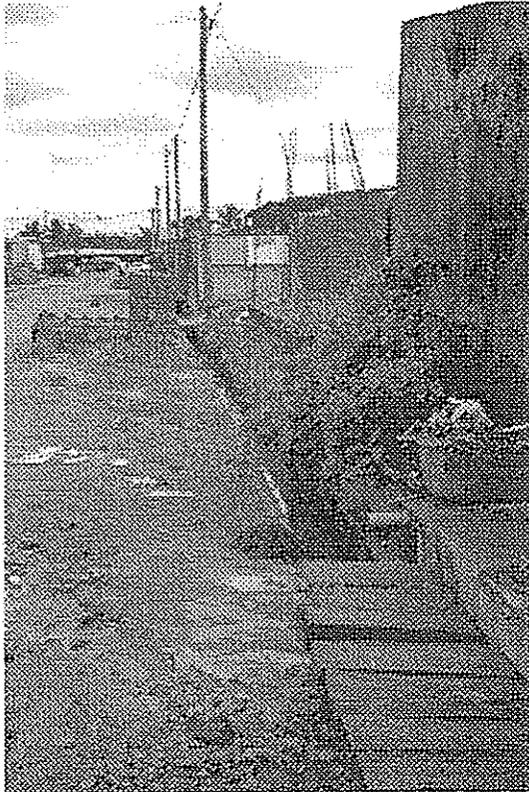
Source: Schertenleib (1989)



General Description

Douala is Cameroon's largest and most important commercial centre with an estimated population of around 460,000 (1983). The climate is tropical with average temperatures between 22 and 32 °C and annual rainfall of 4,000 mm. A private enterprise ("HYSACAM") has been contracted by the local government to provide collection service in Douala. However, the area of Nylon was considered to be inaccessible for their collection trucks and therefore remained unserved. In 1988, an alternative collection scheme was established on the basis of an initiative of a local NGO ("COOPJE, MAETUR-ARAN"). The main data of this pilot scheme with community participation in a low-income area of Douala - Nylon Dibom II - is summarised hereafter:

14 Nylon Dibom II



(Photo: SANDEC)

Organisation & Management

Initiated by: CBO
 Established in: 1988
 Managed by: CBO members (v)
 Supervised: -
 Participation: bring to roadside

Main Problems: primary collected waste is not picked up at collection points by SECOL, low participation from the households (25%).

Characteristics of the Perimeter

Area: ? ha
 Households: 330 hh
 Inhabitants: 3300 inh
 Density: ?
 Income Level: US\$ 50 - 100.-/hh.mth
 Access Roads: unpaved, earth roads
 Topography: flat

Technical & Operational Parameters

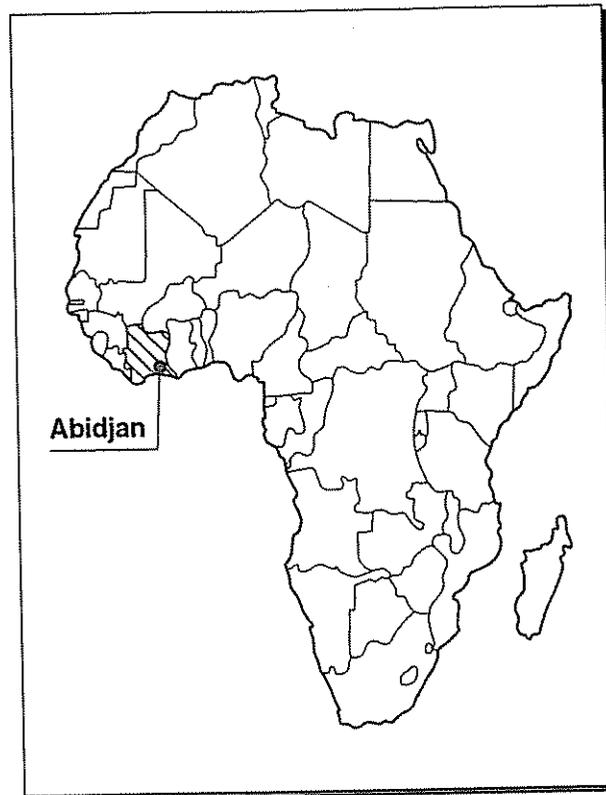
Equipment: 1 handcart
 Others: -
 Personnel: 3 collectors
 Type of Service: door-to-door
 Distance to TP: ?
 Frequency: bi-weekly
 Working hrs: 3 hrs/d
 Coverage: 23 %
 Productivity: 85 inh/coll.hr
 Recycling: -

Service Costs & Financing

Equipment: donation
 Personnel: US\$ 111.-/mth
 Maintenance: -
 Others: -
 Financing: fees
 Frequency: monthly
 Fee Collection: directly by collectors
 Amount: US\$ 1.12/hh
 Total Income: US\$ 85.-/mth

Abidjan, Ivory Coast

Source: Meyer (1993)



General Description

Abidjan, capital of the Ivory Coast, has an estimated population of about 1,500,000 (1983). The coastal city extends over a large urban area interrupted by lagoons, large forests and plantations. The climate is tropical with average temperatures between 22 and 32 °C and annual rainfall of around 2,000 mm. During about 30 years Abidjan was served by a French company. After phasing out of the contract in 1990 and an interim phase of low coverage, another private company (Société "H") was contracted in 1992 to provide the collection service. The city is divided into ten "communes" whose administrations are actively involved in SWM. An excellent road network, which largely facilitates municipal refuse collection and transport, connects the sub-centres and provides house access in all planned areas. However, recently urbanised marginal areas and a few incorporated old villages with dense irregular settlement pattern still lack adequate roads, water and sanitation facilities, including refuse collection service. To increase coverage in these areas, community-based primary collection schemes were initiated. Available data from the visited cases, such as the schemes in the settlements of Avocatier-Abobo, Adjougou II (Port Bouet) and Alladjan (Port Bouet), however, are not representative enough to be summarised hereafter. General information on these cases is nevertheless included in a general way in the main text (for more information, see also SANDEC (IRCWD) News No. 27/1993).

Ouagadougou, Burkina Faso

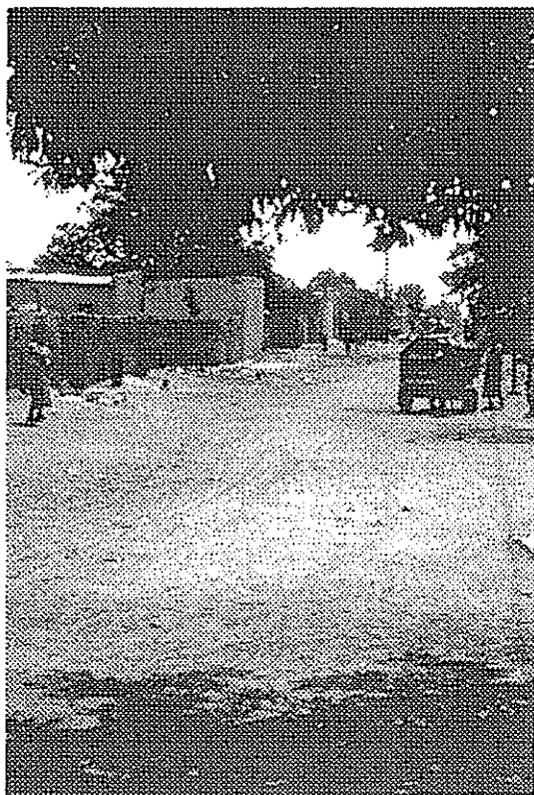
Source: Meyer (1993)



General Description

Ouagadougou, the capital of Burkina Faso, has an estimated population of around 500,000 (1992). The climate is tropical with temperatures ranging between 16 and 40 °C and annual rainfall of around 900 mm. Administratively, the city is divided into 30 sectors organised in 5 districts ("communes"). Overall responsibility for Solid Waste Management rests with the "Office National des Services d'Entretien, de Nettoyage et d'Embellissement" (ONASENE) which, however, delegates part of its services to private enterprises. Service coverage is estimated at less than 25 %. Due to the large urban area and low population density, infrastructure such as roads, water and sanitation systems, including SWM services, are still underdeveloped. In unserved areas, families usually dump their refuse on nearby land or carry it to one of the roughly 80 common dumping grounds. In order to increase collection service in low-income areas, a community-based pilot project was initiated in 1990 in the area of Wogodogo, "commune" of Baskuy, described hereafter:

16 Wogodogo (Baskuy)



(Photo: SANDEC)

Organisation & Management

Initiated by: community/NGO
 Established in: 1993
 Managed by: CBO (local committee)
 Supervised by: CBO ("")
 Participation: bring to roadside

Main Problems: accumulation of refuse at collection points due to irregular secondary collection.

Characteristics of the Perimeter

Area: 174 ha
 Households: 2,800 hh
 Inhabitants: 25,700 inh
 Density: 150 inh/ha
 Income Level: low
 Access Roads: earth roads
 Topography: flat

Technical & Operational Parameters

Equipment: 4 animal carts à 0.9 m³
 Others: protective clothing
 Personnel: 8 collectors
 Type of Service: door-to-door
 Distance to CP: 1,000 m
 Frequency: weekly
 Working hrs: ?
 Coverage: 18 %
 Productivity: -
 Recycling: households, collectors

Service Costs & Financing

Equipment: US\$ 810.-
 Personnel: US\$ 674.-/mth
 Maintenance: -
 Others: -
 Financing: fees
 Frequency: monthly
 Fee Collection: directly by collectors
 Amount: US\$ 1.90/hh
 Total Income: US\$ 900.-/mth

Cucuta, Colombia

Source: Giesecke (1993), Pfammatter (1995)



General Description

Cucuta, the capital of Colombian's Department Norte de Santander, has a total population of around 500,000 (1995). As most cities of commercial importance, Cucuta also faces considerable migration from the surrounding area, which leads to unplanned new settlements in the urban-marginal zones. Most of these areas are either not serviced or underserved. To improve the situation, a first small private refuse collection and transport enterprise was established in 1989 within the frame of a primary health care project between Colombian institutions and the German Cooperation Agency (GTZ). The small enterprise of around 15 collectors services around 50,000 beneficiaries twice a week with small handcarts. The waste is collected at the households, transferred to trailers and transported with an agricultural tractor to the final disposal site. The enterprise is built-up as a cooperative and performs the service based on a contract with the municipality. Based on this successful pilot project, two additional schemes have been initiated in the same municipality, and now ensure a successful service coverage of almost 150,000 people. One example of such a cooperative micro-enterprise system in Cucuta - the oldest scheme of Los Patios - is described hereafter:

17 Los Patios



(Photo: SANDEC)

Organisation & Management

Initiated by: government/GTZ
 Established in: 1989
 Managed by: cooperative
 Supervised by: committee
 Participation: bring to roadside

Main Problems: not enough collectors for increasing population to be served, deficient unloading and loading activity.

Characteristics of the Perimeter

Area: -
 Households: 10,000 hh (approx.)
 Inhabitants: 50,000 inh (approx.)
 Density: low
 Income Level: US\$ 150.- (low-medium)
 Access Roads: unpaved
 Topography: hilly

Technical & Operational Parameters

Equipment: 8 handcarts at 0.6 m³,
 3 trailers at 6 m³, tractor
 Others: uniforms, gloves, boots
 Personnel: 13 collectors + 1 driver
 Type of Service: door-to-door
 Distance to DS: 5,000 m (approx.)
 Frequency: twice a week
 Working hrs: 7 hrs/d
 Coverage: 85 %
 Productivity: 156 inh/coll.hr
 Recycling: households, collectors

Service Costs & Financing

Equipment: US\$ 1,400/mth interest
 Personnel: US\$ 2,400/mth (14)
 Maintenance: US\$ 500.-/mth
 Others: US\$ 1,200.-/mth
 Financing: contract, loan
 Frequency: monthly
 Fee Collection: (municipal taxes)
 Amount: US\$ 0.55/hh
 Total Income: US\$ 5,500.-/mth

Cajamarca, Peru

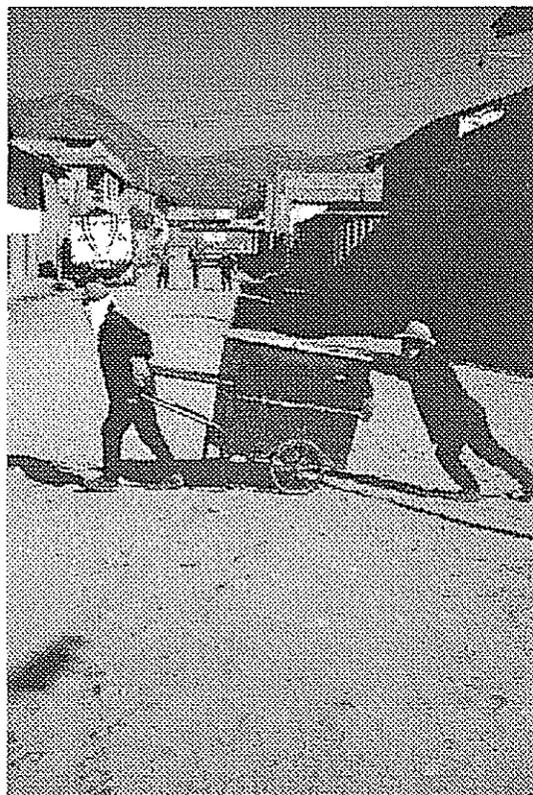
Source: Pfammatter (1995)



General Description

Cajamarca, the most important town in the northern part of Peru, has an estimated population of 100,000 (1994). It is located in a high Inter Andean valley at almost 3,000 m, the climate is continental with an annual precipitation of around 700 mm and temperatures between -3.5 and 30 °C. As in many other cities of commercial importance, migration from rural areas persists and makes it difficult for the local authorities to meet the raising demand for infrastructure and public services. To increase the collection service in the urban-marginal areas of difficult truck access, the local government decided in 1993 to contract a small private enterprise for manual collection of domestic refuse and transport to the municipal landfill. The scheme was established by RUTAS, a consulting enterprise comprising different shareholders such as e.g. the Peruvian NGO "Instituto de Promoción de la Economía Social (IPES)". Based on their experience with micro-enterprises in Lima, Peru, a scheme was introduced for half of Cajamarca's population. The main data are summarised hereafter:

18 Urban-Marginal Areas



(Photo: SANDEC)

Organisation & Management

Initiated by: government/NGO
 Established in: 1994
 Managed by: cooperative
 Supervised by: government
 Participation: bring to roadside

Main Problems: some problems with the design of carts (handling), large quantities of sand and rocks to be collected, inefficient transfer from handcarts to trailers, lack of self-responsibility within the micro-enterprise.

Characteristics of the Perimeter

Area: -
 Households: 10,000 hh
 Inhabitants: 50,000 inh
 Density: low
 Income Level: low
 Access Roads: unpaved, earth roads
 Topography: flat - hilly

Technical & Operational Parameters

Equipment: 8 handcarts at 0,6 m³,
 3 trailers à 6 m³,
 1 tractor (50 hp)
 Others: uniforms, boots, gloves
 Personnel: 16 collectors + 1 driver
 Type of Service: door-to-door
 Distance to DS: 12,000 m
 Frequency: twice a week
 Working hrs: 7 hrs/d
 Coverage: 80 %
 Productivity: 148 inh/coll.hr
 Recycling: households, collectors

Service Costs & Financing

Equipment: US\$ 32,000.- (loan)
 Personnel: US\$ 3,500.-/mth (17)
 Maintenance: US\$ 400.-/mth
 Others: US\$
 Financing: contractual payment
 Frequency: monthly
 Fee Collection: (municipal taxes)
 Amount: US\$ 0,75/hh
 Total Income: US\$ 7,500.-/mth