Guidelines for the Promotion of Small Scale Recycling Projects

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Technical Field:
- ☐ Energy / Environment (E)
- ■ Water / Sanitation (W)
- ☐ Agriculture (A)
- ☐ Foodprocessing (F)
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Modern way of life and economic growth generating increasing amounts of household and commercial waste also in developing countries. The change in lifestyle and consumption goes along with a change in composition of the waste. In former times biodegradable organic waste has been the main part of household waste in rural or poor urban areas. Nowadays plastic, paper, glass and metal form the major components (at least in volume) of the waste which is generated not only in the modern sector of developing countries.

Re-use and recycling of valuable goods from waste have a long tradition in the countries of the South. Articles like empty bottles, plastic containers, tinplate cans, non-ferrous metals, and certain paper qualities never became waste. They were sorted out already at the source and sold to scrap dealers. Metal scrap, for example, is still the main source of raw material for foundrymen and blacksmiths of the informal sector in developing countries.

With increasing amount and complexity of waste material recycling gets more and more a sophisticated exercise, which takes the normal small scale recycler of the informal sector to his technical and financial limits. On the other hand, it may open up a wide range of additional opportunities for job creation and income generation, if the required technical knowledge, financial resources and business administration is available to the small scale entrepreneurs.
To give some advice how to approach and utilise the recycling sector for business development is the objective of this paper.

Inception phase - gathering of information, investigation of markets

Before starting a business in the recycling sector (and in other sectors as well) a proper investigation of all factors which might have an influence on the business is essential. By gathering as much information as possible, the entrepreneur is able to develop a comprehensive picture of the activities and prospects of his future enterprise.

In the recycling sector, three major areas have to be investigated:

- availability of raw material
- availability of technology and funds
- market prospects for the product.

The following checklist may assist in helping to answer these questions in detail:

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Checklist to assist in the layout of projects in the recycling sector

A. Raw material

- What types of waste material will be collected?

For each type:

- From which places is the waste material collected or purchased?
- What will be the monthly amount of collected waste?
- What is the average distance to drive for collection or purchase?
- What means of transport are required?
- What is the waste material quality?
- Is the material free of charge or must something be paid for the material?
- Do people bring the waste? For what price?

B. Waste handling technologies and administration

General set-up:

- Where will the waste be accumulated/stored?
- What type of premises are needed?
- What type of infrastructure is required at the premises?
- What will be the total investment for establishing the infrastructure?
- How many people will be employed and what organisational structure will be needed?

For each type of waste:

- What is the quality of the entering material?
- What type of up-grading process will be applied?
- What type of machinery is necessary?
- How many labourers are needed for up-grading?
- What will be their productivity?
- What is consumed during processing (energy, fuel, lubricants, water, etc.)?
- What investment will be required to buy the required machinery, means of transport, office equipment, etc.?
- What will be the quality of the products to be marketed?
- What will be the operational costs?

C. Market of products

For each product:

- Who are the customers for the product?
- Where are the customers located?
- What is the market price of the product?
- What is the transport distance and what are the transport costs?
- What will be the monthly amount to be shipped and sold?
- What means of transport are needed?
- What will be the operational net profit of the total operation?

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Not all of these questions can be answered immediately. Further effort has to be spent on the technical layout, investment planning and cash flow calculation.

Technical layout

Regarding the major waste fractions - metal, plastic, paper, glass - there are a number of recycling technologies available which have proved to be economically viable and technically reliable. Some of the recycling processes (particular for commercial waste) need to be carried out on a large scale because of the required sophisticated technology, high investment and extended environmental protection measures. Developing countries with limited generation of waste and a limited market for recycling products, are not a favourable place to start recycling activities on a large scale. In these cases the recyclers should concentrate primarily on the collection and pre-treatment of waste fractions and deliver these products to the big manufactures of recycling products (e.g. paper mills, glass factories, steel mills, etc.).

In order to start small scale recycling appropriate technologies and processes must be available. From where do these technologies come from?

The technical and economic development of industrialised countries in the North has produced technologies which reflect their own economy, society and needs. These technologies are not always appropriate to be transferred to developing countries. It would be more sensible to consider technology transfer between countries in the South. In the field of recycling and processing of waste, countries such as India, China, Egypt and Brazil, have developed small scale technologies for developing countries, which are affordable, technically manageable and economically viable. Unfortunately, the technology transfer between countries in the South is not developing satisfactorily. There is a great need for more information and co-operation.

In developing countries with a high percentage of unskilled labourers, relative low wages, high transport and energy costs, high interest rates, and little financial support available to the mass of the small entrepreneurs, appropriate processes and machinery are characterised in the majority of the case as:

- Small in size and output
- Cheap
- Locally manufactured or from the region
- Labour intensive and manually operated
- Energy saving
- Environmental friendly.

Many developing countries do not have a significant local manufacturing capability, most of the required technology and equipment would have to be imported. To decide whether an imported technology is appropriate they must be examined to determine:

- the total investment (including transport, customs fees and a set of genuine spare parts),
- the availability of local service and repair (including local spare parts),
- the required skills for operation,
- the operational cost (energy consumption, grease, spare parts, maintenance, etc.).

It is important that the entrepreneur selects processes and technology according to the local circumstances and his personal resources. In general, low labour costs combined with high interest rates normally do not favour high capital investment. Lack of qualified workers, service personnel, and spare parts, complicates the operation of imported machinery. The following checklist shall

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help to select the right process and machinery.

Checklist to assist in the selection of appropriate processes and machinery

A. Production Process

- Application of processes
  - Feed preparation?
  - Main process?
  - Final handling, e.g. canning, packaging, storage, etc.?
  - Auxiliary machinery?

- Location of manufacturers/suppliers of the machinery
  - Locally?
  - In neighbouring countries?
  - Overseas?
  - Do they provide service, maintenance and spare parts?

- Purchase conditions of equipment
  - Price of equipment?
  - Transport costs to premises?
  - Import taxes?
  - Price of spare parts including tax and transport?
  - Lifetime of machinery and guarantees?

- Operation characteristics
  - Manual, semi-mechanised or automatic operation?
  - Batchwise or continuous operation?
  - Is operation of low or high productivity?
  - Energy intensive?
  - Noisy and polluting?
  - Risky for the worker's health?
  - Generates reasonable amounts of waste and residues?
  - Generally environmental friendly or unfriendly?

B. Economic factors

- Labour market
  - Availability of skilled labour?
  - Level of wages and related labour costs?
  - Availability of technical assistance by local research and technology institutions?

- Capital market
  - Level of self-financing by the entrepreneur?
  - Level of interest rates?
  - Availability of favourable investment loans?
  - Existence of government support schemes?

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Business plan, feasibility study

The market for recycling goods in developing countries is often limited due to the small population and the absence of large scale recyclers (steel mills, glass manufacturers, paper mills, plastic recyclers, etc.). In this case many waste collectors and recyclers would have to market their products internationally, which is not only a logistical problem but will also create significant transport costs. Also if local customers are available within a country other hampering factors might limit the profitability of small scale recycling operations.

One major factor which decides whether a business is viable or not are the transport costs. Long distances for the collection of raw materials, or for selling the products, may increase the operational costs to such an extent that the business becomes uneconomic. In the case of the recycling of waste, the refuse often has to be collected from scattered places. The bulky nature of many waste fractions, and their low weight and density, makes transport very inefficient. Therefore, compaction of the waste is essential in order to minimise transport costs.

A second factor hampering recycling is that the disposal of waste in developing countries is normally very easy and cheap. Either the local authorities collect the waste from private householders or businesses at no extra cost, or it is possible to dump the waste at a communal landfill at very low rates or free of charge. In the worst case, people dump their waste in the bush, knowing that prosecution is unlikely to follow. Under such circumstances, recycling has to be financially attractive by increasing the value of the material during processing, which is not always possible. In particular, the treatment of some hazardous waste components can be more expensive than justified by the market selling price.

If government intends to promote the recycling and re-use of waste, the following instruments can be used to encourage recycling activities in the private sector:

- provision of incentives for recycling through waste management regulations,
- introduction of a levy system (e.g. for tyres, batteries, oil, plastic bag, etc.),
- introduction of cost covering disposal fees for household and industrial waste,
- full support for recycling projects by government or private sector funding schemes.

➢ ***Business plan***

Before a business is started the entrepreneur should prepare a business plan. The data obtained will help to judge the feasibility of the project and will be needed when applying for loans and grants from banks and funding agencies. An outline of a standard business plan is as follows:

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Sample outline of a standard business plan

- Description and history of company
  - How and what the company is
  - Status of project/company
  - Key goals and objectives
- Product and Services
  - What the product or service is
  - How it works
  - What it is for
  - Proprietary advantages
- Markets
  - Who the prospective customers are
  - How many customers there are
  - Market growth rate
  - Competitors
  - Industry trends
  - Estimated market share
- Operations
  - How the product or service will be manufactured/provided
  - Facilities/equipment
  - Special processes
  - Labour skills needed
- Channels of distribution
  - How the product or service will be distributed
  - Means of transport
  - Advertising and marketing
- Management
  - Who will do what
  - Staff qualifications
  - Availability of skilled labour
- Financial prospects
  - Investment cost
  - Capital costs
  - Operational costs
  - Monthly turnover
  - Prospected yearly revenues
  - Tax, social and legal costs
  - Cash flow analysis (one year)
  - Feasibility study
- Sources and application of funds
  - Present needs
  - Future needs
  - Own funds
  - Required loans or grants

Calculation of net present value

In order to judge the feasibility of a project, a calculation of the net present value (analysis of cash flow, annual payback and internal rate of return) over the prospected project lifetime has to be carried out.

An example is set out in the following table using the factors described below:

Capital investment

Summarises the total need of capital funds for:

- machinery and equipment
- building and infrastructure
- pre-operating expenses
- working capital.

Payback of investment

The payback is linear, if the investment capital is paid back in equal portions over the prospective life time of the operation.

Depreciation

The depreciation is linear, if equal portions of money are saved per year in order to replace the investment for machinery and equipment, buildings and infrastructure after service life.

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Yearly income (=Cash in)

Total amount of incoming cash through sales, services, licensing fees, earned interest, etc..

Operation costs (= Cash out)

Total expenditures for:

- Raw material
- Energy, water and other consumables
- Costs for transport and external services
- Rent/lease of premises, infrastructure or equipment
- Wages and social costs
- Paid interest on loans
- Depreciation of equipment.

Discounting rate

Rate of interest received if invested capital would be deposited at a commercial bank.

Interest rate

Paid interest rate for capital investment.

Service life

Projected lifetime of project/equipment.

Net cash flow

'Cash in' minus 'Cash out'

Discounting factor

Expresses the loss in value of revenues earned at a later stage (years two to five) of the operation due to interest for capital investment not received. It is calculated as:

$$1/(1+\text{'discounting rate'})^{\text{year}}$$

(example: $1/(1+0{,}15)^3 = 0{,}6575$)

Discounted net cash flow

'Net cash flow' times 'Discounting factor'

Revenues before tax

'Net cash flow' minus 'linear payback rate' (e.g.: In year 1: 12.000 – 30.000/5).

Annual payback

Linear payback of investment including accumulated interest. It is calculated as:

'Capital investment' divided by 'service life' + ('Capital investment' divided by twice 'interest rate')
(e.g.: In year 1: 30.000/5+30.000/2 x 0,15).

Net present value

Accumulated net cash flow over lifetime of project.

Internal rate of return

Interest earned by capital investment into company. The internal rate of return can be calculated by increasing the discounting rate until the net present value at the end of service life reaches zero.

Indicators for the feasibility of projects

The following results of the net present value calculation indicate whether a project is viable or not:

- Annual payback must be higher than net cash flow
- Net present value at end of service life must be positive
- Internal rate of return must be higher than discounting rate.

By changing the magnitude of capital investment, yearly income, operation costs, discounting rate, interest rate and service life, a sensitivity analysis can be carried out. This sensitivity analysis indicates the acceptable fluctuation of the critical factors in order to keep the project viable.

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Sample outline of net present value calculation

Capital investment	US$	30.000			Payback of investment:	linear
					Depreciation:	linear
		1. Year	**2. Year**	**3. Year**	**4. Year**	**5. Year**
Yearly income	US$	40.000	50.000	60.000	70.000	80.000
Operation costs	US$	28.000	35.000	42.000	50.000	58.000
Discounting rate	%	15				
Interest rate	%	25				
Service life	years	5				

Year	Cash in	Cash out	Net cash flow	Dis. rate	Dis. factor	Discounted net cash flow	Revenues before tax
	US$	US$	US$	US$	US$	US$	US$
0		30.000	-30.000	0,15	1,0000	-30.000	
1	40.000	28.000	12.000	0,15	0,8696	10.435	6.000
2	50.000	35.000	15.000	0,15	0,7561	11.342	9.000
3	60.000	42.000	18.000	0,15	0,6575	11.835	12.000
4	70.000	50.000	20.000	0,15	0,5718	11.435	14.000
5	80.000	58.000	22.000	0,15	0,4972	10.938	16.000

Net present value: 25.985

Annual payback: 9750 US$

Internal rate of return: 46,50%

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In many developing countries there are government, non-government and private sector institutions active, which support small scale enterprise development. They normally offer assistance in preparing a business plan, in investigating the market or in product development. Often they are able to offer loans or grants to start the business.

These institution have a lot of experience with the traditional productive sector. They might still hesitate to support waste management or recycling activities due to a lack of experience and knowledge. It is therefore important to point out, that the manufacture of intermediate or final products from waste (secondary raw material) has a lot of similarities to the processing of minerals or other natural resources (primary raw material). It therefore should be justified to receive a similar support like the traditional crafts.

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