El reciclaje como una Tecnología Apropiada para la comunidad de refugiados de Poipet, Camboya

Recycling as an Appropriate Technology for the refugee community in Poipet, Cambodia.

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i. Summary

The following report is a case study on the concept of using Appropriate Technology to create a recycling venture in the refugee community of Poipet, Cambodia.

The report starts with a look at the concepts of recycling and Appropriate Technology. It then moves on to analyse the available waste materials in the region and the feasibility of turning different types of recyclable waste into marketable products or materials.

The case study focuses on creating furniture from cardboard, detailing possible manufacturing methods, costs and markets.

Contents

1. Introduction

1.1 The concept and world-wide need for recycling

We live in a consumption-orientated world. Every day, materials originating from our planet are used to maintain the standard of living we have come to expect and demand.

In developed countries we drive cars, rely on computers and buy products that in time will become outdated and need replacing. We eat and drink products, discarding their packaging when it is no longer of use. Obviously in developing countries, average rates of consumption are lower, but significant none the less.

Our planet, the provider of these resources from which we draw, has only a finite capability to supply our ever increasing needs for materials. The over-use of our environment is creating truly world-wide problems. To mention a few:

- Environmental problems:
  Ecological risks are posed by the materials we discard into our environment: from Nuclear waste products, to agricultural poisons and chemicals to household waste.

- Waste mountains.
  An ever increasing quantity of waste is being produced. The total amount of waste produced in 1990 in OECD countries was 9 billion tonnes (OECD, 1991).

- Finite resources
  The majority of plastics and rubbers have crude oil as their principal raw material. Estimates as to when this resource will run out vary considerably, but the indications are that depletion of supplies will occur in the foreseeable future

Wood based products, paper and cardboard, when created from virgin materials are partly responsible for the unprecedented deforestation that is ravaging the tropical regions of our planet. In many cases the damage suffered to the earth is irreparable.

All metals originate from the earth. With ever fewer deposits to be exploited, and ever more environmental controls, continued extraction cannot continue indefinitely.

Recycling as a solution

Along with reduction in usage of materials and reuse of products after they have served their primary function, recycling of materials offers many solutions to the problems listed above. It can reduce the quantities of materials discarded as waste into the environment and also save precious energy and material resources.

There is much scope for recycling initiatives to progress and improve around the world. There are huge potential benefits awaiting the environment, and willing governments and/or entrepreneurs, in the form of financial rewards.

1.2 The concept of Appropriate Technology

In the world in which we live, there exist enormous differences between societies and cultures. Of much importance is the difference in economic conditions between communities. Approximately 4 in every 5 people on earth live in developing countries (Population Reference Bureau 2002)[1] over 1 billion of which survive on less than one dollar a day. (United nations 2002)[2].

Closing this marked gap between the rich and the poor is an increasing priority for international NGOs, charities and governments alike. One of the key strategies is the modernisation of antiquated technologies and working practises used in such countries – for example the construction of steel and chemical works, dams, airports and power stations. However it is often suggested that such modernisation is a discontinuous progression from the inefficient and unproductive methods and technology currently employed[3]. *Intermediate*, or *Appropriate Technology,* was proposed by E. F. Schumacher in 1964 as a new route to development.

> "I have named it Intermediate Technology to signify that it is vastly superior to the primitive technology of bygone ages but at the same time much simpler, cheaper and freer than the super-technologies of the rich. One can call it self help technology or democratic or peoples technology- a technology to which everyone can gain admittance and which is not reserved to those already rich and powerful."
>
> E.F. Schumacher[4]

The Appropriate Technology Sourcebook[5] suggests some general characteristics that tools and techniques must possess to be in keeping with Appropriate Technology:

1. Be low in capital costs.
2. Use Local materials wherever possible.
3. Create jobs, employing local skills and labour.
4. Be small enough in scale to be affordable by a small group of farmers.
5. Can be understood, controlled and maintained by villagers, not necessarily highly educated.

6. Equipment can be produced out of a small metal working shop, if not in a village itself.
7. Will bring people together to work collectively and bring improvements to local communities.
8. Involve decentralised renewable power resources.
9. Make technology understandable to the people who are using it.
10. Be flexible so that they can continue to be used or adapted to fit changing circumstances.
11. Do not involve patents, royalties, consulting fees or import duties.

There exist many organisations world-wide, such as the Intermediate Technology Development Group (ITDG) that facilitate the use of Appropriate Technology to build upon the existing skills and knowledge of people in developing countries, while increasing the efficiency and productivity of their enterprises or activities. Examples of fields where Appropriate Technology has been successfully applied include:

- Energy production/usage
- Agro-production
- Manufacturing
- Information and Communication Technologies
- Shelter programmes
- Disaster Reduction
- Water Sanitation
- Food production

2. Recycling as an Appropriate Technology in Poipet, Cambodia

The e-mails Shown in Appendix 8.1 that came to the attention of Dr Mike Clifford at the University of Nottingham illustrated the existence of a community in Cambodia with:

- High rates of unemployment
- lots of surplus labour
- Limited capital to invest in equipment - in the range of £30 to £125
- A desire to become financially self sufficient and independent through setting up small scale businesses
- Access to waste materials that have the potential to be recycled and processed to add value

Looking at section 1.2, it becomes apparent that the people in Poipet Cambodia are in need of a recycling solution that fulfils the criteria of an Appropriate Technology.

As mentioned, there exists a difference between recycling and reuse. Reuse of old products in developing countries is already widespread – and will not be considered in this report. Recycling is less well documented and tends to involve more mechanical processes. The focus will be on these processes in the following sections.

3. Options and limitations

What follows is a series of subsections probing deeper into the processes involved when recycling 5 types of materials that the community has access to: They include Plastics, Aluminium, glass, paper and cardboard, and rubber. These all could have the potential to be recycled using Appropriate Technology. They are all:

- "Low risk" materials. Handling will not require the high specification, high cost, safety precautions required for say Nuclear waste processing
- Waste materials that will be widely available in any environment world-wide.

Details of suppliers for machinery quoted in the following sub sections can be found in Appendix 8.2. It should be noted that:

- Machinery prices are the lowest that could be found from companies in the UK (December 2002)
- It is suggested that companies based in India can supply similar machinery for around half the price[6]
- Shipping, installation costs and import taxes are not included in pricings

The various steps involved for recycling each material can be explained in great detail, but due to the engineering nature of this report, the processing step for each material will receive most attention.

3.1 Plastics

Why recycle specifically plastics

- Plastics are generally non-biodegradable or degrade very slowly taking years to degrade in landfill sites
- Plastics can be produced cheaper from “in-country” recycled plastic scrap than from expensive virgin raw materials that have to be imported
- There are well documented cases that show small scale recycling of plastics using Appropriate Technology can be a financially viable business venture[6]

Stages involved

The stages involved depend on the objective of the process. There are 3 broad recycling processes that plastics can undergo.

1. Converting plastics to a fuel

Plastics contain a quantity of energy that is worth reclaiming by process of combustion. I.e. the energy content of the plastic can be recycled into a fuel. The technique is practically and financially feasible[7] but its use is limited to large industrial plants where fumes and processes can be controlled limiting damage to the environment[8].

2. Production of composite plastic products

Recycling mixed and dirty plastic waste to form large products of low quality, such as pallets and building materials, is feasible practically but not financially on a small scale and should be avoided.

3. Recycling of plastics so as to substitute for virgin materials

The simplest of the three, this solution lends itself most as an Appropriate Technology and will be considered over the remainder of the section.

When processing plastics so as to substitute for virgin materials the stages shown in figure 3.1.1 must be adhered to:

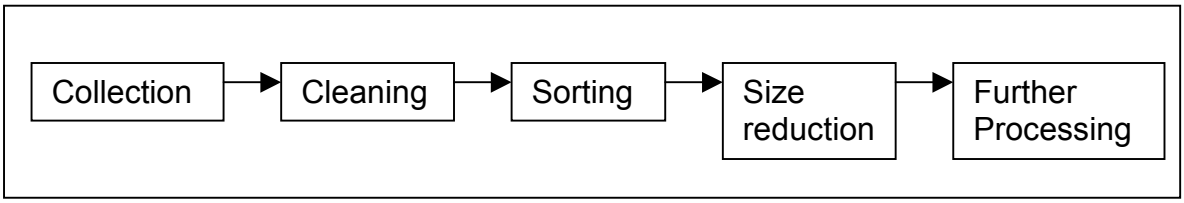

Figure 3.1.1 – Stages of recycling plastics

When sorting, 4 commonly recycled types of plastics should be isolated:

- Polyethylene (PE)
- Polypropylene (PP)
- Polystyrene (PS)
- Polyvinyl chloride (PVC)

Simple tests as outlined in references 1 and 9 provide a means of distinguishing between plastic types.

Virgin polymer is normally sold in pellet or as powder form. Pellets are of uniform shape and size – about the size of a grain of maize. Sorted and cleaned waste plastic should be reduced in size using the following methods, hence enabling its substitution for virgin materials:

Granulation

Passing plastic through a granulator (see Figure 3.1.2) produces regular sized, irregular shaped light flakes of plastic.

Figure 3.1.2 – Vertical Axis Granulator

Agglomeration

For processes requiring extrusion or injection moulding, a more free flowing material is required than granulated plastic. Plastic in such a form is produced

by an agglomerater. Agglomeration is similar to granulation, but heats the plastic to melting point as it is chopped. Water is added to the cutting chamber causing the plastic to explode into a hard dense irregular shaped and sized beady crumb. Steam is removed using an extraction fan.

Further processing of the plastics can be undertaken to add extra value to the end product. Such processes include:

- Extrusion
- Pelletising
- Injection Moulding

Further details on the processes are given in references 1 and 9.

Potential markets

Recycling waste scrap into flakes, pellets or crumb generates materials of significant worth as shown in figure 3.1.3 (1999 USA Market Prices)

Material	USA Market Price Per Metric Ton, $US
Reclaimed Polyethylene (PE)	528 - 1080
Reclaimed Polypropylene (PP)	220 - 683
Reclaimed Polystyrene (PS)	617 - 948
Reclaimed Polyvinyl chloride (PVC)	No Data

Figure 3.1.3[10]

Markets for such reclaimed plastics are as follows:

Granulated plastic can be:

- Sold to companies using large scale processes to produce power
- Sold to companies specialising in agglomeration.
- Sold to cement companies: Plastic mixed with cement can improve its strength and its chemical/water resistance

Crumb plastic can be:

- Sold to companies specialising in extrusion or injection moulding

Extruded plastic can be:

- Sold as piping or as a structural product
- Sliced at regular intervals to produce products of uniform cross sectional area.

Pelletised plastic can be:

- Used as roughage for animals
- Sold to companies specialising in extrusion or injection moulding

Injection moulded plastic can be:

- Sold as products ranging from buckets to buttons depending on the shape and complexity of mould used.

Costs involved – See Figure 3.1.4

Stage	**Method**	**Details and Costings**
Collection	By hand	Local labour rates
Cleaning	By hand + simple water washing equipment	Local labour rates + Cost of basic washing equipment
Sorting	By hand + simple testing equipment	Local labour rates + cost of simple testing equipment.
Size reduction	Granulation	Low spec. 15hp granulator = £200 - £500 second hand, or can be fabricated for less by a competent mechanic
Size reduction	Agglomeration	Low spec. 15hp agglomerator = £3,000
Further Processing	Extrusion	Low spec. 90mm extruder = £2,000
Further Processing	Pelletising	As for Extrusion + simple cooling bath and chopping mechanism
Further Processing	Injection moulding	As for Extrusion + Apr. US$125 per mould made of epoxy or Aluminium. Alternatively, moulds can be made

		cheaper in local workshops.

Figure 3.1.4

limitations

The main limitation to the implementation of the above processes is cost. The machinery required to process the plastics is simply too expensive for the application that is being considered. It is clear though, that with a little saving, the enterprise could invest in building its own granulator – as the first step to setting up a plastic-recycling venture.
Furthermore, many aspects of health and safety must be taken into account when working with fast rotating blades, high temperatures, noisy equipment and high-pressure apparatus.

3.2 Aluminium

Why recycle Aluminium

- Requires 5% of energy to recycle compared to 100% required to make it from virgin material[11]
- Much value can be added through reprocessing
- Recycling can be repeated many times without loss of material quality

Processes involved

There is one principle method for recycling Aluminium as shown in figure 3.2.1

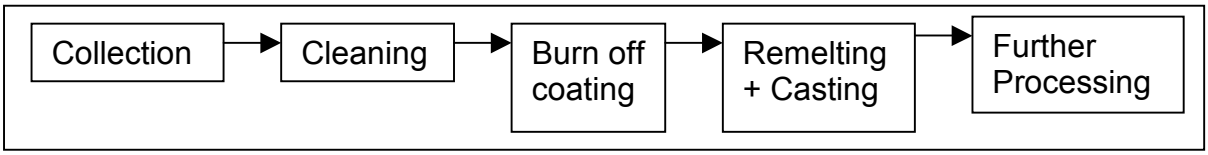

Figure 3.2.1

Collection and cleaning are straightforward processes. Any printed coatings must be burnt off the Aluminium before the pure scrap is melted down in a furnace. The minimum furnace temperature must be 660^{o}C, the melting point of Aluminium.

The Aluminium can then be cast into simple ingots or more complex shapes using sand casting as shown in figure 3.2.2.

Figure 3.2.2[12]

Further processing techniques can be used to add further value.

- Rolling
- Extrusion

Costs involved – See Figure 3.2.3

Stage	Method	Details and Costings
Collection	By hand	Local labour rates
Cleaning	By hand + simple water washing equipment	Local labour rates + Cost of basic washing equipment
Re-melting	Furnace	Small scale Aluminium facilities can be constructed for less than $5,000[13]
Casting	Sand Casting	Simple wooden moulds and “Sand boxes” can be manufactured locally
Further Processing	Rolling	Large array of equipment needed makes rolling an inappropriate activity for small scale enterprise.
Further Processing	Extrusion	Low spec. 90mm extruder = £2,000

Figure 3.2.3

Potential markets

Simple, ingot like, castings of Aluminium:

- Can be sold to engineering companies for machining purposes

More complex Aluminium castings:

- Can be supplied to local manufacturers for use in vehicles, general engineering components or architectural fittings.

Rolled Aluminium:

- Foil can be supplied to the packaging industry
- Sheet can be supplied to the Construction industry and Automotive companies for body panels
- Plate Can be supplied to the construction industry or supplied for air frames or military purposes

Extruded Aluminium:

- Can be supplied to the construction industry for use in window and door frames, roofing and cladding

limitations

Once again: cost is the limiting factor. US $5,000 is too high a sum for the project to invest in equipment. Other factors include health and Safety when working with molten metal.

3.3 Glass

Why recycle Glass

- Using recycled glass uses 30 percent less energy than making products from virgin materials (Department of Energy)
- 30 Gallons of Oil are saved for every ton of glass recycled (Friends of the Earth)

Processes involved – See Figure 3.3.1

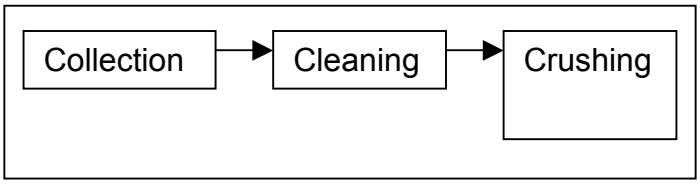

Figure 3.3.1

When crushing the glass, it must be crushed to the consistency of a fine sand before it can be used fabricate products.

Costs involved – See Figure 3.3.2

Stage	Method	Details and Costings
Collection	By hand	Local labour rates
Cleaning	By hand + simple water washing equipment. Solvents may be required to remove gum	Local labour rates + Cost of basic washing equipment and low grade solvents
Crushing	Glass crushing machine	Smallest scale glass crushers start at £22,000

Figure 3.3.2

Potential markets

The Crushed glass could then be sold to specialist companies. Applications for the material include:

- Use as cullet in the production of new glass products
- The manufacture of “Glassphalt” – a material used for road resurfacing
- Concrete reinforcement
- Fabrication of glass wool
- Creation of glass polymer composites
- Brick and Tile manufacture

limitations

Glass recycling is only marginally profitable and so is left to governments or large companies to recycle glass on a massive scale. Consequently the smallest glass crushers commercially available produce over 10 tons per hour. This is a major over-specification for the type of recycling application that is being considered.

3.4 Rubber

Why recycle rubber

- Recovered rubber can cost half that of natural or synthetic rubber. (ITDG)
- Producing rubber from reclaim requires less energy in the total production process than for virgin material. (Tire and Rubber Recycling Advisory Council (TRRAC)).
- Rubber tyres are a difficult product to dispose of, taking a long time to bio-degrade.

Processes involved

There are 3 broad processes involved in the recycling of rubber

1. Energy recovery

Around 60% of tyre rubber is made up of Hydrocarbons (ITDG), a worth while quantity of energy that can be recovered by incineration. The process requires sophisticated plant and its application is limited when looking at small-scale enterprise.

2. Simple material recovery

Large pieces of rubber such as those found in tyres can by manually cut up to form a whole range of products such as shoe soles and mats.

3. Advanced material recovery

Advanced material recovery involves steps as shown in figure 3.4.1

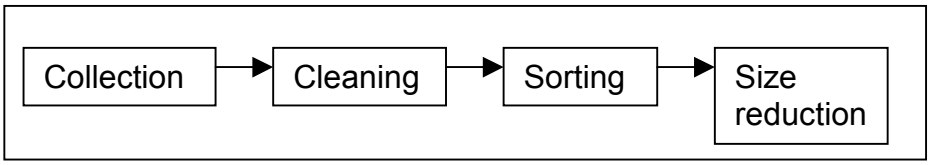

Figure 3.4.1

The size reduction processes for recycling rubber involve granulating and crumbing. The processes, costs, and limitations that prevent its use as an Appropriate Technology are identical to those outlined in section 3.1.

Further processing of rubber generally requires higher specification technology, and is undertaken by specialist companies.

Potential markets

Granulated rubber can be used in the fabrication of:

- Low-grade products such as floor mats
- Better performing road construction materials by being added to asphalt
- Non slip cover for floors and tracks

Rubber crumb can be used in the fabrication of:

- Adhesive Mastic for plastic Tiles
- Roofing Adhesive
- Solid Propellants

3.5 Paper and Cardboard

Why recycle paper and cardboard

- Compared with producing a tonne of paper from virgin wood pulp, the production of one tonne of paper from waste paper:
  - May use half as much energy and water.
  - Results in 74% less air pollution,
  - Saves 17 trees
  - Reduces solid waste going into landfill sites
  - Creates 5 times more jobs (Earth Care, 1988).

Processes involved

There are 2 broad processes that waste paper can undergo to be reclaimed:

1. Making new paper/cardboard from waste paper/cardboard
2. Creating useful products by reforming paper and cardboard

Process 1: Making new paper/cardboard from waste paper/cardboard

Making the paper by hand requires considerably less machinery than conventional production methods. The processes involved can be seen in figure 3.5.1 below:

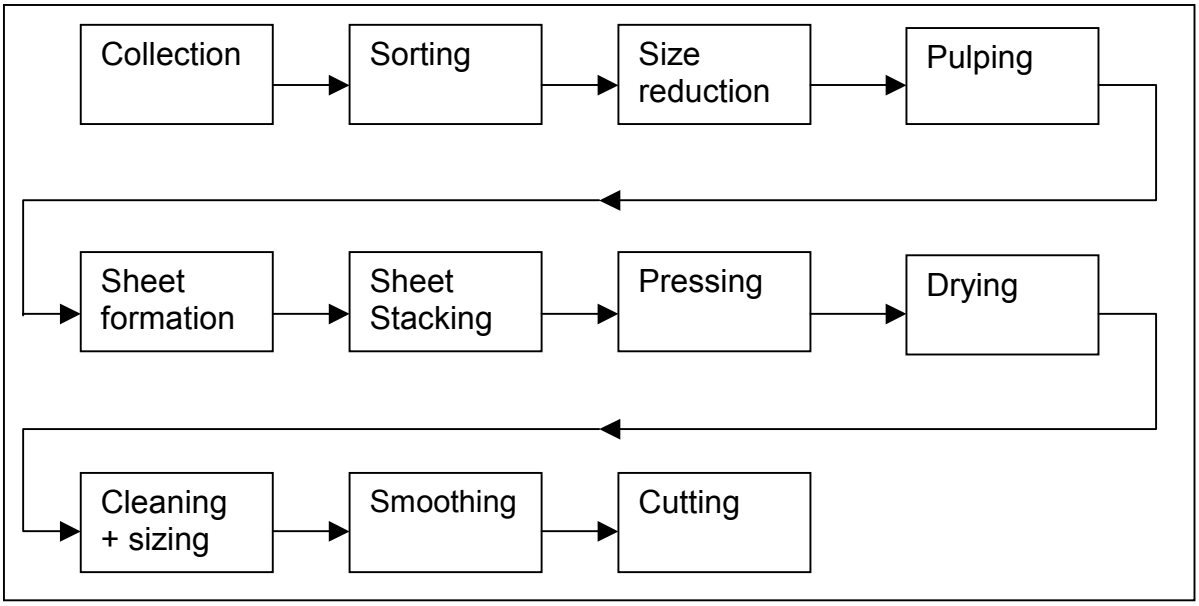

Figure 3.5.1

Equipment required for the most basic of operations includes:

- Cutting tools
- Pulping containers
- Lifting Moulds (Mesh on a wooden frame)
- Hydraulic press
- Calendaring machine that includes spring loaded rollers for smoothing
- Cutting machines to cut the product into sheets.

Before proceeding any further it is already clear that the financing for such equipment is beyond the scope of the enterprise in Cambodia. There exists a good market for hand made paper and the process is used in developing countries but is often supported by government initiatives and can secure greater levels of funding.

Process 2: Creating useful products by reforming paper and cardboard

Reforming paper and cardboard can be done in a number of different ways to produce a range of goods that can fill market niches. There are few, if any,

obstacles that prevent this process being used as an appropriate technology. Examples include:

1. Forming paper/cardboard briquettes to be used as a fuel

Process:

a. Tear up paper and cardboard into shreds
b. Add water and manually beat the mixture into a pulp
c. Compact the pulp using a manual press to extract most of the water
d. Allow briquettes to dry

The costs involved will be trivial, whilst an enormous market exists for such a technology in regions where there is much waste and fuel sources are scarce. The technology can also be adapted to make low specification products such as plant pots or egg boxes.

2. Formation of construction materials

By using a process similar to that mentioned above, replacing water with a glue, engineering materials can be created that can be used for a variety of purposes. Such applications include:

- Use as a substitute for wood, e.g. for making pallets
- Creation of paper plywood. Shown to have good tensile strength and resistance to corrosion[14]

Utilising and modifying this technique also permits the manufacture of low cost, conservation friendly cardboard furniture, which is discussed in detail in section 4.

3.6 Summary

In conclusion, there's lots going for recycling as an Appropriate Technology in developing countries:

- There exists a freely available array of recyclable waste materials
- There is the presence of a large, low cost work force, essential for undertaking the time consuming tasks of collecting and sorting waste materials
- There exist suitable processes for the recycling of plastic, rubber, paper and cardboard, and possibly Aluminium as an Appropriate Technology.
- The most significant hurdle is financing the purchase of equipment.
- Significant financial backing is required for all processes with the exception of forming products from paper and cardboard – which is the only appropriate recycling solution for the community in Poipet, Cambodia.

4. A viable solution - Cardboard furniture.

After discussions with Mike Fennema, it was decided that Cardboard furniture had the best possibilities of success for a venture in Poipet, Cambodia.

It should be noted that not only has cardboard furniture been successful with European design Studios[15], but also with individuals and small organisations using Appropriate Technology Production Methods[16]. The material which although may appear flimsy, can be used to create furniture strong enough to take human weight.

Different methods of production can be employed to create different types of furniture:

4.1 Solid Surface supported by Cardboard lattice

Method of production[17]

1. A structure is created with intersected cardboard plates cut out according to the original design. The cardboard is taped and glued as necessary. This forms the support frame of the piece. (See Figure 4.1.1)
2. The frame is then covered with “Cut to fit” cardboard, glued and taped as necessary. (See Figure 4.1.2)
3. To create unique surface finishes, the piece can be covered in different types of paper or paint. The furniture is finally waterproofed using a varnish (See figure 4.1.3)

Figure 4.1.1

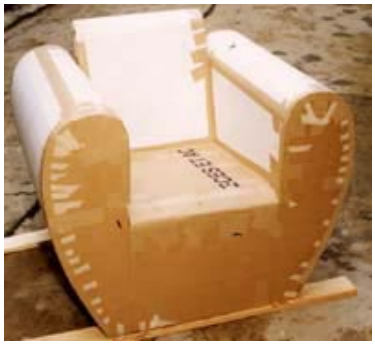

Figure 4.1.2

Figure 4.1.3

Equipment required and costing – See Figure 4.1.4

Process	Equipment Required	Costing
Cutting out cardboard plates	Coping saw	£10 per saw
	Die cutters can be used to cut multiple sheets at once	£50 per die cutter
Gluing and Taping	Glue and Tape	Negligible
Varnishing	Varnish	£3 per litre
	Brush	Negligible
Painting	Paint	£2 per litre
	Brush	Negligible

Figure 4.1.4

4.2 Slotted panels

See figure 4.2.1 for an example of a cot made out of slotted panels of cardboard.

Figure 4.2.1

Method of production

1. Multiple panels of cardboard are cut using the same template.
2. These panels are bonded together under force using PVA glue. (See figure 4.2.2)
3. An array of different shaped panels can then be slotted together. The intersections can be glued for extra strength, or left dry to allow disassembly.
4. The furniture can then be painted and varnished as necessary

Figure 4.2.2

Equipment required and costing – See Figure 4.2.3

Process	**Equipment Required**	**Costing**
Cutting out cardboard plates	Coping saw	£10 per saw
	Die cutters can be used to cut multiple sheets at once	£50 per die cutter
Gluing	PVA Glue	£4.20 per litre
Panel compression	G- clamps	£6.50 per 75mm clamp
	Alternatively, the panel can be compressed between 2 boards and heavy masses. E.g. Rubber tyres	Negligible
Varnishing	Varnish	£3 per litre
	Brush	Negligible
Painting	Paint	£2 per litre
	Brush	Negligible

Figure 4.2.3

4.3 Solid Furniture

More robust furniture can be created using the method detailed below:

Method of production

1. Cardboard laminates are torn up by hand into small pieces
2. The shreds of cardboard are mixed with a simple PVA glue
3. A press is prepared by lining it with a cling-film like material, and the cardboard/glue mixture is fed in. See Figure 4.3.1
4. Several tons of force are applied to the press by tightening the nuts, compacting the mixture
5. The mixture is removed and allowed to dry.
6. Once dry – the profile of the product can be altered using a coping saw.
7. Varnish and paint can be applied as necessary

Figure 4.3.1

Equipment required and costing – See Figure 4.3.2

Process	**Equipment Required**	**Costing**
Tearing up cardboard	Manual labour	Local labour rates
Gluing	PVA Glue	£4.20 per litre
Mixture compression	Simple manually operated press. Only low tonnages are required	£500 for a simple 250mm by 250mm press including moulds
Profile alteration	Simple Coping saw	£10 Per saw
Varnishing	Varnish	£3 per litre
	Brush	Negligible
Painting	Paint	£2 per litre
	Brush	Negligible

Figure 4.3.2

4.4 Examples of furniture that can be produced using these methods

- Chairs
- Sofas
- Beds
- Tables
- Trays
- Cots
- Office organisers
- Shelving
- Small huts

4.5 Summary

With the funds available, methods 1 and 2 could be utilised immediately by the venture, where as funds will need to be saved, or cheaper locally manufactured presses be found before method 3 can be undertaken. Overall, cardboard furniture is an excellent venture for the community:

- It falls completely under the criteria for Appropriate Technology given in section 1.2
- Processing cardboard into furniture is a high added value process. The Cot shown in Figure 4.2.1 retails for US $106: a sum much higher than the cost of the individual parts
- It is a flexible venture. Depending on the needs of the local population, imagination and product innovation can be put to good use.
- There is a large market for cheap furniture.
    - Sell direct to the public
    - Supply local businesses.
- It has the potential to employ lots of people.
    - Cardboard scavengers
    - Suppliers
    - Designers
    - Mechanics
    - Fabricators
    - Sales men

5. Conclusions

There is no doubt that on overcoming the financial constraints, there exists a wealth of recycling possibilities for small-scale enterprises in developing countries. For the refugee community, cardboard furniture is a good base to start from. However, as the venture grows in strength, the community should not be blind to doors that other peoples waste will open for them.

Whereas developed countries are fortunate enough to be able to subsidise their recycling operations, developing countries benefit from lower rates for labour. The two styles of recycling are worlds apart, yet learning should be encouraged both ways; the developing countries to learn of the best methods and possibilities for recycling; and the developed, to the ingenuity that thrives from necessity. And although so different, the practises are linked by the common threads of recycling and technology, appropriate to wherever it may be used.

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8. Appendices

Appendix 8.1 Correspondence with Mike Fennema

To whom it may concern,

I work with ZOA refugee care in Poipet Cambodia as project manager of an integrated development project covering agriculture, health, education, income generation, water and sanitation, and road construction. I noticed your request for problems and am more than happy to mention a few ideas that come to mind.

Our project focus is in Poipet, which is on the border with Thailand. this is a challenging environment to work in as the value of the land has increased over the past few years, casinos have moved in. The place is a little like the wild west of long ago. The result has been that the rich and powerful end up taking land away from the poor and powerless. The gap between rich and poor grows each year.

Many of the poor survive as day labourers, earning just enough to survive. But always staying dependant on day labor. This work is mostly based at the border, carrying good across by hand, stuck inbetween unscrupulous businessmen and corrupt border officials to whom they must pay bribes.

One focus of our project is to identify alternative sources of income, so that these day laborers can start to depend on different sources of income. So far our efforts are small scale, setting up small businesses. But to make a difference we need to identify a few technologies which can employ much larger number of persons.

There are a few areas that seem to have potential to me.

Currently there are a number of resources, raw materials that are exported in great amounts via this border point. They end up being processed in Thailand. These include cardboard paper, recycled plastics, and scrap metal, old batteries. truckloads each day are sent out. Now, Thailand recycles then, adds the value and sells the products back to Cambodia. I have not yet been able to identify some of the potential appropriate technologies that might provide stable income in recycling these products locally.

Do you have any suggestions or experience with this area?

Looking forward to your reply

Mike Fennema
Project Manager
ZOA Refugee Care
Poipet Cambodia

2nd E mail

Hello Paul

Regarding financial constraints: There is some flexibility. The $50 refers to the grants that we provide to one family to get a business started. So, if there are potentials at that level, that is ideal. At this level of investment we can still target the poorest of the poor.

However, if you find that there is nothing at that low level, but for example you find that the lowest option is in the area of $200, then we can also consider setting something up, especially if it works out economically and also can employ more than one person.

Thanks

Mike

Appendix 8.2 - Suppliers of machinery

Supplier	Equipment Quoted for
Kween B The Old Manse 2 Compton Rd Birmingham B24 8QA	• Second hand granulators • Agglomerators • Simple extrusion machinery • Basic moulds for injection moulding
Information Supplied by Reference 13	• Small scale Aluminium facilities
Kween B	• Simple extrusion machinery
Lanway Ltd. Lanwill Works Silver St Brierley Hill DY5 3QT	• Glass Crushing Machines
B&Q www.diy.com	• Coping saw
Crossland Cutters Ltd New Factory Nimmings Road Halesowen B62 9JE	• Die cutters
Bostik Ulverscroft Rd Leicester LE4 6BW	• PVA glue
MBK surface coatings Ltd Taylor Lane Loscoe DE75 1NF	• Pre Catalyst Lacquer
Millenium Pressings Ltd 1 Twitch Hill Horbury Wakefield W. Yorkshire WF4 6NA	• Manual Press

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