



WATER, SANITATION, ENVIRONMENT and DEVELOPMENT

Small enterprises for solid waste recycling



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This paper is based on the results of a comprehensive research into the great variety of products made, markets covered and technologies used in the recycling of urban solid waste by small-scale enterprises in six selected cities in the South. The research meant to seek and develop options for these small recycling enterprises to create new and more employment, but also to propose alternative solutions to the increasing problem of the removal of the urban solid waste.

WASTE Consultants has coordinated this research project, whereas the research itself has been carried out by local consultants¹ in the following six cities: Manila, Calcutta, Cairo, Nairobi, Bamako and Accra. This paper is based on their findings².

By describing the recycling of three materials namely, plastic, rubber and batteries, some insight will be provided into factors which are of vital importance for the economic feasibility and the scale of the recycling activities. It also shows in which way the product quality and thus marketability could be improved. Finally the need to reduce environmental hazards is stressed.

Plastic recycling

Plastic is a relatively modern material, widely used in the North and increasingly so in the South. In the North the recycling of plastic is rarely done: identification and separation of the various plastics is a technically complex and expensive process. The situation is different in many Southern countries. An ample supply of cheap labour and an increasing demand for low-priced products have resulted in a rapid growth of a labour intensive recycling industry: in Cairo more than 400 small enterprises exist, which recycle approximately 70% of the waste plastic generated and offer a wide variety of employment.

In Egypt, plastic was one of the first non-organic waste products to be recycled. This is due primarily to four factors: the fluctuating price of imported plastic polymers, the rising rate of exchange for hard currency, local inflation and the rising value of plastic waste. The plastic industry is growing fast in Egypt. The Egyptian laws prohibit the import of most plastic products, with the exception of certain items of necessity such as spare parts. Domestic production of plastic polymers is encouraged. The market for recovered polymers is highly competitive and volatile. However, despite this market volatility, prices have been increasing fourfold since 1981.

The recycling of plastic is a process in which many people are involved in the various stages of the process from 'waste' till final 'product'. The waste plastic has to be collected from dump sites or household storages, sorted out according to colour and type, washed and shredded, granulated and finally moulded into a product such as tubes, shoe soles, combs and plugs. Every additional step in the process adds value to the product and consequently generates additional income.

In the cities researched the state of the art of the applied technology however differs considerably. In Nairobi plastic is only collected, partly sorted and then sold to large processing companies. In Cairo, Manila and Calcutta all stages of the process are present. Small entrepreneurs process the waste plastic and produce low-priced products. The technology applied is adapted to local circumstances and capabilities. Local machine shops are able to construct and maintain rather advanced extruders, driven by lorry gearboxes and car tyre v-belts.

In sorting and washing the plastic there was another striking difference. Sticky liquids, solid matters mixed with the plastic or still inside containers make the sorting of plastic a dirty job. In India, however, this problem was tackled: in concrete basins the waste plastic is washed, while the water is pumped around by a small electrical engine. The washed plastic is first dried in a rotating drum made of welded mesh and then spread on a field to be fully dried by the sun. At this stadium especially women come in to sort the plastic. This different approach, first washing and then sorting, has improved working conditions considerably.

Rubber recycling

Waste rubber is one of the most important materials to be recycled in Bamako in Mali. The level of the recycling is however very basic. Relatively simple hand tools are used to cut and punch the rubber tyres and tubes into springs, pulling ropes, sandals and v-belts. Products which are a common sight in most street markets in Southern cities.

In the other cities such as Manila and Calcutta the rubber processing is more advanced and often mechanized. The waste rubber is first devulcanized, a process to remove elasticity and make the rubber mouldable. Rubber reclaimed in this way is sold to other enterprises in the tyre industry and has a wider application than crude waste rubber. Most of the recycled rubber is used for the

manufacture of moulded rubber products, like solid tyres for wheel barrows, tri-cycles, pedals for bicycles, bumper pads, vibration absorbers and so on.

There is a high degree of integration between the formal and informal rubber industry. In fact often people who were working in the formal industries start on their own; the necessary equipment (mixing mills, presses, extruders and so on) is locally produced often from inferior materials from scrap yards and discarded drive units which are available at extremely low prices, however not always conforming to material specification and safety standards. But this lowers capital investment with 75% and is consequently a major reason for the high profitability of this sector. The high rate of wear and tear or breakages are easily absorbed in day to day economics of the recycling processes.

In Accra, Ghana, on the other hand, rubber recycling is quite limited. Most of the existing retreading industries were abandoned because of the lack of capital for the rehabilitation of equipment and because of the import of used rubber tyres from Europe. There are only a few small workshops producing engine seats, bearing housings and bushings with relatively simple methods like cutting and mechanical pressing using a vice. These recycled spare parts are 8 to 10 times cheaper than the imported ones. Customers are satisfied with lower prices and faster replacement service despite lower quality as compared with original parts. The craftsman is also satisfied with a lower charge and in some cases a higher replacement turnover.

Household battery recycling

Batteries are also a more modern product which is in itself a clever source of energy, but after use poses a threat to the environment and the health of people. The use of batteries is however steadily growing in Northern but also in Southern countries. In the North a feasible recycling process hardly exists. Batteries are piled up in controlled places until a solution is found. In the South due to its specific economic conditions a recycling 'industry' has evolved.

In Egypt, the batteries are stripped down with the aid of simple tools. Valuable compounds like zinc are removed and sold to zinc foundries, where the zinc is melted and reused. The carbon pins are used as heating elements and the residue is simply thrown away. Consequently the heavy metals from the partly decomposed batteries contaminate the organic waste, eaten by animals roaming around for food.

In India, there are a number of small battery manufacturers, who make new ones out of the old elements. The used up chemicals are piled up together with fresh ingredients in old zinc containers. New paper wrappings and plastic are used to give the product a good appearance. Such local batteries are sold at less than half the price of a standard quality battery. Most of these batteries are marketed in

villages and are used for operating small transistors, radios and so on. These dry cells have poor operating characteristics and poor shelf life.

Only a small number of people is employed in this recycling sector. The labour intensive method of stripping the batteries is not always feasible. For example in Manila, batteries recycling is absent. The main reason for this is the low price paid for zinc. One kilogram of zinc costs US\$ 1.53. Assuming that zinc represents 5% of the battery weight, to recover one kilogram of zinc will require the recovery and processing of around 20 kilograms of household batteries. Considering that the local minimum wage is US\$ 4.37 per day, to cover just the labour cost would entail recovery and processing of around 57 kilograms of batteries!

People do not consider batteries as a health threat. That is why they can be seen abandoned everywhere after use: in compost heaps, in mud walls of houses, laying in the field between the crops, children playing with it. In the Philippines batteries are even used as a disinfectant for wounds and a smell repellent in pit latrines.

Also employers are not aware of the health hazards of this enterprise. Taking the minimal income and dangerous working conditions into account, recycling of batteries is not an activity which should be encouraged. Other solutions like separated storage or alternative energy sources have to be found.

Conclusions and recommendations

Product innovation

At international level recycling products, technology and markets differ remarkably and as such offer a broad range of products. At local level recycling often results in a great supply of identical, low-quality final and semi-final products, produced under severe working conditions and serving low-income markets only.

Appropriate innovation may diversify the products and improve their quality, to broaden the market into the middle-income market, thus generating more income and employment. Improved processed waste material will fetch a higher price in the formal industries. Ultimately these improvements may even reduce importation of some products.

External influencing factors

It appears that the extent of recycling differs very much per country and depends among others on world market prices of raw materials, import regulations and government subsidies. They influence the feasibility of recycling activities.

Especially in Asian countries, the informal recycling sector thrives on formal industries. Small-scale entrepreneurs often receive their educational training there. The use of second-hand machines and the local manufacture of equipment makes huge savings on capital investments possible.

Also, these formal industries form a market for semi-finalized products from the informal sector.

It is clear that these factors are of vital importance for the feasibility of recycling activities and they should be taken fully into account when considering South-South technology transfer. It also calls for policy changes at the national and international level.

Co-operation between public authorities and private entrepreneurs

Up till now the efforts of private small scale entrepreneurs have not been taken seriously in the sense of their contribution to the removal of urban solid waste, the creation of employment and likewise the savings on the use of virgin (imported) materials. Authorities still opt for advanced solutions such as compacting trucks and incineration.

Authorities should become aware of the impossibility to solve the urban solid waste problem on a public base only. Legislative and policy measures should be developed to enable co-operation between the public and the (small scale = employment) private sector.

Improvement of working conditions and environment

Although recycling contributes to a sustainable development, recycling in itself needs not to be an environmentally sound enterprise. The challenge for the future lies in trying to extend recycling activities on the one hand and trying to improve working conditions and lessen negative environmental effects on the other hand.

The nearer to the source the waste is separated, the less contaminated the raw material is and the more homogeneous the semi or final product is. Separation at source also improves the working conditions of those (often women and children) handling the waste.

Exchange of information and experiences at workshop level

In different cities recycling has developed in different ways and on different levels. In some cities solutions that have been found on a workshop level and at a municipal level are worth to be disseminated and replicated (and adapted) elsewhere.

Opportunities should be created (network, exchange programme, visits) to enable a free flow and exchange of information. Particularly small scale entrepreneurs, representatives of enterprise support institutions and authorities involved at this level of recycling should participate.

- 1 These consultants are: EQI/Cairo, AUC/Cairo, Undugu Society/Nairobi, Ptr/Calcutta, CAPS/Manila, ABP/Ghana and GERAD/Bamako.
- 2 Results will be disseminated in four publications on urban solid waste recovery: 'Organic Waste', 'Plastic', 'Rubber' and 'Hazardous Waste' (Tool/Waste, Amsterdam, The Netherlands).