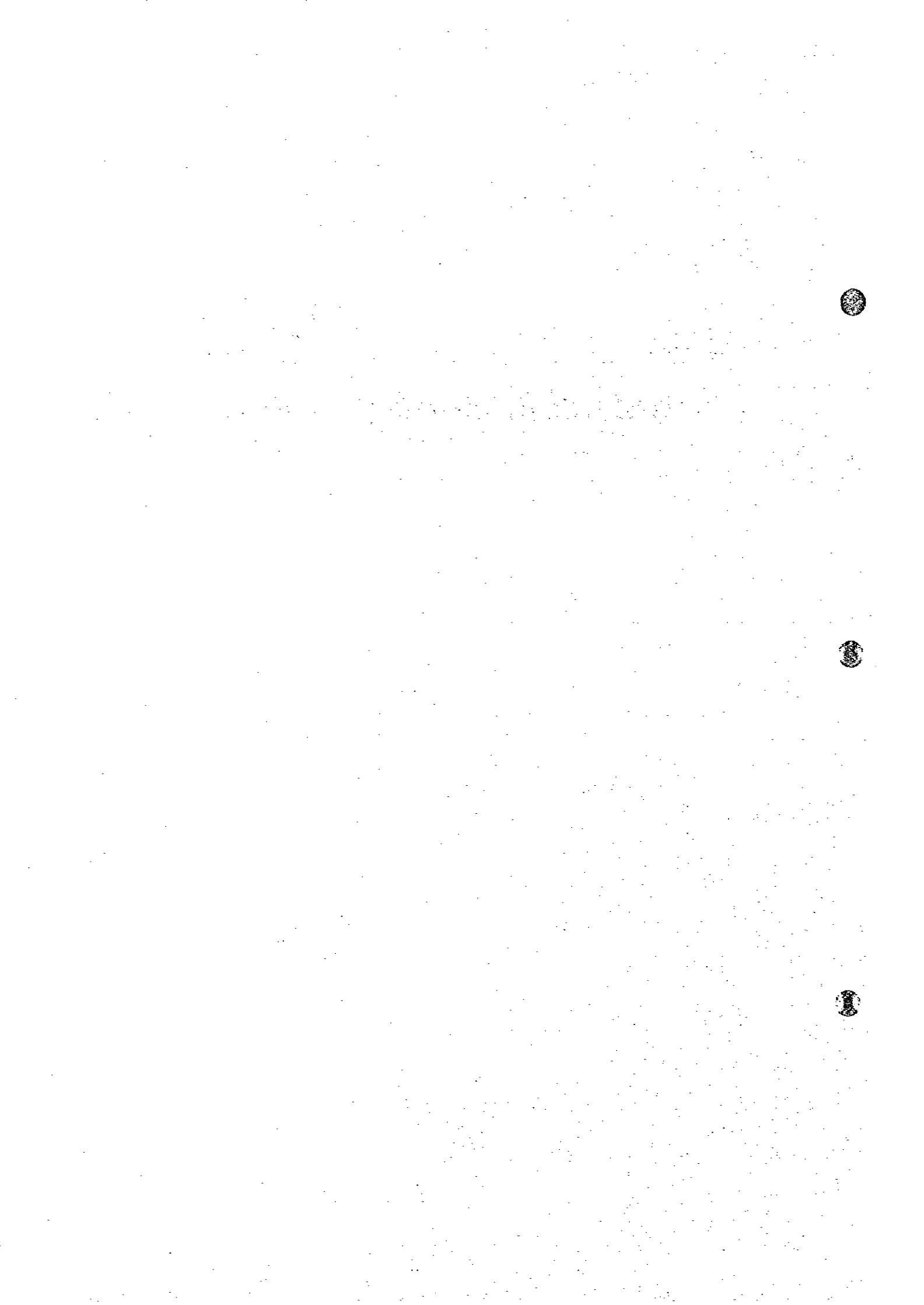


Annex 11

Recycling Survey - Interview Data



11 Recycling Survey - Interview Data

This appendix contains the Recycling survey questionnaires and responses.

11.1 Recycling Survey Questionnaires

11.1.1 Questionnaire - Middlemen & Micro-Industries

Name of Business:

Location:

No. of Workers:

Interviewee:

1. What materials do you recycle and in what condition?

2a For how many years have you been doing this work?

2b. How many hours do you work per week?

2c. How many days do you work per month?

2d. How much can you earn per month from this work?

2e. How many jobs do you have?

3. Who collects these materials for you?

a) You and/or some of your workers collect yourselves.

b) Individuals bring to you.

c) Middlemen collect from different sources and bring to you.

4a. Who do you collect materials from?

a) households

b) scavengers

c) middleman

d) shops

e) offices

f) hotels

g) other (specify)

4b. Where do you collect materials from?

5. How much do you pay for such materials per unit (kg, items, etc.)?

6a. How many units (kg, items, etc.) do you collect/buy per week or month?

6b. Is your demand for these materials stable? Yes/No

6c. Can the supply meet your demand? Yes/No

7. What do you do with these materials?

8a. How much do you sell these materials and/or the products you make from them for?

8b. Where do you sell these materials?

9a. How many units (kg, items, etc.) do you sell per week or month?

9b. Is the demand for these materials/products small or medium or large?

9c. Can your business meet this demand?

10. What do you do with the waste that results from your business?

11. Please describe any problems you have from this work:

11.1.2 Questionnaire - Large Industries

1. Name of Industry:

Location:

Products:

Interviewee:

2. What materials do you collect for recycling and in what condition?

3. If the materials are returnable, reusable items (eg. glass bottles):

a) what is the rate of return of these materials (in %)?

b) how has the rate of return varied in recent years?

c) what is the average usage time per item?

d) how many years has the production of such materials been ongoing?

4. Who do you collect materials from?

a) residents

b) shops

c) scavengers

d) middleman

e) recycling factories

f) other (specify)

5. How much do you pay for such materials per unit (kg, crate, etc.)?

6. How many units (kg, crates, etc) of these materials do you collect per week or month?

7. What do you do with these materials?

8a. Are these materials essential to your business? Yes/No

8b. If yes, what percentage of the raw materials do they constitute?

9a. Is your demand for these materials stable? Yes/No

9b. Can the supply meet your demand? Yes/No

10a. Are your prices for these materials stable?

10b. If no, how have your prices varied in recent years?

11. Is it profitable for you to purchase materials for recycling?

12a. Does your industry recycle any waste materials itself. If so, please fill in the following table:

| Waste Materials Recycled | Amount of Waste Generated per month | Amount of this waste recycled per month | | Details on the sale of waste materials | |
|--------------------------|-------------------------------------|---|----------------|--|------------------|
| | | Recycling in Factory | Sale to Others | Name of Buyer | Price (Tsh/unit) |
| | | | | | |
| | | | | | |
| Total | | | | | |

b. What do you do with your other waste?

11.2 Survey Results

11.2.1 Small (Market and Roadside) Middlemen Survey Results

Survey: 1 (bo/ct/pl)

2/7/96

Name of Business: N/A

Location: Buguruni market

No. of Workers: 1

Interviewee: market operator

1. Materials Recycled and Condition: usable glass bottles, plastic bottles/containers, tins (small/paint).

2. Employment Details: this is a stall in Buguruni market and is virtually a full-time activity.

3 & 4. Collection and Sources of Materials: people bring these materials to the market to sell to him.

5. Purchase Price: prices paid for different items are shown below:

| Item | Price | Comments |
|----------------------------|-------------|------------------------|
| glass bottles | 5-20/- ea. | price varies depending |
| plastic bottles/containers | 50/- ea. | on type of bottle |
| small tins | 20/- ea. | |
| paint tins | 30-40/- ea. | |

6. Quantity of Purchases and Demand: depends on sales. See Q9 below.

7. Use of Recycled Materials: resale.

8. Sale Price: selling prices are listed below:

| Item | Price |
|----------------------------|--------------|
| glass bottles | 40/- ea. |
| plastic bottles/containers | 70-100/- ea. |
| small tins | 30-40/- ea. |
| paint tins | 80-100/- ea. |

9. Quantity of Sales and Demand: the number of each item sold per month is shown below:

| Item | No sold | Demand |
|----------------------------|---------|---------------|
| glass bottles | 200 | variable |
| small glass bottles | 500-600 | high |
| plastic bottles/containers | 20-30 | very variable |
| small tins | 20-30 | very variable |
| paint tins | 20-30 | very variable |

Note: the reason for the high demand for small glass bottles was not known; paint tins are generally used for pot plants.

10. Disposal of Waste: the small amount of waste produced is dumped with the other market waste.

11. Problems: not stated.

Check on income: assuming in one month he sells the following quantities of bottles with the selling and buying prices indicated the profit he can earn is shown below:

| Item | No sold | Buying Price | Selling Price | Profit/item | Profit |
|----------------------|---------|--------------|---------------|--------------|---------------|
| small glass bottle | 500 | 20 | 40 | 20 | 10,000 |
| glass bottle | 200 | 10 | 40 | 30 | 6,000 |
| plastic bottle/cont. | 20 | 50 | 70 | 20 | 400 |
| small tins | 20 | 20 | 30 | 10 | 200 |
| paint tins | 20 | 30 | 80 | 50 | 1,000 |
| | | | | Total | 16,600 |

Survey: 2 (bo)

4/7/96

Name of Business: N/A

Location: Mtambani market

No. of Workers: 1

Interviewee: market operator

1. **Materials Recycled and Condition:** glass bottles (approximately 4 types).
2. **Employment Details:** this is the interviewee's only job and he has been doing it for 8 months, working on average 10 hours per day, 7 days per week. He said that his income was sufficient to live off.
- 3 & 4. **Collection and Sources of Materials:** individuals, mainly youths, collect and bring bottles to him. He thinks they mainly collected bottles from households in the area.
5. **Purchase Price:** 15-30/- each.
6. **Quantity of Purchases and Demand:** on average, ~7 sacks/month, each of which contains up to 100 bottles, giving a total of 700 bottles per month. However, demand is highly variable. Generally, the supply is sufficient to meet the demand.
7. **Use of Recycled Materials:** resale.
8. **Sale Price:** 25-50/- ea.
9. **Quantity of Sales and Demand:** an average of 300-500 bottles are sold per month. Demand for bottles is small and they are able to meet the demand. However, there are a few customers who may purchase 200 bottles at any one time. The stall owner does not know what these people do with the bottles.
10. **Disposal of Waste:** N/A
11. **Problems:** not stated.

Check on income: based on sales of 400 bottles per month with a profit of 20/- per bottle, this gives an income of 8,000/- per month which is not sufficient to live off.

Survey: 3 (ct/me)

5/7/96

Name of Business: N/A

Location: Manzese market

No. of Workers: 1

Interviewee: market operator

1. **Materials Recycled and Condition:** buying and resale of kitchen/household items made from recycled metal (pourers, sieves, funnels, etc.) and other items (not recycled) such as baskets.
2. **Employment Details:** this is the interviewee's only job. He has been selling household items for many years but only began to sell recycled items about 3 yrs ago. He works 10 hrs/day, 7 days per week. His monthly income is variable but he can make sales of 1,000-2,000/- per day on average.
- 3 & 4. **Collection and Sources of Materials:** individuals and middlemen bring these materials to him. Generally they buy them from small workshops (Gerezani area) and then resell them to traders like him.

5. **Purchase Price:** depends on item; e.g. sieves and pot holders are 200/- and 150/- ea. respectively.
6. **Quantity of Purchases and Demand:** highly variable. All recycled items can sit for a long time. Demand is small and the supply can easily meet this demand.
7. **Use of Recycled Materials:** resale to market customers.
8. **Sale Price:** depends on item; e.g. sieves and pot holders are sold for 230/- and 170-180/- ea. respectively.
9. **Quantity of Sales and Demand:** Sales are small. Demand is small and can be easily met.
10. **Disposal of Waste:** N/A
11. **Problems:** not stated.

Check on income: insufficient data to calculate.

Survey 4: (dr)

10/7/96

Name of Business: Nasi Tunjaribu Co-op Soc.
No. of Workers: 6

Location: Nyerere Road
Interviewee: Mr Njoka

1. **Materials Recycled and Condition:** used iron and plastic drums (mainly 50 gallon).
2. **Employment Details:** this Coop has been going for 1.5 yrs. They work approximately 12 hrs/day; 6 days per week and each person can earn about 100,000/- per month. This is the interviewee's only job.
- 3 & 4. **Collection and Sources of Materials:** themselves from factories mainly in the Chan'gombe area, particularly Bayfield Trading Ltd.
5. **Purchase Price:** 5,000/- ea. for an iron drum and 10,000/- ea. for a plastic drum.
6. **Quantity of Purchases and Demand:** on average about 40 drums per month. Generally the supply is sufficient for their demand.
7. **Use of Recycled Materials:** resale.
8. **Sale Price:** iron drums: 8,000/- ea.; plastic drums: 17,000/- ea. Individuals purchase drums at their depot (an open space near intersection of Nyerere and Chan'gombe roads).
9. **Quantity of Sales and Demand:** on average, about 24 drums per month (they have a reasonable surplus of drums stored at their depot). The demand is medium and their business can meet this demand.
10. **Disposal of Waste:** N/A
11. **Problems:** their depot location is on land which is not their property and they have been warned several times that they may be evicted; low capital; cost of hiring transport to collect drums is high.

Check on income: based on buying and selling 40 drums in 1 month - 20 plastic and 20 iron, income = $20 \times (8,000 - 5,000) + 20 \times (17,000 - 10,000) = 200,000$ or 33,000/- per person - different from stated income.

Survey: 5 (dr)

12/7/96

Name of Business: Tandika General Enterprises
No. of Workers: 35

Location: near Tandika market
Interviewee: chairman and secretary

1. **Materials Recycled and Condition:** used drums (iron, mainly 50 gallon).
2. **Employment Details:** this group has been operating since 1980. Prior to that, some individuals were selling drums. They work approximately 12 hrs/day, 7 days per week and this is their only job. Each member operates independently and can earn approximately 50,000/- per month. A certain percentage is then paid to the company by each member and members' contributions total about 70,000/- per month.
- 3 & 4. **Collection and Sources of Materials:** members of this group collect the drums themselves mainly from industries in Chan'gombe and shops in Kariakoo (e.g. shops selling grease).
5. **Purchase Price:** 6,000/- per drum.
6. **Quantity of Purchases and Demand:** 300 drums/month for the entire group. Demand is stable but supply does not always match demand.
7. **Use of Recycled Materials:** resale of drums.
8. **Sale Price:** 7,500-8,500/- per drum. Customers are mainly from upcountry areas (90%) and some other individuals from within DSM.
9. **Quantity of Sales and Demand:** 300/month. Demand is medium and can generally be met by them.
10. **Disposal of Waste:** N/A
11. **Problems:** low capital; lack of tools for repairing drums (welding machine for filling holes; tools to remove dents from drums); unreliable transport; lack of furniture/books in their office.

Check on income: assuming they sell 300 drums per month at 8,500 ea. and ignoring any transport costs:
profit = $300 \times (8,500 - 6,000) = 750,000$ per month for 35 members = 21,000/- per member.

Survey 6 (wo)

10/7/96

Name of Business: Nasi Tunjaribu Women's Group

Location: along Nyerere Rd nr. Chan'gombe Rd

No. of Workers: 64

Interviewee: Tabu Ally

1. **Materials Recycled and Condition:** used wooden pallets. (also drums, plastics, firewood and timber).
2. **Employment Details:** this group was stated 3 yrs ago. They work from 9am-6pm, 26 days per month. Each member can earn 50,000/- per month.
- 3 & 4. **Collection and Sources of Materials:** group members collect the materials mainly from THA.
5. **Purchase Price:** 300/- per pallet.
6. **Quantity of Purchases and Demand:** variable. Demand is stable but the supply is limited and sometimes they may only be able to buy pallets once every two months.
7. **Use of Recycled Materials:** resale.
8. **Sale Price:** 700/- per pallet. They sell to Mohammed Enterprises and other small businesses (mainly Indians) in DSM.
9. **Quantity of Sales and Demand:** on average, 50 pallets per week. Demand is large and their ability to meet the demand is limited by the supply.

10. Disposal of Waste: any pallet waste is made into bundles of firewood and sold at 50/- per bundle.

11. Problems: lack of capital.

Check on income: assuming they sell 50 pallets per week = 200 per month; profit = $200 \times (700 - 300) = 80,000$ for the entire group which does not correspond to the stated income.

11.2.2 Large Middlemen Survey Results

Survey: 1

Name of Business: private business

Location: 2 depots; 1 next to Fazal & Co., Chang'ombe Road, near Nyerere Rd intersection (there is no sign advertising this business; it is found at the back of an old garment factory); 1 near Selander Bridge.

No. of Workers: a few casual labourers (> 5).

Interviewee: Mrs Lwabutaza (owner of business)

1. Materials Recycled and Condition: all types of paper and boxes.

2. Employment Details: this is a full-time, well established business.

3 & 4. Collection and Sources of Materials: main sources of paper/boxes are commercial printers in DSM. Offices and shops are a secondary source of paper/boxes. Sometimes, especially when the business was started, workers visited shops, offices, printers, etc. to ask for paper/boxes. Generally, this is not necessary now as this business is well known and new clients are directed here by current clients.

5. Purchase Price: no fixed price; usually 10-20/- per kg although some places give their waste paper away. Prices are stable and were last increased in 1994.

6. Quantity of Purchases and Demand: seasonal. During the wet season, collection is low (about 0-5 t/month) while during the dry season it is about 20-30 t/month. Supply is much larger than demand.

7. Use of Recycled Materials: The paper/boxes are sorted into various categories: white paper, assorted paper and boxes. Paper of the same type is then baled and stored prior to transport to their customers for further processing: Kibo Paper (DSM), Tanpak Industries (DSM), Kibo Match (Moshi), Chandaria Paper Industries (Nairobi) and Kamongo Waste Paper Company (Nairobi).

8. Sale Price: the rates paid by different customers are given below:

| Customer | Item | Price per tonne | Transport provided by customer |
|-------------------------|--------------------|-----------------|--------------------------------|
| Kibo Paper (DSM) | box | 25,000/- | No |
| | Sack kraft paper | 30,000/- | No |
| | assorted paper | 15,000/- | No |
| Tanpak Industries (DSM) | assorted paper | 50,000/- | No |
| Kibo Match (Moshi) | all | 50,000/- | Yes |
| Chandaria (Nairobi) | assorted paper | 90,000/- | No |
| | newsprint | 120,000/- | No |
| | bright white paper | 180,000/- | No |

Note: 1) Kenyan prices are based on an exchange rate of 1 Ksh = 10 Tsh.

2) transport cost to Chandaria in Nairobi is 1.2 million Tsh for a truck and trailer which can carry 25-30 tonnes of waste paper.

9. Quantity of Sales and Demand: depends on collection amounts - see Q6. Demand is very low during the rainy season and most of the waste paper is collected and sold during the dry season. Paper Mill companies do not like buying paper during the rainy season as typically it gets wet during the discharge, collection, packaging, transportation stages. [storage area used by this business for waste paper is in the open air].

10. Disposal of Waste: not stated.

11. Problems: not stated.

Survey: 2

Name of Business: Kibo Pulp and Paper Board Mill - collection depot in DSM

Location: the mill is located in Moshi but they have an office and collection depot in DSM. This is located opposite the police station in Buguruni, one block back from Uhuru St.

No. of Workers: > 5

Interviewee: Depot Manager

1. Materials Recycled and Condition: kraft waste paper.

2. Employment Details: this is a collection depot for the Kibo Moshi Paper Mill.

3 & 4. Collection and Sources of Materials: many middlemen who collect paper from various sources. The depot has 4 workers who collect the paper from middlemen and take it to a certain place where it is baled and then sent to Moshi. These workers check the quality of the waste paper before purchase.

5. Purchase Price: normally 30/- per kg; sometimes 40/- per kg when supply is short. (price was 12/- per kg in 1995).

6. Quantity of Purchases and Demand: average of 160 tonnes per month. The supply is sufficient. Demand varies seasonally. Most paper is purchased in the dry season as in the wet season, its moisture content is increased.

7. Use of Recycled Materials: the waste paper is transported to the mill in Moshi and processed into kraft paper. The kraft waste paper is an essential raw material.

8. Sale Price: N/A. See Q7.

9. Quantity of Sales and Demand: no sales - see Q7.

10. Disposal of Waste: at the Moshi mill, offcuts from paper produced during the manufacturing process are recycled within the mill.

11. Problems: not stated.

Survey: 3

Name of Business: Maginga Investments

Location: at his home behind Maryland centre, Mwenge

No. of Workers: 10 casual labourers for collection and packaging of the paper

Interviewee: Japhet Maginga, P.O. Box 31359, Tel 20036/36485 DSM

1. Materials Recycled and Condition: waste paper from printers and waste packaging materials (brown) in both clean/unclean condition.

2. Employment Details: the interviewee has two jobs, this paper business being one of them. He works about 50 hrs per week, 26 days per month and is able to earn about 150,000/- Tsh from both jobs.

- 3 & 4. Collection and Sources of Materials:** middlemen, offices, shops and printers. Casual labourers are the main collectors of waste paper for him although at times he is also involved in this operation. Sometimes, individuals bring to him. At times, middlemen collect from different places for him.
- 5. Purchase Price:** variable according to the type and quality of paper from 15-30/- per kg. The price for waste paper is stable.
- 6. Quantity of Purchases and Demand:** average of 5-10 tonnes per week (20-40 t/month). Demand is stable. The supply is plentiful and can meet his demand which is often determined by availability of his funds to purchase paper.
- 7. Use of Recycled Materials:** sorting, baling, storage, transportation for sale.
- 8. Sale Price:** 50-100/- Tsh per kg to Tanpak Industries (DSM), Kibo Paper (DSM), Kibo Match Co. (Moshi) and to Kamongo Industries and Chandaria Industries in Nairobi
- 9. Quantity of Sales and Demand:** approximately 30-40 t/month. Demand for waste paper is large and his business cannot meet this demand.
- 10. Waste Disposal:** not stated.
- 11. Problems:** 1) shortage of working capital. The supply and demand is large but lack of working capital prevents him from expanding his business.
2) lack of means of transportation either from collecting centres to godown for storage and for delivering to the industries for sale.
3) lack of own permanent built godown. Hiring or lease of storage facilities increases costs significantly as rents are high.
4) at present, Tanpak and Kibo Paper are not buying paper, so waste paper is being stored at his property.

Survey: 4

Name of Business: private business

Location: take the road opposite the turnoff to Vingunguti dump on Nyerere Road; follow it for about 500m and on the left hand side in a large open area is the paper storage area. He also has another storage area near the Congo bar in the Jangwani area of Morogoro Rd.

No of Workers: over 20 workers employed to sort and bale the paper (they are paid on a per bale rate).

Interviewee: Mr Otiemo - owner.

1. Materials Recycled and Condition: waste paper - white, brown, coloured, cardboard, boxes.

2. Employment Details: own business, started in 1989. He is also involved in other business activities. His turnover is good but not constant. On average, he can earn 800,000/- p.a. (net profit) after paying raw materials, labour and transport costs if a market is present. If no market, he may earn nothing for several months at a time.

3 & 4. Collection and Sources of Materials: main source of paper (approximately 60%) is printing companies in DSM (Tanzam, TPS, Kyota, Maxons, TP, etc.). Scavengers at Vingunguti disposal site provide another 15% while the remaining material is collected from some factories, individuals and companies (including shredded documents from banks). He also collects paper from scavengers at Jangwani illegal dump which is stored at his other depot.

5. Purchase Price: normally 25/- per kg. The purchase price is driven by market forces and can drop to as low as 5/- per kg when demand is low.

6. Quantity of Purchases and Demand: an average of 30-40 tonnes/month when demand is low. However, when the demand is high, he may collect as much as 30 t/wk. The supply of paper is very large. However, demand fluctuates considerably due to the lack of a stable selling market.

7. Use of Recycled Materials: the waste paper is sorted into different grades and baled for transport to customers.

8. Sale Price: His normal customers are: Kibo Paper, DSM (30/- per kg); Kibo Match, Moshi (30/- per kg at their depot in DSM but if he transports himself to Moshi at a cost of 60,000/- per 30 tonne truck he is paid 70/- per kg. He normally uses the latter route); Tanpak, DSM (price not stated); other Industries in Kenya (~80/- per kg).

9. Quantity of Sales and Demand: depends on the state of the market. The status of his customers at present is:

1) Kibo Paper is currently using only about 2 t/day of paper and has problems paying suppliers. He is still waiting for payment of 800,000/- from them for a shipment of paper at the start of this year.

2) Kibo Match, Moshi. Currently, they are not collecting paper. Their stocks are full and they have power problems so they are not operating

3) Tanpak, DSM: He said that this factory was built in about 1990 and uses about 6 t/day normally. However, he last supplied paper to it 2 yrs ago and has not been able to sell paper to them since then. He suspects that the factory is a front and that their products: paper plates and toilet paper are actually imported from Kenya and sold through this factory.

4) Other Industries in Kenya: He used to export paper to Kenya but now the transportation cost is too high for this to be economically viable (1.5 million Tsh for a 30 tonne truck). Presently, he is trying to get a market in Kenya and overseas as he has a big backlog of paper in storage.

10. Disposal of Waste: not stated.

11. Problems:

1) lack of stable market. See Q9. He suggested we could help alleviate this problem by:
i) constructing an industry which would use recycled paper;
ii) investing in the present paper factories (Kibo Paper and Kibo Match) to improve their performance.

2) high transportation costs. An idea was proposed of JICA supplying 2-3 vehicles which would be available for hire at lower rates than the market rates specifically for use for transporting recycling materials. The justification for the lower rates would be that by reducing the waste load on the city dump, disposal costs would be reduced. These vehicles could be available for transport of paper to Moshi or Kenya and even for transporting scrap metals.

3) lack of compressing machines. Another problem associated with transportation is that a 30 tonne truck can only be filled with 15-20 tonnes of paper before its entire volume is occupied. However, if the paper is compressed when baled, the entire 30 tonne capacity may be utilised, making long distance transportation of paper much more economical. Possibly a baling machine could be made available on a rental basis also.

Note: He knows many other paper middlemen in DSM and stated that co-operation between them is good. He gave me the names of 6 more middlemen: Mr Jakob, Mr

Issac, Mr Richard, Mr Roco, Mr Mashaka and Mr Davy whom I have not met. He said they are all small middlemen handling approximately 2 t/wk.

Survey: 5

Name of Business: Mandela Group **Location:** Veterinary, Nelson Mandela Rd
No. of Workers: 24 members, 1 clerk and 4 watchmen **Interviewee:** worker

1. Materials Recycled and Condition: scrap metals, wood.

2. Employment Details: this group began work about 3 yrs ago. The interviewee has been working for the group since it started in 1994 and works from 7am-6pm, 7 days a week.

3 & 4. Collection and Sources of Materials: 50% of their raw materials are purchased from aluminium/steel industries (rejected metal sheets, mat, building rods, etc.), 30% from small companies (J.J. Industries, Gogi Industries and Remangi Industries) and ~20% of materials comes from scavengers (mainly metals) and Tazara (mainly wood).

5. Purchase Price:

1) J.J. Industry: metal shavings - 12,000/- per tonne + 4,000-5,000/- per tonne transportation cost.

2) Gogi Industry - reject materials: iron sheets (2,500/- ea.), 2.5m x 0.75m x 2mm plate sheets (13,000/- ea.), checker plate (for making car bodies).

3) Remangi Industry - reject materials - 1ft x 4ft wire mesh (230/- ea.).

No prices stated for materials purchased from aluminium/steel industries. Purchase prices are relatively stable.

6. Quantity of Purchases and Demand: 30 t/month. Demand is medium; supply of scrap is sufficient.

7. Use of Recycled Materials: make and sell furniture, wheelbarrows and sell scrap metals. The scrap metals are usually sold to ALAF for smelting and making billets which are then used to make building rods by factories in Mikocheni, Arusha and Tanga. Some scrap is sold directly to factories in Mikocheni.

8. Sale Price: members have first priority on the scrap metals for their work. Secondly, they sell the scrap metal to ALAF aluminium/steel industries and to individual customers.

1) scrap from J.J. Industry - 25,000/- per tonne.

2) reject materials from Gogi: iron sheets (3,000/- ea.); plate sheets (18,000/- ea.)

3) reject materials from Remangi Industry: wire mesh - 500/- ea.

The net profit from the scrap metal part of their activities only for the entire group is approximately 160,000/- per month.

9. Quantity of Sales and Demand: depends on collection amounts - see Q6.

10. Disposal of Waste: not stated.

11. Problems: lack of scrap metals; small capital; lack of stable market; increase in tax from 21,000 p.a. for 1995 to 163,800/- p.a. for 1996.

Survey: 6

Name of Business: Umoja wa Wauza Kuni/Mikokoteni na Vifaa vya Ujenzi.

Location: Veterinary, Nelson Mandela Rd

No. of Workers: 95

Interviewee: P.H. Ruwanda, General Secretary

1. **Materials Collected and Condition:** cans/tins and other scrap metal (including metal packaging straps), copper wire, wood. The scrap is sorted into two categories - (a) for own use; (b) for sale.
2. **Employment Details:** This co-operative was started in 1987. Originally it had 118 members but membership has now dropped to 95. When starting, members contributed 30,000/- ea. which was used to buy items for resale (firewood, cotton, construction materials). They also made and sold handcarts. In their first yr., they made a profit of 1,000,000/-. After 3 yrs, they purchased 2 milling machines. They continue to do all these lines of business as well as carpentry. All members work full-time (7 days/wk). Most of their income is derived from carpentry and milling activities.
- 3 & 4. **Collection and Sources of Materials:** scavengers, collectors, shops, hotels, offices and factories. Factories provide over 65% of their raw materials while beer cans are mainly provided by the other sources. Most of the scrap comes from within DSM but some is collected from other regions of Tanzania. For those items not brought to them for sale, they transport them themselves to their workplace using handcarts within DSM or hired trucks (outside DSM).
5. **Purchase Price:** 80/- per kg for aluminium (beer) cans; 10/- per kg for iron/steel; 300/- per kg for copper wire. Purchase prices were increased last year.
6. **Quantity of Purchases and Demand:** 10-15 tonnes per month of scrap metals are collected; approximately 70% of these are iron/steel; 10% copper and 20% aluminium. Demand is large. There is competition amongst the different scrap dealers for raw materials, suggesting that the supply is limited.
7. **Use of Recycled Materials:** resale. In the past they resold scrap metals to individuals who exported them to Kenya but the government has changed the law and export of scrap metals is now prohibited. However export of scrap metals is still continuing by illegal routes and they sell iron/steel, aluminium and copper to some middlemen in DSM who they suspect are engaged in the illegal export business. They also sell scrap iron/steel to factories (mainly steel industries in Mikocheni).
8. **Sale Price:** scrap metal (mainly beer cans) is sold at 120/- per kg; iron/steel at 15/- per kg and copper at 400/- per kg.
9. **Quantities of Sales and Demand:** depends on collection amounts - see Q6.
10. **Disposal of Waste:** not stated.
11. **Problems:** many other people/groups have started similar businesses. Hence, there is competition amongst the different groups for the purchase of scrap metals; lack of transportation (funds are insufficient to buy their own vehicle)

Note: 1) This group is interested in being involved in a project concerning scrap metal.

Survey: 7

Name of Industry: Bondeni Youth Group.
No. of Workers: approximately 7.

Location: along Mandela Rd
Interviewee: chairman

1. **Materials Collected and Condition:** scrap metal (mainly iron/steel) - pipes, roundbars, angle and channel sections.
2. **Employment Details:** this group began in 1992. Currently, they only collect scrap metals but they hope to expand their activities to include welding. The interviewee works 10-11 hr/d, 7 days/wk.

- 3 & 4. **Collection and Sources of Materials:** they collect themselves from aluminium/steel industries (reject iron sheets, pipes) and industries in Tanga, Morogoro and Tabora.
5. **Purchase Price:** 17.5/- per kg.
6. **Quantity of Purchases and Demand:** 640-850 kg per month. Demand is medium. However, currently the supply of some materials is inadequate to meet demand.
7. **Use of Recycled Materials:** they straighten any materials which are deformed. All scrap metals collected are resold.
8. **Sale Price:** they sell most of their scrap to individuals at 25/- per kg. Scrap metal which they are unable to sell to individuals is then sold in bulk to steel industries at Mikocheni for 26,000/- per tonne (hard iron) and 22,000/- per tonne for soft iron (e.g. iron sheets). Average income is approximately 55,000/- per month for the entire group.
9. **Quantity of Sales and Demand:** depends on collection amounts - see Q6.
10. **Disposal of Waste:** not stated.
11. **Problems:** disturbances from police looking for stolen property; increase in income tax from 150,000/- p.a. in 1995 to 250,000/- p.a. in 1996; increase in stamp duty from 10,000/- (1995) to 14,000/- per month (1996); lack of specific market (i.e. they wait for individuals to come to them to buy).

Note: the stated income is not consistent with the given data.

11.2.3 Micro-Industries Survey Results

Survey: 1 (ct/me)

2/7/96

Name of Business: --

Location: near Buguruni market

No. of Workers: 5 (male)

Interviewee: worker

1. **Materials Recycled and Condition:** tins (margarine, coffee, milk powder, etc.) in good condition (not burned or crushed).
2. **Employment Details:** this business has been operating for at least 1 year. Details concerning the number of hours worked per week, days per month, monthly earnings and number of jobs were not obtained during this interview. The workers commented that they earn enough to survive but the income generated is relatively small.
- 3 & 4. **Collection and Sources of Materials:** by themselves, mainly from hotels in the nearby area and further afield.
5. **Purchase Price:** 5/- per tin.
6. **Quantity of Purchases and Demand:** average of 300 tins per week. Demand is stable and supply is sufficient.
7. **Use of Recycled Materials:** manufacture of small kerosene lamps ('vibatari' in swahili) from tins by cutting, joining and soldering.
8. **Sale Price:** 40/- ea. at their workplace.
9. **Quantity of Sales and Demand:** not stated but presumably sales will be similar to collection rates (i.e. up to 300 per week). There is a big demand for the lamps. They are used in households in areas where there is no electricity, in small eating places and in some stalls after dusk.
10. **Disposal of Waste:** scrap metal from their work is stored at their workplace until a large amount has accumulated. They then pay for it to be taken to the dump by handcart.
11. **Problems:** not stated.

Check on income: Assuming they collect 300 tins per week, that 1 tin can be made into 1 lamp, they make a profit of 35/- per tin giving an income of 10,500/- per week, not taking into account any other expenses. This is quite small when shared amongst 5 workers and suggests that they must do some other activities to earn enough money to survive.

Survey: 2 (ct/me)

3/7/96

Name of Business: ---

Location: DASICO, Kisarawe St, Kariakoo

No. of Workers: 3 (male)

Interviewee: worker

1. **Materials Recycled and Condition:** tins (evaporated milk, etc.) in good condition (not crushed or burned).
2. **Employment Details:** interviewee has been doing this work for the last 14 years. This is his only job and he works from 8am-5:30pm, 6 days a week and earns on average 3,000/- per day.
- 3 & 4. **Collection and Sources of Materials:** individuals collect tins from hotels in Kariakoo and the city centre and sell to them. Sometimes when there is a shortage of tins, they collect them themselves.
5. **Purchase Price:** 20/- per tin.
6. **Quantity of Purchases and Demand:** approximately 1000 tins per week (for 3 workers). Demand for tins is stable but the supply does not always match their demand.
7. **Use of Recycled Materials:** manufacture of small kerosene lamps. Other items are made with the remaining tins.
8. **Sale Price:** lamps are sold for 40/- (wholesale) or 50/- (retail) mainly to kiosk operators in DSM and to traders from Mbeya and Iringa (especially Makambako).
9. **Quantity of Sales and Demand:** on average the 3 workers make 400 lamps per week. The demand for lamps is medium and their production is sufficient to meet this demand.
10. **Disposal of Waste:** Their waste is stored in a box. DASICO regularly hires a truck to carry all waste from DASICO operations to the dump at Vingunguti.
11. **Problems:** Their tools (especially a special 'soft' hammer) and other raw materials are expensive. These include chemicals (acid), soldering sticks and 'nosali' (used for cleaning hammers).

Check on Income: based on a profit of 30/- per lamp and that 1 tin can be made into 1 lamp, making 400 lamp per week gives an income of 12,000/- per week for 3 people which is not consistent with the stated income of 3,000/- per day for 1 person only. However, other income would be generated from the manufacture and sale of other items.

Survey: 3 (ct/me)

early July 96

Name of Business: ---

Location: Mwananyamala Illegal dump

No. of Workers: 1 (male)

Interviewee: worker

1. **Materials Recycled and Condition:** tins in good condition (not burned or crushed).

2. **Employment Details:** this is the interviewee's only job which he has been doing for less than 3 yrs. He spends about 2 hrs collecting tins per day for 5-10 days per month. The remaining working time is spent making lamps and selling them.
- 3 & 4. **Collection and Sources of Materials:** collects himself from the illegal dump at Mwananyamala.
5. **Purchase Price:** tins collected by him are at no cost as he scavenges them from the dump. Sometimes when there is a shortage of tins or he has no time to collect tins he buys them at 5/- ea.
6. **Quantity of Purchases and Demand:** over 500 tins/month. Demand is stable and supply is sufficient.
7. **Use of Recycled Materials:** manufacture of small kerosene lamps.
8. **Sale Price:** 50/- ea. to individuals and shops locally.
9. **Quantity of Sales and Demand:** approximately 500/month. The demand for the lamps is large and his business can meet this demand.
10. **Disposal of Waste:** not stated.
11. **Problems:** risk of injury due to sharp objects. e.g. glass.

Check on Income: 500 lamps x 50/- ea. = 25,000/- per month.

Note: This man was also classified as a scavenger.

Survey: 4 (ct/me)

10/7/96

Name of Business: UMATA (Umoja wa Mafundi wa Majiko Tabata). They work outside in the open air under a temporary shelter.

Location: Tabata (opposite old dump on Mandela Rd)

No. of Workers: 6 (male)

Interviewee: worker

1. **Materials Recycled and Condition:** old car bodies, iron sheets, tins.
2. **Employment Details:** interviewee has been doing this work since 1980. He has 1 job only, works from 7am-6pm, Mon-Fri and can earn 1600/- per day (per worker).
- 3 & 4. **Collection and Sources of Materials:** themselves from scrap dealers at Veterinary and Kigogo.
5. **Purchase Price:** car body or can/tin prices were not stated. The price of iron sheets varies depending upon the size and quality of the iron sheet. They cheaper sheets may be bought at 150-200/- ea. while the more expensive sheets (better quality) cost 450/-. Generally, one sheet is sufficient to make one stove.
6. **Quantity of Purchases and Demand:** approximately 4 sheets per day (not stated for cans/tins and car bodies). Demand is not stable and the supply is insufficient.
7. **Use of Recycled Materials:** manufacture of charcoal stoves and small kerosene lamps.
8. **Sale Price:** selling price of stoves depends upon the size and quality and whether they are sold wholesale or retail. Wholesale prices are around 350/- per stove; retail can be 600-650/- per stove. Lamps are sold for 100/- ea. They sell their products wholesale to shops at Tabata and Chalinze. Retail sales are made to individuals coming to their workplace or by walking around with their wares.

9. Quantity of Sales and Demand: they may sell 14 charcoal stoves per week. The number of lamps was not stated. The demand for their products is medium and their business can meet this demand.

10. Disposal of Waste: this is dumped near their workplace.

11. Problems: lack of raw materials; lack of market.

Check on income: insufficient data to calculate.

Survey: 5 (ct/me)

10/7/96

Name of Business: Mburahati Metal Works & Carpentry Co-operative Society ('Kilulumo Ushirika' in swahili).

Location: Mburahati

No. of Workers: 25 (male)

Interviewee: Fidelis Paul

1. Materials Recycled and Condition: tins, car bodies, iron sheets, building rods.

2. Employment Details: the co-operative began in 1982. This is the interviewee's only job which he has been doing since 1973. Each worker arranges his own work but the interviewee works for 30 days/month from 8am-6pm and earns approximately 45,000/- per month.

3 & 4. Collection and Sources of Materials: individuals bring materials to them. These are mainly middlemen but there are also some scavengers. It is thought that they collect the materials from Vingunguti disposal site and other illegal dumps.

5. Purchase Price: 5/- per tin. Car wrecks cost approximately 3,000/- ea.

6. Quantity of Purchases and Demand: approximately 1,000 tins/wk per person (estimated total of > 3,000 tins). Not all co-operative members use tins and some tins are used to make other items like pourers and funnels. Quantities of other collected items were not stated. Generally demand is stable and the supply is sufficient.

7. Use of Recycled Materials: the Tin section make small kerosene lamps, shower pourers ('kata' in swahili - used for pouring water over you when bathing), charcoal stoves and funnels.

8. Sale Price: lamps are sold for 45/- ea. (wholesale) to traders mainly from Mbeya and Iringa but also Morogoro and Dodoma. These traders then sell the lamps in these towns.

9. Quantity of Sales and Demand: on average, each person sells 200 lamps/wk (estimated total of > 600). The demand for these materials is large during July-Sept (many traders come to DSM after the harvest with lots of money to buy these items for resale upcountry) and small during other months. Normally, their business can meet this demand although it can run short during the busy months.

10. Disposal of Waste: formerly, they rented a vehicle to take the waste to Vingunguti dump for disposal but this was very expensive at approximately 15,000/- per trip for a 7 ton truck. DCC has told them that they will collect the waste within their area for disposal at Vingunguti but this has not happened yet.

11. Problems: waste disposal; small capital; lack of transport; security problem at nights as no electricity in this area; poor toilet facilities.

Check on income:

| | |
|--|------------------------------------|
| sales: 200 lamps/wk x 45/- ea. | 9,000 Tsh/wk (other items unknown) |
| - cost of tins 1,000 tins/wk x 5/- ea. | 5,000 |
| Profit | 4,000/wk = 16,000/month. |

This is much lower than stated income. However, sales of other items may account for the difference.

Note: they use recycled timber in their manufacturing activities.

Survey: 6 (me)

8/7/96

Name of Business: ---
No. of Workers: 7 (male)

Location: Mbagala Kizinga
Interviewee: Omary Njoine

1. **Materials Recycled and Condition:** 50 gallon drums, old car bodies.
2. **Employment Details:** this is the interviewee's only job. He has been doing this work for 6 yrs and works from 7:30am-5pm 7 days/wk if there is work to do. His income is variable and was not stated.
- 3 & 4. **Collection and Sources of Materials:** collect themselves. Drums are bought from Tandika market and some other places; car bodies from places in Temeke, Ubungo and Kigamboni.
5. **Purchase Price:** a new drum costs 3,000/- per week (note - these are damaged drums that may have a hole in the side and hence can't be used); used drums cost 1,000/- ea. Car bodies cost 10,000-15,000/- ea. on average.
6. **Quantity of Purchases and Demand:** they use about 10 drums/wk and 2 car bodies/wk. Their demand is stable and the supply can meet this demand although sometimes it can be difficult to buy drums. (note: 1 bus body is sufficient to make 100-150 woks).
7. **Use of Recycled Materials:** manufacture of metal woks for labourers to carry cement in ('makarai ya ujenzi' in swahili), charcoal stoves, repairs of various items.
8. **Sale Price:** they mainly sell wholesale to Indian and Arab shop owners in DSM (Swahili St, India St). Wholesale selling prices are: 1 wok - 600/-; small charcoal stove - 1,000/-; barbecue type grill - 5,000/-.
9. **Quantity of Sales and Demand:** depends upon the supply of raw materials. If available, they can make up to 50-70 woks/day and a total of 10 grills and stoves per day. The demand for woks is medium and large for other items.
10. **Disposal of Waste:** they are working on the site of an illegal dump and dispose of their waste there.
11. **Problems:** lack of raw materials; shortage of required tools for their work.

Check on income: insufficient data to calculate.

Note: they also buy new aluminium sheets from shops to make buckets and saucepans from but this is not recycling.

Survey 7 (me)

3/7/96

Name of Business: ---
No. of Workers: 1 (male)

Location: DASICO, Kariakoo
Interviewee: Kiwana Muhunzi

1. **Materials Recycled and Condition:** iron sheets.

2. **Employment Details:** this is the interviewee's only job and he has been working since 1980. He works from 8am-6pm, 30 days per month and earns on average 30,000/- per month.
- 3 & 4. **Collection and Sources of Materials:** he collects most of his raw materials from ALAF, Carnaud Metalbox and IPP factories. Both Carnaud Metalbox and IPP factories import some raw materials which are packaged in metal sheets. After unpacking, these metal sheets are sold to scrap metal dealers and other people like him. Sometimes, individuals bring iron sheets from their homes and sell to him. Scavengers may also bring some materials for sale but these two sources of supply are not dependable.
5. **Purchase Price:** approximately 2,000/- per sheet.
6. **Quantity of Purchases and Demand:** ~ 20-30 sheets per week. Demand is variable and supply is sufficient.
7. **Use of Recycled Materials:** manufacture of wood charcoal stoves.
8. **Sale Price:** sale price of the stoves depends upon the size and ranges from 1,200-2,500/- ea. (wholesale) for 10"-14" stoves respectively while for retail it is 2,000-4,000/- ea. for 10"-14" stoves. Traders from Mbeya, Iringa, Ruvuma and Zanzibar buy stoves wholesale.
9. **Quantity of Sales and Demand:** 70-100 stoves/month. The demand is variable; being small during the rainy season and large during the dry (harvesting) season. His business can meet the demand.
10. **Disposal of Waste:** the wastes are stored at his working place and DASICO hires a truck to carry all tradesmens' wastes to the dump at Vingunguti.
11. **Problems:** lack of capital, lack of necessary tools, scarcity of raw materials sometimes.

Check on income: Assuming he sells 90 stoves in 1 month - 70 at wholesale for 1,800/- and 20 at retail for 3000/-; Income = 196,000. If he uses 20 iron sheets per week, expenditure = $20 \times 2,000 \times 4 = 160,000/-$. Profit = 36,000/- per month which is consistent with his stated income.

Survey 8 (me)

4/7/96

Name of Business: ---

Location: Mtambani market

No. of Workers: 1 (male)

Interviewee: worker

1. **Materials Recycled and Condition:** iron sheets; metal pieces from car bodies.
2. **Employment Details:** this is the interviewee's only job which he has been doing for more than 10 yrs. He works about 10hrs/day, 7 days per week and earns sufficient money to survive. He has his own workplace within the market itself.
- 3 & 4. **Collection and Sources of Materials:** he collects raw materials himself from small scrap metal shops in Gerezani (car bodies) and from the Carnaud Metalbox factory.
5. **Purchase Price:** 8,000/- per sheet (2.5m x 1.5m)
6. **Quantity of Purchases and Demand:** 3 sheets/month. His demand is stable but the supply can sometimes not meet this demand.
7. **Use of Recycled Materials:** manufacture of charcoal stoves and some repair work.
8. **Sale Price:** charcoal stoves are sold for 2,000-3,000/- ea.

9. **Quantity of Sales and Demand:** he sells approximately 4 stoves per month at the market itself. The demand is small and his business can meet this demand easily.
10. **Disposal of Waste:** his waste is usually removed with the market waste by DCC trucks (if they come). Otherwise he dumps it himself.
11. **Problems:** high cost of raw materials and other materials he uses for manufacture.

Check on income: insufficient data to calculate.

Note: he also buys new aluminium sheets to make saucepans from but this is not recycling.

Survey: 9 (ty)

4/7/96

Name of Business: ---

Location: on Rashidi Kawawa Rd opposite Mtambani market

No. of Workers: 3 (male)

Interviewee: boss

1. **Materials Recycled and Condition:** worn/discarded tyres.
2. **Employment Details:** the interviewee only has one job and has been working in this trade for 30 years in different parts of the country: 1966-68 - Moshi, 1968-80 - Singida and 1980-96 in DSM. He works from 7am-6pm for 7 days per week. Each worker is able to earn 5000/- per week
- 3 & 4. **Collection and Sources of Materials:** themselves from wealthy people, THA, UDA (bus company) and DCC. Demand is stable for most of the year and the supply is usually sufficient. However, their business activity increases during Aug-Sept when many wholesalers from upcountry come to make large purchases (this is after the harvest when they have a lot of money). Sometimes during these two months, the supply is insufficient.
5. **Purchase Price:** 500-700/- per tyre depending upon size and quality.
6. **Quantity of Purchases and Demand:** 20 tyres per month on average.
7. **Use of Recycled Materials:** manufacture of bushes for vehicles and sandals. Usually, one tyre can make 6 pairs of sandals complete with straps or 11 pairs without straps. Bushes come in different shapes and sizes depending upon the particular end use (e.g. spring, exhaust pipe, etc.).
8. **Sale Price:** they sell the sandals at 250-300/- (wholesale) and 350-500/- (retail). Most of the sandals are sold to traders from Kondo, Arusha and Singida who subsequently sell them there. The price of bushes is variable depending upon its size and use, varying between 200-1400/- ea. (these bushes are at least half the price of a new bush).
9. **Quantity of Sales and Demand:** 20 pairs of sandals per week and 40 bushes per week. The demand for these products is large and their business can meet this demand.
10. **Disposal of Waste:** a lot of small rubber trimmings and cuttings are produced from this business. The owner hires a car or handcart to transport the waste to the dump at Vingunguti. [It is my opinion that the waste is dumped nearby at the illegal dump in Mwananyamala].
11. **Problems:** a licence is required for his business, the raw materials are expensive and sometimes in short supply.

Check on income: Sales: assume 20 sandals/wk x 4 wks x 300/ ea. (i.e. wholesale) 24,000
assume 20 bushes/wk x 4 wks x 400/- ea. (small ones) 32,000
assume 20 bushes/wk x 4 wks x 1,000/- ea. (large ones) 80,000

| | |
|---|---------|
| Total | 136,000 |
| less cost of raw materials: assume 20 tyres/month @ 600 ea. = | 12,000 |
| Profit | 124,000 |

Stated income was 5,000 per worker x 3 workers x 4 wks = 60,000. Estimated amount is high although no transport costs have been included.

Survey: 10 (ty)

July 96

Name of Business: Mshimbula Enterprises

Location: at port end of Kilwa Rd near Nairobi Grocery

No. of Workers: 2 (male)

Interviewee: Faraji Ally

1. Materials Recycled and Condition: old vehicle tyres

2. Employment Details: they have been doing this work since 1980. They work from 6am-6pm, 6 days per week and earn 5,000-15,000/- per day (total for both). This is their only job.

3 & 4. Collection and Sources of Materials: individuals collect tyres for them from garages and households.

5. Purchase Price: 10,000/- per tractor tyre.

6. Quantity of Purchases and Demand: 2 tyres per month. Normally the tyre supply can meet their demand although on a few occasions, there are shortages.

7. Use of Recycled Materials: manufacture of bushes for vehicles; brakes for bicycles.

8. Sale Price: the price depends upon the type of bush. Spring bushes are sold for 500/- ea.; suspension bushes @ 3 for 1,000/-.

9. Quantity of Sales and Demand: 300-400 bushes per month (@ avg. price of 500/- ea.).

10. Disposal of Waste: the waste from the vehicle bushes is used to make bicycle brakes. Other small bits of waste are used to light fires.

11. Problems: lack of proper tools - it takes more time to make bushes using local tools than it would with proper tools; not enough capital (sometimes unable to buy tyres due to shortage of money).

| | |
|---|---------|
| Check on income: Assume sale of 350 bushes per month @ 500/- ea. | 175,000 |
| less cost of two tyres | 20,000 |
| Profit | 155,000 |

This is equivalent to 18,000/- Tsh/week/worker. Stated amount per day is too high.

Survey: 11 (pa)

4/7/96

Name of Business: ---

Location: Dasico, Gerezani

No. of Workers: 40 (male)

Interviewee: boss

1. Materials Recycled and Condition: large paper sacks (cement, milk powder, sugar, etc.) in good condition.

2. Employment Details: the interviewee has been doing this work since 1958. He works 8am-6pm every day. This is his only job and he can earn 150,000/- per month. The working hours and earnings are similar for the other workers although he is a senior person and his earnings may be higher.

3 & 4. Collection and Sources of Materials: individuals collect these sacks from factories (e.g. milk powder, sugar sacks from Coca-cola) and construction sites (cement sacks) and bring to them.

5. Purchase Price: 30-40/- per sack.

6. Quantity of Purchases and Demand: 200-300 cement sacks per person per week. Their demand for these sacks is stable and the supply can meet their demand.

7. Use of Recycled Materials: each cement sack (and it is assumed milk powder and other types of sacks) has 4 layers. These layers are carefully removed and then used to make bags/envelopes of various sizes. Typically, 8 A4 size bags can be obtained from 1 cement sacks. In addition they buy large paper rolls from Southern Paper Mills to make other types of bags (not recycling).

8. Sale Price: each bag is sold for 20/- and they sell to markets, shops and individuals in DSM.

9. Quantity of Sales and Demand: they sell approximately 1500-2000 bags per person per week. The demand for the bags is medium (due to competition with plastic bags) and their business can meet this demand.

10. Disposal of Waste: there is a large amount of paper cuttings and trimmings produced from this work. This is sold to Kibo Paper (DSM).

11. Problems: competition with plastic bags.

Check on income:

Assuming 1 person makes 1,750 bags per week and sales @ 20/- ea.

35,000

less cost of raw materials 250 bags @ 35/- ea.

8,750

Earnings/week

26,250

This equates to 26,250 x 4 wks = 105,000/- per month. Agreement with stated figure of 150,000 per month is reasonable.

Survey: 12 (pa)

4/7/96

Name of Business: UMIDA = 'Utengenezaji wa mifuko wa DSM' (paper makers of DSM)

Location: under a tree about 10m off Gerezani Road between Tanzania Tea Blenders and NUWA (right hand side going to town).

No. of Workers: 17 (male)

Interviewee: Ramadhan Sultan

1. Materials Recycled and Condition: paper (cement sacks and computer paper).

2. Employment Details: The interviewee has worked here since 1952 and this is his only job. He works 8 hrs/d, 28 days/month and earns 2,000-3,000/- per day (56,000-84,000/- per month). Work details and earnings are similar for other members.

3 & 4. Collection and Sources of Materials: collect themselves, generally from building sites in Upanga and the city centre (e.g. Ward Adams).

5. Purchase Price: 40/- per cement sack. Computer paper is purchased for 500/- per kg from Kariakoo and Tandika markets.

6. Quantity of Purchases and Demand: approximately 300 sacks per day for all workers. Their demand for these materials is not stable and the supply can not meet their demand.

7. Use of Recycled Materials: manufacture of paper bags of different sizes. They also purchase some new paper for making very small bags used by pharmacies for medicine

(not recycling). Typically 12 large bags or 6 small bags can be obtained from 1 cement sacks while 2 bundles = 200 bags can be obtained from 1kg of computer paper.

8. **Sale Price:** they sell their bags at 1,500/- per 100 bags (wholesale) to markets (Kariakoo, Kisutu and Ilala), shops and supermarkets in DSM. Bags made from computer paper are sold at 300/- per bundle (100 bags).

9. **Quantity of Sales and Demand:** approximately 4,000 bags/week for all workers. The demand for bags is large and their business can not meet this demand. For computer paper, they make 1,000 bundles (10,000 bags) per week.

10. **Disposal of Waste:** there is a large amount of cuttings/trimmings from this work. These are sold to Kibo Paper (DSM) at 20/- per kg.

11. **Problems:** scarcity of raw materials (bags); lack of capital.

Check on income:

| | |
|--|--------|
| assuming each person makes 2,000 bags/wk for sale @ 15/- ea. = | 30,000 |
| less cost of bags: 300/wk @ 40/- ea. | 12,000 |
| profit | 18,000 |

equivalent to 72,000/- per month which agrees well with stated income of 56,000-84,000/- per month.

Survey: 13

8/7/96

Name of Business: 'Wito wa Taifa'
No. of Workers: 16 (male and female)

Location: Mbagala Kizinga
Interviewee: Shaibu Hassani

1. **Materials Recycled and Condition:** cigarette filter material, blanket leftovers, sisal, cotton.

2. **Employment Details:** this group began in 1978. The interviewee works from 10am-4pm for 28 days per month and this is his only job. If business is good they can sell 2 mattresses per day (=10,000/- per day) providing the entire group with an income of 280,000/- per month. However, sometimes 1 week can elapse without selling any mattresses.

3 & 4. **Collection and Sources of Materials:** members of the group collect the materials themselves from industries. Filters are collected from waste dumped by Tanzania Cigarette Company; blankets from blanket manufacturers, sisal from TASCO (Chang'ombe) and cotton from Polystar (Morogoro).

5. **Purchase Price:** sisal costs 10,000/- per truckload (price is the same whether the truck is 3.5 or 7 tonnes). Cotton costs 70/- per kg for dirty cotton; 120/- per kg for clean cotton. Demand is stable and supply is sufficient.

6. **Quantity of Purchases and Demand:** data is in terms of truckloads. About 1 truckload of sisal is collected per month; 1 truckload of blanket materials every 3 months; 1 truckload of filter waste is dumped per month (some uncertainty about this).

7. **Use of Recycled Materials:** manufacture of mattresses.

8. **Sale Price:** mattresses made from filters and blanket material are sold for 5,000/- ea.; mattresses made from sisal for 4,000/- ea.

9. **Quantity of Sales and Demand:** they sell mattresses to people passing by. The quantity of sales is variable but they can sometimes sell two mattresses per day. The demand is medium and their business can meet this demand.

10. **Disposal of Waste:** the waste from their business is dumped at the dump nearby (Mbagala Kizinga).

11. Problems: shortage of raw materials; lack of capital, especially to cover the expense of transporting the raw materials from Morogoro to DSM and to buy material to cover the mattresses in.

Check on income: insufficient data to calculate.

11.2.4 Large Industry Survey Results

Survey: 1

1. Name of Industry: Kibo Paper (government owned)

Location: Head Office is in Chang'ombe; Paper mill is on Nyerere Road, Vingunguti.

Interviewee: D. Bucheye, Senior Paper Maker + Mr R.T.C. Mtambo, Process Engineer.

Products: In the past, they imported bleached kraft pulp (BKP) and unbleached kraft pulp (UKP) which were mixed with some waste paper before processing into various products. Currently they use waste paper only to produce fluting board and test liner board from which they make corrugated boxes. Stationery waste paper is made almost entirely into core paper (i.e. core of a roll of toilet paper).

2. Materials Collected and Condition: they collect 3 types of waste paper from DSM only:

a) corrugated boxes.

b) sack kraft paper which is further divided into:

i) Grade I: brown envelopes obtained from printers (Bahasha Printers, Tanzania Printer Services, Maxons Printer Services); ii) Grade II: used cement bags obtained from their factory at Chang'ombe.

c) Stationery paper. Currently they don't purchase these as their main product requires paper of high strength and stationery paper is generally low in strength and highly variable in quality. However, they sometimes accept stationery paper from NBC and different Government Ministries when these organisations request them to process certain documents they want destroyed.

DSM is the major source of waste paper in Tanzania. Most of the waste paper produced in the city is exported to Kenya or sold to Kibo Match in Moshi (a private company). Both these outlets offer higher prices for paper than this factory (Kenya - 50,000-80,000 per tonne; Moshi - 50,000 per tonne).

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: mainly from middlemen. The main collection areas for waste paper are dumping areas (legal and illegal) with approximately 80% of waste paper coming from these sources. Shops and other businesses provide the remaining 20% of paper. Employees also bring in paper.

5. Purchase Price: prices differ according to the type of waste paper:

a) corrugated boxes: 25/- per kg. If 10 tonnes or more is brought in, the rate is increased to 35/- per kg.

b) sack kraft paper: Grade I - 35-40/- per kg as this paper is of high quality and strength; Grade II - 30/- per kg but the price depends upon the quality.

c) Stationery paper: 10-15/- per kg depending upon quality.

6. Quantity of Purchases: variable. Corrugated boxes are the main items collected (about 70-100 t/month). When the factory is operating for peak production, the quantity

collected can be as high as 200 t/month. These boxes constitute 80-85% of the waste paper collected. Sack kraft pulp makes up a further 10% and stationery paper 5-10%.

7. Processing of Recycled Materials: When paper arrives, it is first weighed, then sorted manually to remove polythene bags, sisal ropes, metals, etc. and then classified into the categories described above before processing.

8. Importance to Business Activity: vital. (waste paper constitutes 100% of paper pulp).

9. Supply and Demand: demand is not stable, depending on production rates which fluctuate significantly. They are dependent upon TANESCO for electricity and partially on NUWA for water. They did sink 3 boreholes several years ago to achieve some independence from the NUWA Water supply but only one of these is still operating efficiently. They plan to build 2-3 more boreholes when finance becomes available. The paper supply can meet their demand. In particular, they have a big share in the market for corrugated boxes.

10. Stability of Purchase Price: prices have remained stable.

11. Profitability: using recycled paper as the main raw material is very profitable. For example, they may pay 550,000/- to buy 10 t of waste paper. The yield of paper product from waste paper is approximately 90%. Hence 10 t of waste paper will produce 9 t of paper which currently sells at 392,000/- per tonne.

12. Internal Recycling: trims and sheet breaks from the paper making process are internally recycled. These constitute about 1-2% of the total production (5% on rare occasions).

Survey: 2

1. Name of Industry: Tanpak Industries Ltd

Location: Bagamoyo Road, near ITV noticeboard

Interviewee: Mr M.M. Chandaria, Managing Director

Products: Tissue and toilet paper.

Note: this is a newly established factory and production started only one month ago. Presently, they are not at full production and are making 1-2 grades of tissue paper. Later they plan to make a wider variety of tissue paper and possibly other products.

2. Materials Collected and Condition: assorted paper (white and brown).

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: middleman have been approaching them with paper for sale.

5. Purchase Price: depends upon the quality of the paper supplied.

6. Quantity of Purchases: amount of paper collected presently is not representative of planned operation. When at full production, they expect to collect 15 t/day of waste paper.

7. Processing of Recycled Materials: processed into tissue and toilet paper.

8. Importance to Business Activity: the waste paper is an essential raw material for their business. If they are making cheap, low quality tissue paper, 100% waste paper may be used. For better quality tissue paper, the waste paper is mixed with a certain percentage of pulp.

9. Supply and Demand: demand is steadily growing as production increases. Based on full production, their research has shown that the waste paper supply is sufficient to meet their demand.

10. Stability of Purchase Price: N/A.

- 11. **Profitability:** it is profitable for them to purchase waste paper.
- 12. **Internal Recycling:** all waste from the factory is dumped.

Note: It was commented by the interviewee that compared with Kenya, the paper recycling industry is not well organised in Tanzania with recycled paper being under-utilised. The supply is big but the demand for recycled paper is small.

Survey: 3

1. Name of Industry: Steelcast

Location: Tazara, DSM

Interviewee: N.C. Mwakatumbula, Deputy Works Manager

Products: steel billets.

2. Materials Collected and Condition: scrap steel, mainly in the form of dumped/abandoned vehicles, including cars, buses, trucks, railway rolling stock and sea vessels. These materials are collected from within DSM and from upcountry, being transported to the factory by road/rail. They have their own fleet of 5 trucks for the collection of steel scrap within DSM; this being one of the activities co-ordinated by their Procurement department.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: In 1995 most of the scrap steel was obtained from upcountry but this year contracts have been signed with Tanzania Railways Corporation (TRC) and Tanzania Harbours Authority (THA) so that virtually all of the scrap steel is being obtained from these sources within DSM. Most of the scrap steel collected from TRC and THA consists of old railway wagons/rolling stock and old sea vessels respectively although smaller amounts of scrap from vehicles and even buildings may be collected. Abandoned cars and other motorised vehicles are mainly collected from garages in DSM.

In 1995, the price paid for scrap steel was significantly increased, resulting in more people collecting scrap steel both in DSM and upcountry. It was estimated that there are around 5-6 middlemen in DSM who buy scrap steel, stockpile it and then sell it to Steelcast. However, they supply a very small percentage of the total scrap collected by Steelcast.

5. Purchase Price: the scrap steel is graded in two ways:

i) processed or unprocessed. Processed scrap is that which is small enough to be fed to the electric arc furnace directly while unprocessed scrap consists of bigger materials which must first be cut using oxyacetylene torches before being fed to the furnace. The latter is bought at a lower price to compensate for the costs associated with cutting.

ii) light, medium or heavy.

The prices paid (Tsh/tonne) for materials collected in DSM are listed below. No prices were available for the light category as virtually all of the scrap steel collected is medium or heavy grade.

| Category | Processed | Unprocessed |
|----------|-----------|-------------|
| Medium | 30,000 | 27,000 |
| Heavy | 40,000 | 35,000 |

6. Quantity of Purchases: they were operating at full capacity for several months from October 1995 and produced 1,500-2,000 t/month during this period. Their normal production target is 1,200 t/month and typically they produce 800-900 t/month (approximately 50-60 t/day). 10% of the scrap steel feedstock is lost in the casting process. Using the typical production figures, this equates to a collection rate of 880-990 t/month of steel scrap.

Production figures are variable as the Company is dependent upon TANESCO for its electricity supply and NUWA for its water supply (used in cooling the steel and breaking up the slag into smaller bits) although it does have a medium sized rainwater storage tank. A regular supply of imported materials is also critical to maintain production schedules and this can be hampered by slow payment of import bills.

7. Processing of Recycled Materials: oil and rubber are removed from some of the scrap steel collected (as appropriate) by burning to avoid undesirable impurities entering their cast steel products. For example, rubber will increase the sulphur content of the steel. Other metal impurities in the scrap steel may become part of the cast steel product or be removed as part of the slag from the production process depending upon the type of impurity. Unprocessed scrap steel is also cut to size before processing. The steel scrap is then lifted by an overhead crane (electromagnet) and dumped in a "bucket" of 3 t capacity for weighing purposes. It is then lifted by a hoist crane and put in an electric arc furnace where the scrap is melted and molten metal is taken off on one side to be cast into steel billets while slag is removed from the other side of the furnace. For a daily production of 50-60 t of billets, 12-15 t of slag (about 25%) is estimated to be produced although accurate figures are not available.

8. Importance to Business Activity: the scrap steel constitutes approximately 99% of the raw materials used in the steel casting process and is essential to their process. Other raw materials (refractories, ferro-alloys, cathodes and anodes) are imported from Europe and India.

9. Supply and Demand: demand for scrap steel fluctuates. For example, they have a massive stockpile of scrap steel currently and the amount of scrap collected is consequently low. The scrap steel supply is more than sufficient to meet their demand.

10. Stability of Purchase Price: purchase prices for the different grades of scrap were increased significantly last year but it is intended that the current prices will remain fixed for some time.

11. Profitability: use of scrap steel as a raw material is the most economically viable option currently available to the company.

12. Internal Recycling: an estimated 12-15 t/day (200-225 t/month) of slag is produced, this being the major waste product from the process. The company has its own truck for disposal of the slag. Slag is taken and used to fill potholes in roads or dumped in swampy areas for land reclamation. A few residents come to collect slag for no charge for their own purposes. No use of the slag is made by road contractors or in other industries such as for cement production.

Survey: 4

1. Name of Industry: M.M. Integrated Steel Mills Ltd

Location: Mikocheni

Interviewee: H.R.S. Urs, Steel Melting Shop Manager

Products: mild steel and high tensile steel for the construction industry (building/construction/flat rods).

Note: the factory is relatively new and only began operation about 1.5 yrs ago.

2. Materials Collected and Condition: mild steel scrap - 3 grades: heavy, commercial and light (e.g. car/bus bodies).

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: middlemen bringing scrap from DSM, Tanga, Arusha and Mbeya; forging scraps from UFI.

5. Purchase Price: 45-50/- per kg for good scrap; 25-30/- per kg for poor scrap (e.g. pieces with a lot of rust or big pieces that require cutting). If good scrap is brought to them from upcountry the middlemen will increase their price to cover their transport costs.

6. Quantity of Purchases: 650-700 t/month.

7. Processing of Recycled Materials: light and commercial scrap are compacted by a hydraulic press prior to melting. Scrap is cut into smaller pieces if necessary. It is then melted in a furnace. Some ferrous alloys (ferro-manganese, ferro-silica) and pure aluminium are added. Molten metal is made into ingots which are then passed through the rolling mill and finally through a series of drawing machines to produce building rods of the required thickness. 100 kg of scrap will produce 85 kg of steel.

8. Importance to Business Activity: essential. The scrap metal constitutes over 95% of their raw materials. The ferrous alloys, aluminium and refractory materials are all imported from overseas.

9. Supply and Demand: demand is stable and the supply is sufficient.

10. Stability of Purchase Price: the price of scrap is prone to fluctuations (it is a sellers' market). They expect that as a new factory (Iron and Steel Limited) will be opening shortly (commissioning to begin next week), the price will increase.

11. Profitability: viable; their industry is based on the use of recycled materials. In terms of process costs, scrap is relatively cheap. Their major costs are (in decreasing order) electricity, labour and imported materials. They use 800 kW/t of steel produced in the furnace and a further 150kW/t of steel processed in the rolling mill. Their electricity supply has been reliable since Jun. 1995 when the Ubungo power station was commissioned. They have their own pipeline to a nearby river. Water is pumped from the river to a large storage tank which supplies the entire factory with water. The technology used is at least 30 yr old and labour intensive.

12. Internal Recycling: reject steel products are remelted. About 75 t/wk of slag (300 t/month), used refractories and used casting sand are produced. These are currently used for filling holes on the factory site and in the road leading to the factory.

Survey: 5

1. Name of Industry: Iron and Steel Limited

Location: 33 Mikocheni Industrial Area

Interviewee: G. Abbas Hirani

Products: iron bars and rods for the construction industry.

Note: This factory is presently under construction and it is planned to begin production next month. Purchasing of steel scrap is underway.

2. Materials Collected and Condition: mild steel scrap.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: their primary source of scrap steel is scrap dealers from DSM and upcountry, particularly Morogoro (currently almost 100%). It is planned to purchase scrap in the future from companies, especially TRC (major source) and THA (old shipping vessels).

5. Purchase Price: 50/- per kg.

6. Quantity of Purchases: full production target is 40,000 kg/day. The collection rate will be about 20% higher than this at 48,000 kg/day (about 1,250 t/month) as there is some wastage of scrap in the production process.

7. Processing of Recycled Materials: scrap will be sorted with unsuitable material being rejected. It will then be melted in a furnace and cast into ingots. These will be processed in the rolling mill into bars/rods.

8. Importance to Business Activity: scrap is vital to their business, constituting approximately 95% of the raw materials; the remainder being ferro-alloys.

9. Supply and Demand: demand for scrap is stable. They have carried out market research and found that the scrap steel supply in the country should be sufficient to meet their demands for at least the next 5 yrs.

10. Stability of Purchase Price: stable.

11. Profitability: viable; their business is based on recycling.

12. Internal Recycling: they anticipate producing about 500kg/day (about 13 t/month) of slag which will be used for road filling in the immediate vicinity of the factory and for levelling the plot on which the factory is built. They anticipate it will be approximately 2 years before these works are finished. They have not made plans for the disposal of slag after that time.

Note: 1) formerly, scrap metals were exported from Tanzania to other countries. However, various industries proposed to the government that this practice should be banned. The government agreed and about 1.5 years ago changed the law. Industries are now required by law to seek markets for their scrap metal within Tanzania. Presently, approximately 70% of iron bars and rods are imported while for angles, channels and I beams the figure is 100% (relatively small demand for latter items). The demand for building rods is growing and they expect that more factories will be built to cope with the demand.

2) However, the Manager interviewed is worried about the competitiveness of Tanzanian industry relative to Ugandan and Kenyan industry, especially with the revival of the East African community. There is also some competition with South African companies. Electricity is the major expense incurred in making building rods and Tanzanian electricity charges are approximately 1.5 times those of Kenya and Uganda. He is negotiating with TANESCO for a reduction in the tariff to heavy industrial users such as the steel industry, arguing that the cost and unreliability of Tanzanian utility services will kill the country's industries.

3) This company and M.M. Integrated Steel Mills Ltd. are the only two private steel mills in DSM. This company is also building a steel mill in Mwanza.

Survey: 6

1. Name of Industry: ALUCO

Location: Nyerere Road, Vingunguti.

Interviewee: Mr W.C. Ndunguru, Works Manager

Products: Aluminium (Al) circles and sheets. The circles are used by small industries for making other items such as small stoves.

2. Materials Collected and Condition: soft Al scrap including beer cans and tins.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: two sources of raw materials. Most of the scrap is collected from 6 middlemen companies: Pwijage Yolada, Chuma Migamba, KISEC, Mbasa, Bapoo, Tanganyika Scraps Ltd. Al product manufacturers (e.g. SIDO) are also a source of scrap, these being trims and offcuts from their manufacturing operations.

5. Purchase Price: 400 Tsh/kg.

6. Quantity of Purchases: 20 t/month on average.

7. Processing of Recycled Materials: the scrap collected is melted in a "scrap furnace" with the Al being taken off and cast into ingots. The waste material from this furnace is a mixture of Al, other impurities and slag. These waste materials are further processed to separate the Al from the other waste with the separated Al being returned to the scrap furnace and remelted. The overall yield of Al from scrap is approximately 50% (i.e. 10 t of scrap gives 5 t of Al ingots). The Al ingots are then placed in a larger furnace together with other raw materials to make into Al slabs.

8. Importance to Business Activity: the scrap is essential to their business (about 20% of raw materials).

9. Supply and Demand: demand is stable and the supply can not satisfy this demand.

10. Stability of Purchase Price: prices have increased by 100% since 1994 when the price was 200 Tsh/kg. It currently stands at 400 Tsh/kg.

11. Profitability: it is profitable to use recycled Al materials in their factory.

12. Internal Recycling: none. About 10 t/month of waste (mainly slag) is produced from the recycling operation. This is stored on site prior to dumping. Some is given to road construction companies free of charge; the remainder is dumped at the Vingunguti Dump.

Survey: 7

1. Name of Industry: NECO

Location: Nyerere Road, Vingunguti

Interviewee: Mr John Mshana, Principal Production Manager (Machine Shop)

Products: the machine shop makes spare parts and offers some repair services; the steel shop fabricates storage tanks, roof trusses, bridges, overhead crane booms and cast iron products (e.g. manhole covers).

2. Materials Collected and Condition: they purchase predominantly cast iron scrap but also small quantities of bronze and aluminium (Al) scrap.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: materials are obtained from local suppliers who act as middlemen/scrap dealers.

5. Purchase Price: the prices for cast iron, bronze and Al scrap are 50,000/-, 500,000/- and 800,000/- (Tsh/t) respectively.

6. Quantity of Purchases: depends on production. On average, they purchase 50 t/month of cast iron scrap, 2-3 t/month of bronze scrap and about 5 t/yr (0.4 t/month) of Al scrap.

7. Processing of Recycled Materials: the scrap is melted. Cast iron scrap is usually melted in an induction furnace while non-ferrous materials are melted in the "non-ferrous furnace".

8. Importance to Business Activity: the scrap materials are essential to their business activity. Scrap cast iron constitutes approximately 79% and over 99% of the raw materials for cupola (not commonly used) and induction furnace operation (usually used) respectively. The aluminium and bronze scrap constitute over 99% of the raw materials used in the non-ferrous furnace operation.

9. Supply and Demand: demand is generally steady but does fluctuate with orders. The supply of these scrap materials, particularly bronze is not large but adequate to meet their demand.

10. Stability of Purchase Price: prices variations differ for each type of scrap; e.g. the price of cast iron has increased from 25,000/- to 50,000/- per tonne in the last 3 years while the price of bronze has remained at 800,000/- per tonne over the same period.

11. Profitability: the scrap purchased constitutes virtually all of the raw materials and hence this practice is essential to their profitability.

12. Internal Recycling: the only waste materials recycled come from the machine shop. These consist of chips (shavings) of different metals and are produced in small quantities. These wastes make up a very small percentage of the raw materials fed to the foundry's furnaces. Such materials are a low grade furnace feedstock as they are very small, light and tend to "evaporate" on being put in the furnace.

Waste from the machine shop includes:

- a) cast iron chips - these are recycled in their foundry and a small quantity is sold to Steelcast Ltd.
- b) bronze chips - these are recycled in their foundry.
- c) aluminium chips - these are recycled in their foundry.
- d) mild steel scrap - a small quantity of this is used to make cast iron in their foundry. The remaining waste is sold to ALAF or Integrated Steel Mill Ltd.
- e) steel chips - these are dumped on site.

Furnace slag and other wastes (refractories, etc.) are dumped on site. Sometimes people come (about 1/yr) and offer to remove the slag/scrap waste for free to use for foundation/construction purposes.

Note: The Tazara foundry is similar in size to NECO while UFI has a very small furnace and is mainly involved in heat treatment.

Survey: 8

1. Name of Industry: Tazara Workshops

Location: Tazara

Interviewee: ---

Products: repair and manufacture of spare parts for railway engines and wagons ("rolling stock")

2. Materials Collected and Condition: old/damaged/broken locomotives and wagons, engine blocks, axle shafts, gear box casings from TAZARA trains.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: Tazara trains

5. Purchase Price: N/A

6. Quantity of Purchases: not quantified. The supply of scrap is plentiful. Usually, there is no shortage. Scrap items are stored in an area near the foundry.

7. Processing of Recycled Materials: large items such as engine blocks, wagon axles and brake shoe springs are crushed (by dropping a large metal ball on them from 10-20 m high). Some items are cut when necessary. The materials are then melted in small furnaces to make cast iron and blanks which are used in the forging shop to make spare parts (pins, springs). They have 3 induction furnaces for cast iron/steel, aluminium (ingots imported) and copper/bronze (copper ingots imported and mixed with tin/zinc to get brass/bronze) and a cupola for cast iron.

8. Importance to Business Activity: the use of scrap materials is essential to their business. When making cast iron, their main raw material is pig iron (65%) mixed with scrap (35%). For making blanks, they use imported iron bars from China. However, if these are not available they will use scrap.

9. Supply and Demand: supply and demand are stable.

10. Stability of Purchase Price: N/A

11. Profitability: it is profitable for the railway to recycle its rolling stock. The Tazara work is their main business. Recently they opened their services to outside customers but only a small amount of business presently comes from outside (sugar industries).

12. Internal Recycling: about 20 t/month of swaf (metal shavings) from the machine shop is disposed of on site (metal shavings are not suitable to feed to the furnace). At one stage, they had a plan to design a metal swaf compressing machine so that the swaf could be compressed and then melted in the furnace but this has been shelved. About 10 t/month of moulding sand waste is produced. This is given away for free to people who collect it to use on building sites. Most rejects, runners and risers from the furnace/forging processes are remelted. In the past, they dumped all of their waste at the Vingunguti dump but now they dump it on site.

Survey: 9

1. Name of Industry: Small Industries Development Organisation (SIDO)

Location: Nyerere Rd, Vingunguti

Interviewee: O. Machongwe

Products: spare parts, machines (sugar cane crushers, grinding machines, etc.), general sheet metal fabrication.

2. Materials Collected and Condition: none. They used to have a foundry but this was closed some time ago for a number of reasons but mainly because it was running at a loss. Normally, they buy their raw materials from ALUCO, National Steel Corporation and individual metal dealers.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: N/A

5. Purchase Price: N/A

6. Quantity of Purchases: N/A

7. Processing of Recycled Materials: N/A

8. Importance to Business Activity: N/A

9. Supply and Demand: N/A

10. Stability of Purchase Price: N/A

11. Profitability: N/A

12. Internal Recycling: efforts are made to utilise as much as possible of the raw materials purchased so that wastage is minimised. The amounts of offcuts and other scrap were estimated to be roughly 300 kg/week and are disposed of at the back of their property. This is a large area and scrap is dumped here in heaps, most of which consist of rusted metal and are overgrown. A very few scrap dealers do collect scrap metal from them (at no charge) for subsequent sale to factories like ALAF but the frequency of visits by such people is very low (around once per year). Hence, it can be said that essentially no waste is recycled internally or externally from this factory.

Note: This factory used to be called "Small Scale Industrial Development Organisation" some time ago. There is another SIDO at Gerezani, different from this one.

Survey: 10

1. Name of Industry: Carnaud Metalbox

Location: Nyerere Road, nr Vingunguti

Interviewee: Mr A. Ghosh

Products: manufacturer of tins of various types including paint, vegetable oil, car oil, coffee; bottle tops and battery covers including the printing of customised labels on the manufactured items.

Note: This company is a multinational conglomerate. Every factory site throughout the world is required to fill in an internal environmental audit form annually which includes a record of the amount and type of waste generated. They do not use any recycled materials in its manufacturing processes but do have an active programme for the recycling and disposal of waste materials produced from their operations.

12. Internal Recycling: the quantities of waste materials produced are tabulated below:

| Type of Waste | Qty. sold (t/month) | Selling price | Purchaser |
|------------------------|---------------------|--|--|
| Tin plate | 18 | negotiable; above 20,000/- per tonne | ALAF ¹ , licensed scrap dealers for baled scrap; small line scraps sold to miscellaneous buyers on weekly basis |
| copper choppings | 1.35 | negotiable; based on London Metal Exchange rate | licensed (authorised) dealers only |
| wooden stillage boards | 1.2 | negotiable; approx. 600/- per piece | miscellaneous buyers |
| cardboard/used cartons | variable | negotiable according to size and condition of carton | miscellaneous buyers |

Note: 1) Most of the scrap metal waste is tin plate waste which comes from the packaging of imported raw materials. Remaining metal waste is production line rejects (squashed tins, unsealed tins, etc.). Formerly they used to sell scrap metal to ALAF but have now stopped due to long delays in receiving payments from ALAF. Now, every Friday morning scrap dealers (middlemen) come to the factory to buy line scrap with payment being in cash.

2) There is a ready market for copper in Kenya whereas the market in Tanzania fluctuates, the main users being brass/bronze industries. However, law prevents export of scrap metals from Tanzania. They are presently negotiating with local scrap dealers over a sale price for copper.

Survey: 11

1. Name of Industry: DASICO (DSM Small Industries Co-op Society Ltd.)

Location: Kisarawe St, Gerezani

Interviewee: Mr Adamu Hemedi, Chairman

Products: DASICO has approximately 400 members and many trainees. It is divided into 5 sections:

a) Carpentry: manufacture of furniture.

b) Ironwork: manufacture of charcoal stoves, small kerosene lamps, kitchen utensils, etc. (mainly discussed in Micro-Industries survey results).

c) Arts: carving.

d) Welding and Mechanical: iron work (gates, windows, etc.), vehicles repairs (engines, etc.)

e) Paper: manufacture of paper bags (mainly discussed in Micro-Industries survey results).

2. Materials Collected and Condition: There are two sections (iron and paper) which use recycled materials in their work. In the iron section, each craftsman is responsible for the procurement of their raw materials and about 25% of craftsmen use tins in their work. The paper section is one group and raw materials are collected for all its workers. The main materials collected for recycling are steel tins (not crushed or burnt) and large paper sacks (50kg size). Other raw materials (not recycled) in the form of aluminium and iron sheets are purchased from ALAF and small traders for the iron section and approximately 1m diameter, 1.5m width brown paper rolls from Southern Paper Mills for the paper section.

3. Use of Returnable, Reusable Materials: N/A

4. - 11.: these items are discussed in the Micro-Industries survey where a representative of the paper section and an individual lamp craftsman and stove craftsman at DASICO were interviewed.

12. Internal Recycling: there are three main kinds of waste produced at DASICO: metal, paper and sawdust. The metal waste consists mainly of iron/steel and a small quantity of aluminium. In the past, ALAF came regularly to remove the metal waste free of charge for processing at its factory but nowadays, they do not come on a regular basis. Consequently, DASICO hires a refuse truck from DCC to remove the metal waste. Typically, 4 trips per month for an 8 tonne truck are required to remove all the metal waste (cost 60,000/-). In the case of sawdust, a DCC truck is also hired to dump this waste at Vingunguti with approximately 4 trips per month being required. The paper waste is sold to Kibo Paper (see Micro-Industries Survey).

Survey: 12

1. Name of Industry: Kioo Ltd

Location: 180 Saza Road, DSM

Interviewee: N.B. Desai, General Manager

Products: wide range of bottles (soda, beer, other) & jars. This factory has been in operation for > 30 yr.

2. Materials Collected and Condition: broken bottles.

3. Use of Returnable, Reusable Materials: N/A.

4. Sources of Materials: scavengers, middlemen, hotels, bottlers and breweries.

5. Purchase Price: 10,000/- per tonne of broken glass delivered to the factory site.

6. **Quantity of Purchases:** About 200 t/month. This represents 20% of their total production (an increase from 5% in 1992). The average life of a bottle is 1 year.
7. **Processing of Recycled Materials:** reprocessed into bottles/jars.
8. **Importance to Business Activity:** the broken bottles are essential to their business, constituting 40% of the raw materials (20% broken glass from outside and 20% broken glass from within the factory).
9. **Supply and Demand:** demand is stable and supply is sufficient.
10. **Stability of Purchase Price:** the purchase price has increased by 100% since 1994 but should remain stable for some time.
11. **Profitability:** the use of broken glass in the production process is profitable.
12. **Internal Recycling:** 20% of bottles produced within the factory are broken. All of these are recycled internally. This corresponds to approximately 200 t/month.

Survey: 13

1. **Name of Industry:** Coast Cannery Ltd
Location: near Cooper Motors, Chang'ombe
Interviewee: J.T. Khanbhai
Products: jams, tomato and chilli sauces.
2. **Materials Collected and Condition:** glass jars and bottles. They do not use plastic containers.
3. **Use of Returnable, Reusable Materials:** a refund system is not used for their glass jars and bottles, unlike soft drink and beer bottles. The bottles and jars are sold to the customer. Hence return of these jars and bottles is not as simple as for the soft drink and beer industry. However, approximately 80% of the jars and bottles sold are returned to them.
4. **Sources of Materials:** mainly individuals and middlemen - there are many people who collect bottles and bring them to the factory.
5. **Purchase Price:** an average of 20-30/- per item (jar or bottle).
6. **Quantity of Purchases:** varies with production. On average, a total of 4,000 items (both jars and bottles) are returned to them monthly.
7. **Processing of Recycled Materials:** bottles are sorted by hand, then washed and sterilised by machine.
8. **Importance to Business Activity:** recycled bottles/jars are essential to their business activity.
9. **Supply and Demand:** demand is stable although it does depend on production. Supply is sufficient.
10. **Stability of Purchase Price:** stable.
11. **Profitability:** profitability is increased by reusing glass bottles and jars as these bottles/jars are only 20% of the price of new bottles/jars.
12. **Internal Recycling:** none. All broken bottles/jars are buried in a pit on site and covered. Until about 2 yr ago, people used to come and collect bottles/jars for sale to Kioo Ltd. They investigated the sale of broken glass to Kioo Ltd. but found that the cost of transportation to Kioo Ltd. exceeded the amount paid for a truckload of broken glass.

Survey: 14

1. Name of Industry: Tanzania Breweries Limited

Location: Shaurimoyo Road, Gerezani

Interviewee: D. Wilkinson, Plant Manager

Products: beer

2. Materials Collected and Condition: glass beer bottles in usable condition and plastic beer crates.

3. Use of Returnable, Reusable Materials: production of beer at this factory has been going on for at least 10 years. Their industry relies heavily on the use of reusable items (bottles and crates). ~98.5% of the bottles circulated to customers are returned in usable condition. This rate of return has remained constant for several years. The average usage time of a bottle is 10 rotations and for a plastic crate 40 rotations.

4. Sources of Materials: bottles and crates are supplied by them to their retail outlets and distribution centres. Empty bottles and crates are then returned to the supplier for reuse.

5. Purchase Price: N/A. The bottles and crates are lent to customers on a refund system. Customers must first pay a deposit to cover the cost of the crate and bottles. When the customer returns a crate complete with 25 empty bottles, the supplier exchanges this for another crate with 25 full bottles. If the customer ceases to trade in beer then the deposit will be refunded on return of the crate and bottles.

6. Quantity of Purchases: 100,000 crates (2,500,000 bottles) are produced each month. Of these, 98.5% are returned.

7. Processing of Recycled Materials: bottles and crates are reused.

8. Importance to Business Activity: vital.

9. Supply and Demand: demand for beer is steady and the supply can meet this demand.

10. Stability of Purchase Price: prices of all raw materials have risen in recent years in accordance with the CPI index.

11. Profitability: use of reusable glass bottles and plastic crates increases profitability.

12. Internal Recycling: 1.5% of bottles are broken during processing in the factory. The broken glass is sold to Kioo Ltd. for 10,000 Tsh/t for reprocessing. A similar attrition rate applies to plastic crates. These are sent to Amboni Plastics, Tanga for reprocessing.

Survey: 15

1. Name of Industry: Pepsi Bottlers Limited

Location: Nyerere Road, Vingunguti

Interviewee: Mr Chatterjee, Senior General Manager

Products: soft drinks in glass bottles. Recently, Pepsi has started selling soft drinks in 1.5 l plastic bottles. The interview concentrated on the glass bottle part of their business as the plastic bottles are not recycled (the turnover of plastic bottles is quite small).

2. Materials Collected and Condition: whole glass bottles.

3. Use of Returnable, Reusable Materials: on an annual basis, over 99% of the bottles used in producing soft drinks are returned. 20,000 crates, equivalent to 480,000 bottles, (less than 1% of the total annual production) are not returned per year. The bottles not returned are either broken or used for other purposes. The average life of a bottle is 17 rotations.

4. Sources of Materials: the factory distributes and collects bottles from its 5,000 outlets in DSM. Retailers pay a deposit of 1,500/- per crate (the box and 24 bottles) and are refunded this amount when they return the crate complete with 24 bottles.

5. Purchase Price: N/A

6. Quantity of Purchases: not stated. However, assuming the 20,000 crates not returned each year represent 0.5% of the annual production, the annual production is estimated to be 4,000,000 crates which is equivalent to 333,330 crates per month.

7. Processing of Recycled Materials: bottles are reused.

8. Importance to Business Activity: the collection of empty bottles for reuse is vital.

9. Supply and Demand: N/A

10. Stability of Purchase Price: N/A

11. Profitability: the use of reusable glass bottles rather than disposable containers increases profitability by reducing the cost of containers.

12. Internal Recycling: there are two types of waste materials which are recycled internally:

a) broken glass (cullet). Approximately 150,000 crates (3,600,000 bottles) are broken per year. Of these, approximately 100,000 crates (2,400,000 bottles) are sold at a fixed rate to Kioo Ltd. The remaining cullet is not suitable for this use and is disposed with the other factory waste.

b) Crates and pallets. These are made of wooden materials. If damaged or broken they are repaired whenever this is possible. When damaged beyond repair, they are disposed with the other factory waste.

Other waste is transported by their own vehicle to Vingunguti dump for disposal. This consists mainly of office waste, canteen waste and sweeping waste from within the factory.

Survey: 16

1. Name of Industry: Simba Plastics

Location: Chang'ombe

Interviewee: P.K. Nair

Products: a wide range of plastic products including bottles, jars, buckets, jerry cans, pipes, packaging films, blown film.

2. Materials Collected and Condition: no materials are collected from outside the factory for recycling, primarily because of the difficulty in reliably grading plastics. Accurate grading is vital in order to avoid processing problems. Hence, only rejected materials from their production line are recycled (see Q12).

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: N/A

5. Purchase Price: N/A

6. Quantity of Purchases: N/A

7. Processing of Recycled Materials: for internal recycling of materials, the materials are first crushed and foreign particles are removed. They are then mixed with virgin material and processed into plastic. The mixing of recycled materials with virgin materials is not done continuously as such practice is not appropriate for some product lines. When mixing is carried out, typically for every 100 kg of virgin material, 10 kg of rejected material is added. Approximately 2,500 kg/month of rejected materials are

recycled in this way. (For average production figures of 150-160 t/month, the rejection rate is 2.5-3%).

8. Importance to Business Activity: N/A

9. Supply and Demand: N/A

10. Stability of Purchase Price: N/A

11. Profitability: it is profitable to recycle the rejected materials.

12. Internal Recycling: this is the only type of recycling carried out in this factory. Virtually all of the rejected materials (approximately 2.5 t/month) are recycled as explained in Q7 above. Rejected materials may be classified as follows:

| Material | Percentage of Rejected Material | Normal Use |
|----------|---------------------------------|--|
| LDPE | 40 | packaging films, blown films |
| LLDPE | 10 | packaging films, blown film |
| HDPE | 10 | packaging films, blown film, bottles, jerry cans |
| PVC | 40 | pipes |
| Total | 100 | |

Note: LDPE = Low Density Polyethylene; LLDPE = Linear Low Density Polyethylene; HDPE = High Density Polyethylene; PVC = Polyvinyl Chloride

Survey: 17

1. Name of Industry: Tegry Plastics

Location: Nyerere Road, Vingunguti

Interviewee: Mr Masamu

Products: pipes, tubing. The actual production depends upon orders received and varies significantly. For example, the planned production over a 3 month period is 40 t but only 16 t was produced due to a lack of orders.

2. Materials Collected and Condition: none. All raw materials (PVC, HDPE and LDPE) are imported. It was stated that recycling of plastics is difficult due to problems identifying and grading plastic materials, especially LDPE and tubing (e.g. plastic folders). Grading of plastic containers is possible but not easy. The factory does have a crusher for crushing plastic bottles for recycling into plastic containers (mainly 1.5 l bottles but also other types) but this is not used now. Formerly, they did produce plastic bottles but have ceased production due to the market being poor. Furthermore, they do not have a moulding machine which is necessary to make containers.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: N/A

5. Purchase Price: N/A

6. Quantity of Purchases: N/A

7. Processing of Recycled Materials: N/A

8. Importance to Business Activity: N/A

9. Supply and Demand: N/A

10. Stability of Purchase Price: N/A

11. Profitability: N/A

12. Internal Recycling: 90% of the production is of acceptable quality while the remaining 10% is not and must be reworked or disposed of. Material suitable for reworking is recycled internally while the unsuitable material (scorched/burned plastic) is taken by their own truck for disposal at the Vingunguti Dump. Based on a monthly

total production figure of 5.3 t/month (16 t per 3 months), this gives 0.53 t/month of waste. The percentages of each type of plastic reworked or dumped are shown below:

| Material | % of Production Rejected | % of Production Recycled | % of Production Dumped |
|----------|--------------------------|--------------------------|------------------------|
| PVC | 10 | 9 | 1 |
| HDPE | 10 | 9.5 | 0.5 |
| LDPE | 10 | 0 | 10 |

Survey: 18

1. Name of Industry: NAS Tyre Services Limited

Location: Nyerere Road, Vingunguti

Interviewee: B.S. Mason, Technical Director

Products: retreaded Tyres.

2. Materials Collected and Condition: tyres in reasonable condition with at least 1-2mm of tread are collected by them for retreading. The smallest tyres they can process are 640 x 14 which excludes tyres from cars but includes tyres from light pickups, passenger carrying vehicles, trucks and other heavy vehicles. Tyres which are unsuitable for retreading are returned to the customer so that they don't have to dispose of any tyres themselves.

3. Use of Returnable, Reusable Materials: N/A

4. Sources of Materials: this is a service industry. Approximately 45% of tyres retreaded come from DSM; the remainder from outside DSM, particularly from Moshi, Tanga and Mbeya where the company has collection centres. Customers bring tyres directly to their factory in DSM and to these collection centres. Tyres from the collection centres are subsequently transported to DSM for retreading.

5. Purchase Price: they do not purchase tyres. Instead, tyres are retreaded and then returned directly to the customer. The price paid by customers depends upon tread pattern and size. According to their advertisements, the price of retreading is 40% that of a new tyre and the quality is as good as that of a new tyre.

6. Quantity of Materials Collected: 500-600 tyres are currently retreaded per month. The tyre retreading industry is rapidly growing. For example, in Jan 1995 they retreaded 150 tyres only while the total number of tyres retreaded during 1995 was 5,500 and their projected figure for 1996 is 10,000.

7. Processing of Recycled Materials: tyres are retreaded. This is the most technologically advanced tyre retreading operation in East and Central Africa.

8. Importance to Business Activity: vital. Their business is based upon recycling.

9. Supply and Demand: There is a growing demand for their service and retreading is becoming a big business.

10. Stability of Purchase Price: N/A

11. Profitability: viable.

12. Internal Recycling: N/A

Note: 1) There are 3 other retreading companies operating in DSM. These are listed below together with estimates made by the interviewee of the current number of tyres each retreads per month:

- a) Treadsetters 250/month
- b) Kassam Retreads 250/month

- c) Globe not known
- 2) This company is part of a larger Italian company (Maragoni Engineering) which has developed the technology and built a factory in Italy to use tyres for heat and power generation.
- 3) The interviewee expressed an interest in being involved as a private contractor in refuse collection and particularly in the operation of a final disposal site.

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