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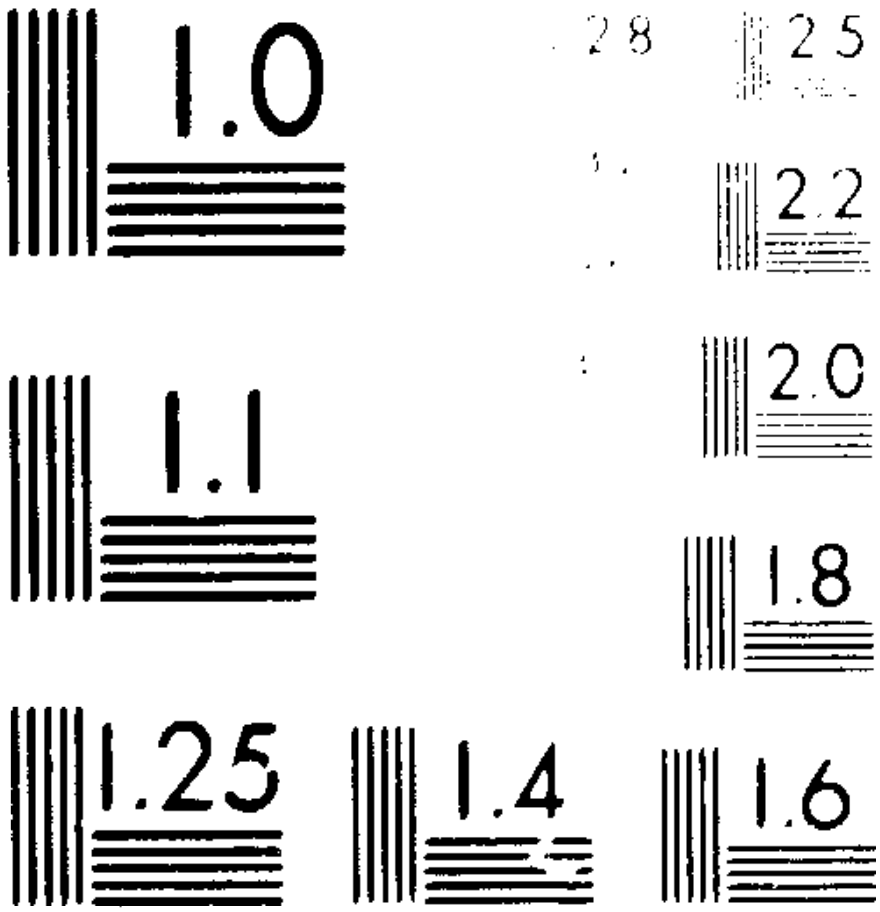
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ESTABLISHMENT OF A PACKAGING RESEARCH, TESTING, DEVELOPMENT AND INFORMATION DEPARTMENT AT JAMAICA BUREAU OF STANDARDS, KINGSTON

DP/JAM/77/008

JAMAICA. Packaging.

Technical report: Techno-economic surveys *

Prepared for the Government of Jamaica
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Allen Jones, expert in techno-economic surveys

United Nations Industrial Development Organization
Vienna

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SUMMARY

A survey necessarily of a somewhat superficial nature, has been made of the situation in Jamaica of the quality and availability of packaging made from paper and board. Virtually no paper or board for packaging is produced in the country and the material imported is currently restricted by financial problems. The converters of the materials, i.e. bag, carton and fiberboard case producers while currently handicapped by spare part and maintenance difficulties are capable of good quality conversion and are beginning to introduce Quality Management for which the new Packaging Laboratory and the Quality Assurance Group of Jamaica Bureau of Standards can provide an essential back up in terms of equipment and technical know how on test methods.

The task of the consultant was to train a counterpart in the Packaging Laboratory so that she was aware of the functions of techno-economic studies in development and would be more capable of using conventional techniques of production of such studies so that the studies contributed to progress. The most direct form of training was to produce typical specific and broad studies, not only for any direct contribution of such studies to economic welfare but also to be examples of procedure in production and to provide background information for studies to be produced by the counterpart after the consultant had left Jamaica.

It was also necessary to develop familiarity with the functions and nature of studies amongst persons outside the Packaging Laboratory. The this end the consultant discussed techno-economic studies at three meetings of the Packaging Committee:

A. An introductory meeting
B. A special meeting to explain the work programme and to present an interim study of the recycling and reconstitution of waste.
C. A final meeting to present further material relative to the study of waste, and to present a study on packaging of liquids.

The assignment terminated with a round table discussion with representation from both the public and private sectors.

The Packaging Laboratory is reaching the end of the first phase of development in which UNIDO experts have been, and are being, introduced to train graduates as leaders of the sections of Materials, Retail Packaging, Transit Packaging and Techno-economic studies. As well as training a counterpart it is expected that the experts will contribute to general packaging education within the Laboratory and elsewhere. This expert was concerned with Techno-economic studies, which are seen as essential in packaging development.

The facilities and co-operation provided by UNDP, the Bureau of Standards and the Laboratory, were excellent. A counterpart of suitable character and education was allocated from the day of arrival. A programme was drawn up and completed. It is suggested that further input from UNIDO on Techno-economic studies would be valuable about mid-1981.

Programme in Brief

Through June - Visits to suppliers and users of packaging to collect information and decide subjects for typical studies.

End June - Establish priority subjects as:

1. Recycling and reconstitution of packaging materials.
2. Packaging of liquids in Jamaica
3. Packaging of Pharmaceuticals (This was subsequently discontinued because the period was too short, further reduced by disruption following a hurricane).

Through July - Work on the typical studies.

July 30th - Packaging Committee.

August 22nd - Written document by counterpart on techno-economic studies. Terminal summary by Expert for the Packaging Committee and a round table conference.

August 27/28th - Presentation to the Packaging Committee and the holding of a round table conference.

INTRODUCTION

Objectives

The Bureau and the Laboratory had requested that techno-economic studies be made an essential component of packaging development. Within a period of three months it is impossible to produce a study of real value to the economy; even under ideal conditions a useful study requires several months of investigation and data processing. It was therefore decided to devote the period to intensive training of the counterpart, using three typical types of study as examples so that the counterpart would subsequently appreciate the techniques of study production for both specific and broad studies. It was intended that the three typical studies would be enlarged and revised by the counterpart in due course, and that she would undertake further studies, using selection methods according to her training. The ultimate objective is to have a techno-economic unit, with staff provided as necessary, which is able to guide developments towards the maximum benefits at the least cost in terms of monetary and other resources.

Achievement

The counterpart, with progressively reduced assistance, produced studies of:

1. Pulp moulded egg trays from waste
   The demand was analysed and related to the ITDG pulp moulding machine. At least three concerns were interested in installing the plant.
2. Recycling and reconstitution of packaging materials.
   Awareness was generated of the economic significance of waste. The rescue of waste paper and of cullet is being seriously examined. Information on a small-scale glass plant was included.
3. Packaging of liquids in Jamaica
   This is a broad study providing background to specific studies in the future.

In support of the production of studies, some assistance was given to the private sector.

The Counterpart was, in the opinion of the expert, capable of producing reasonable studies and of progressively improving her capabilities to make a positive contribution to progress.

Further requirements

1. The continued support of the counterpart, with due tolerance and encouragement.
2. The building up of a library and system of contacts with sources of information in Jamaica and abroad.
3. Further input of guidance, say three man-months, after the techno-economic study unit has progressed. In the opinion of the expert further input would have value mid-1981.

TERMS OF REFERENCE

The consultant will be required to teach local counterpart staff the techniques used in carrying out techno-economic studies in the field of packaging. This will include:

A. Analysis of surveys previously carried out by the consultant in other countries.

B. Locating and visiting local sources of information necessary for techno-economic survey work.

C. Advising on the application of the above technique to local problems, e.g. a comparative study of the use of glass containers versus cartons for the milk and soft drinks industry.

D. Advising on how best the staff of the bureau can carry out techno-economic studies of the above type in the future, the activities that can be undertaken and those which seem to be outside the scope of the present organisation.

E. Take part in a round table conference presenting observations on the present packaging situation in the country, focussing on the economics and feasibility of producing locally materials and containers at present imported.

CONDUCT OF THE MISSION

The consultant arrived in Kingston on the 6th June 1980 and a tentative work programme was agreed on the day of arrival. The Packaging Committee had suggested twenty (20) priority subjects for techno-economic studies. In view of the limited time available it was agreed that the subjects could be best combined, that training from the mission would be maximised, and that some positive benefits could be derived from three subjects:

A. A broad study of packaging of liquids.

B. A broad study of packaging materials recycling and reconstitution.

C. A specific study of packaging of pharmaceuticals.

Out of study "B" there arose a specific study of pulp moulded egg trays. Early investigation of the pharmaceutical packaging indicated that the trade was dominated by foreign packaging which would be difficult to eliminate or replace. The subject was consequently left for the future attention of the counterpart.

During the period visits were made to twenty (20) sources of information in the private and public sectors (listed in the annexes), interim studies of subjects "A" and "B" were presented to the Packaging Committee and a round table conference was held. The consultant left Jamaica on 31st August for debriefing in UNIDO, Vienna.

OBSERVATIONS, CONCLUSIONS AND RECOMMENDATIONS BY FIELDS OF STUDY

TECHNO-ECONOMIC STUDY OF RECYCLING AND RECONSTITUTION OF PACKAGING MATERIALS IN JAMAICA

Background Information

Jamaica suffers from world problems of inflation and instability of markets. As a measure to reduce the outflow of foreign currency a limit of JA$800 million was imposed on imports in 1977 (five-year plan). Subsequently the Jamaican dollar was devalued. The consequence was reduced productivity in almost all secotrs due to the unavailability of sufficient foreign exchange to secure adequate materials and equipment.

One means of reducing the outflow of foreign exchange is to substitute materials from domestic manufacture for imported materials - even if this means a change of types and qualities. The utilisation of waste in Jamaica is relatively low and the processing of waste products would contribute to domestic productivity and social welfare.

In general the processing of waste uses less energy than the production of virgin material. In this study the energy factor has not been included because the consideration of energy would be an important factor in the recommended feasibility studies.

PAPER -- GENERAL COMMENT

Paper is a layer of fibres which have been processed so that they link together as a web. The cost of new paper has two components - the processing of the fibres and the laying of the fibres to a web. If paper is made from waste paper the fibres are already processed so the former cost factor is eliminated. Higher qualities of waste paper are used for reconstituted paper. Lower qualities are used for pulp mouldings. An interim study of moulded eggtrays is appended to this study.

With regard to paper, a small paper making mill is in Jamaica but the mill is idle and there is no production of packaging paper in Jamaica. There is production of tissue to 6000 t/y, partly from clean mill waste and partly from imported pulp. The kraft paper now being converted for packaging is imported as reconstituted kraft from Venezuela, with some virgin kraft from USA (vergin kraft is specified for banana boxes). The level of mill waste in conversion is high, capable of providing much more clean waste than is presently rescued for tissue.

Original Fibres

Recent advances in technology have made it possible to manufacture paper in relatively small scales using non-wood fibres. Although Jamaica has standings of exotic pine and eucalyptus it is doubted that a conventional wood-based paper mill would be economic. It should be possible to install a small mill using bamboo, forest trimmings, banana trash and waste paper. The indicated market for such mixed-fibre paper is wrapping paper and fluting for corrugated board.

Other fibres which could be developed for paper are bagasse and sisal. With inflated oil process the bagasse is probably more valuable as fuel than as a paper making fibre. Sisal is of direct interest since it could bring marginal land into productivity. For paper, sisal may be hammer-milled in small quanitites to extract the fibre, which may be alkali digested without pressure.

Broadly, with regard to paper making from original fibres in Jamaica, there is a need for detailed study to be made of available and potential fibres.

Waste paper fibres

According to L.A. Wheeler in a 1975 U.N. report, the paper content of Jamaica is 60,000 t/y. The Trade Statistics for 1977 indicate imports of recoverable paper to be about 47,000 t/y. Made-up packages imported with products are not recorded but enter into supplies of waste paper. It should not be difficult to discover at least 20,000 t/y of relatively clean and conveniently-located paper.

Limited testing shows that the puncture strength of banana box board, which is of virgin kraft paper, is some fifty percent higher than that of similar board constructed of imported reconstituted kraft. This is a greater difference than expected (similar comparisons in other countries have shown reconstituted kraft to have up to 80 percent the burst strength of virgin kraft). The greater difference could be due to differences in board construction or to inferiority of the Venezuealan reconstituted paper.

The reconstitution of paper causes fibre rupture, which in turn increases the moisture content and, since the strength of paper is reduced by high moisture content the reconstituted paper shows apparent weakness. If waxing or coating is used to maintain dryness in reconstituted paper there is a higher apparent strength. On the other hand if paper fibres are repeatedly repulped and laid out as webs, there is severe damage to the fibres and the reconstituted paper is inherently weak. Such damaged fibres are satisfactory in pulp mouldings.

Domestic papermaking

The conventional sizes for modern wood-based papermaking facilities are from 50,000 to 150,000 t/y, costing up to J$600 million. For 50,000 t/y of wood-based paper it would be necessary to extract a quarter million t/y of trees from the environment. Even if such a weight of trees could be found in Jamaica the extraction would deprive the country of valuable structural wood and would damage the land beyond recovery.

If a facility for papermaking were to be set up using imported wood chips it would not be competitive in world markets. If such a facility was designed to run on imported pulp, detailed analysis might indicate economic paper production - as first phase development pending the digestion of domestic non-wood fibres and forest trimmings. On the other hand, the indication is that Jamaica could supply its own pulp from waste paper, if collection system could be devised and if the size of the mill were to be kept down to about 15,000 t/y. Although it would be simplier to start up

a mill using imported pulp (and the paper quality could be better), it is strongly suggested that all effort is made to develop domestic pulp for progressive import substitution.

The ideal facility would be:

1. Sufficiently small to be duplicated if found advisable.
2. Simple to operate.
3. Low capital cost with more labour involvement than is found in conventional papermaking facilities.
4. Low in pollution levels and energy demands.
5. Flexible in operation so that it may in the future absorb any useful domestic original fibres, and may be diversified in the types of papers made.

Because the conventional paper industry is conservative and saturated with the concept of capitalised mass production, such an ideal facility will have to come from efforts in so-called developing countries - many of which can now provide assistance in small-scale non-wood fibre processing. Advice, assistance and information may be obtained from UNIDO, Intermediate Technology Department Group and from countries which have already built such facilities.

Manually-operated papermaking units have been designed to make specialty papers at only a few kg/day, using domestic waste-disposal grinders and hand-lifted racks. Whilst such small units have value for village industries they do not provide commercial grades of papers for packaging. For commercial grades the minimum level of operation is about 4,000 t/y using only waste paper, possibly 6,000 t/y for inputs of mixed waste paper and original fibres. If bleached paper is required the lowest level is about 15,000 t/y, and any project in Jamaica should allow for future introduction of bleaching.

Most of the small-scale plants in the world use the soda process to digest batches. This allows flexibility of inputs, very useful for a country which is not yet certain of its pattern of original fibres.

Foreign experience suggests that the production cost of paper which is from reconstituted waste is about half the production cost of paper from digested fibres. This is because the fibres in waste are already digested and need no more than repulping and laying as webs. Experience has also shown that the optimum price paid for clean waste paper may be about half the prevailing price for imported pulp.

One unknown factor in Jamaica is the pattern of fibre qualities in waste paper. In so-called developed countries the waste paper has a high proportion of virgin fibres and the quality of consequent reconstituted paper is relatively high. In countries which rely on reconstituted papers (imported or home-made) there is a greater proportion of already-damaged fibres. In a typical economy it is usually possible to divide waste paper into three classes of:

1. Highest quality for reconstituted packaging paper.
2. Average quality for lower-grade wrapping paper.
3. Inferior quality for pulp mouldings.

The pattern of waste depend largely on the mechanics of collection. It will be necessary in the future to detail the possible pattern of waste and to determine the consequent division of reconstitution into grades of paper and pulp mouldings.

Pulp Mouldings

Recent developments in the processing of waste paper allow useful pulp to be obtained from waste with up to 30 percent contamination (developed in Finland). This means that waste which has previously been regarded as too dirty for repulping may now be used for pulp mouldings and possibly lower grade paper. The new development uses a revolving perforated drum which repeatedly drops waste and water, causing the fibres to pass through the perforations and any non-fibre contamination to be passed out of the end of the drum. It is possible that a rotary coffee-berry cleaner could be adapted for small-scale production.

As a general rule, mixed dirty waste is not suitable for reconstituted paper - not so much because it is dirty but because it contains too much broken fibre. It is suitable for pulp mouldings such as eggtrays. (An earlier interim comment on eggtrays is appended to this study). Other outlets for pulp mouldings include:

1. Retail trays - presently mostly imported expanded polystyrene
2. Fruit Interlayers - not commonly seen in Jamaica but could be useful if exported fresh horticultural products develop
3. Nursery plantpots - required in very high number and superior to other types of pots.

From the economic point of view it would be profitable to introduce pulp mouldings instead of imported expanded polystyrene. It will, however, be necessary to study the technical differences of pulp against expanded polystyrene, Pulp is an absorbing cushion which soaks up broken egg but also draws liquid out of foods in retail trays. Expanded polystyrene does not absorb liquids.

EFP Laboratories in Canada carried out extensive tests to compare moulded pulp eggtrays (cartons) against expanded polystyrene eggtrays (cartons). The tests indicated that differences of materials were of much less importance than differences in design. To quote 'carton design was more important than material in determining relative protective ability'.

One advantage of expanded polystyrene eggtrays or cartons is the lower weight per package. A tray for 30 eggs (which is similar in material weight to a carton for 12 eggs) weighs 17 to 24 g in expanded polystyrene, 55 to 60 g in moulded pulp. This makes a difference of about half a kilogramme per filled box of 15 dozen eggs - which may or may not be significant.

The disadvantage of expanded polystyrene is that it does not absorb. Egg displays in Jamaican supermarkets have been observed to be spoiled by spilled broken eggs, which is a serious attraction to infection and infestation. Liquid egg is likewise undesirable in shopping bags and domestic storage.

Waste paper collection

The sensible approach to the economics of waste paper collection is to realise that the imported paper has cost Jamaica at least $J1,000/t and benefit is to be gained by the recovery thereof for some purpose. The national per capita consumption of paper is, according to an earlier U.N. report confirmed by division of statistics, about 30 kg/y. It is not possible that all this could be rescued since some paper products such as tissues or cigarette papers are lost in their application. It is not probable that the consumption is uniform throughout the country, being inevitably higher in urban areas than in rural areas, and higher in areas of high commercial and secretarial activity. The highest consumption will probably be in Kingston., and it is suggested that in the early stages the organisation of collection is concentrated in Kingston.

Waste may be classified as:

1. Clean mill waste
2. Office and institutional waste
3. Domestic waste
4. Waste fraction in mixed collected rubbish

Clean mill waste is presently partly collected and converted to tissue. More could certainly be collected if some form of profitable conversion existed.

Office and institutional waste collection requires the use of shredders to maintain secrecy and reduce bulks for transport. The loan of shredders could be part of the organisation of collection.

Domestic Waste collection requires organisation according to social factors, and it needs a cost/value structure to encourage it. Housewives have to be motivated to keep waste paper apart from other rubbish, small-lot collectors have to be motivated to provide their labour, bulk handlers have to be motivated.

Mixed collected rubbish is rarely an economic source of any raw material. As a later project the composition of Jamaican rubbish could be determined to decide if it is worth dividing it into the various fractions.

GLASS

Glass package design and construction is influenced by the factors of:

1. Colour, in so far that some products require exclusion of certain wavelengths of light, and the colour of bottles is frequently used for sales identification (as for example Heineken green).

2. Glass recipe, which influences glass strength and clarity and consequently package weight and shape. In so far that recipes are confused by the addition of mixed cullet the use of high proportions of cullet in melts is frequently not popular amongst bottle suppliers.

In 1977, 40 million bottles were imported for the beer, wine and spirit trades, plus 2,400 tonnes of other bottles. Averaging the bottle weights the total imports probably weighed about 17,500 with much variation of shapes, sizes and colours. A significant number of the imported bottles were exported as filled packages but these are ignored in the present study because during their stay in the country they are part of the total glass content of the country. They will require further study as a special sector of the bottle trade in which multiple-journey distribution is not a factor in the economics.

At present the glass works is running at possibly a third of its potential, with 27,000 t/y output, the low output being due to the condition of the plant and the fragmentation of the output. If the glass works could be revitalised the substitution of most of the imported bottles should lead to a demand for between 40,000 and 50,000 t/y.

Glass is a brittle material, causing glass packages to have thick walls and thereby causing glass bottles to be very heavy. In general, they are only economic if return journeys are possible in the distribution, although there are situations in which glass is essential but not in return-journey distribution (in which case special lightweight bottles are necessary). It is doubted that the glass works could presently manufacture lightweight glass bottles.

Averaged costs of bottles are about 25 cents imported and 50 cents from domestic manufacture. The high cost of domestic manufacture is an indication of the incomplete and fragmented running of the plant. Bottles average about 15 journeys, giving trip costs of 1.7 and 3.3 cents per journey plus cleaning and recovery costs.

It is normal for glass industries to recycle bottles in return-journey distribution and to reconstitute bottles by remelting waste glass (cullet) as addition to new glass. Efficient glass works have tight control over the quantities and types of glass accepted as cullet. Some form of elementary sorting will be essential as part of the revitalisation of the glass works, and it may not be presumed that all of the waste glass which is generated will be suitable for remelting.

The glass works has no problem of obtaining sufficient cullet. Output in 1979 was about 27,000 tons of new bottles into which went up to 40 percent cullet. The proportion of included cullet has varied and has reached one hundred percent of one melt. Such variation of the cullet inclusion must have a damaging effect on bottle qualities. The output of the works is of white bottles only so the only cullet of value is white and roughly similar in recipe to the intended new bottles. There is no outlet for coloured waste glass, which is presently dumped as rejected material. The works did have a furnace for amber glass but this was closed in 1978 and may not be of the highest priority in plans for revitalisation.

There are problems in Jamaica with regard to return-journey distribution. There is a distinct lack of places where empty bottles may be conveniently taken, and many retailers of drinks do not accept empty bottles. There are probably less than 20 places in Kingston to which empty soft drink and beer bottles may be returned. There are less than five places where other bottles may be returned and these are located inconveniently in downtown, Kingston. The present return value of empty bottles is about 10 cents, which is broadly considered as sufficient. The replacement proportion of bottles is about 10 percent.

Opinion is divided with regard to the efficiency of washing bottles for refilling. The washing plant of the larger companies is evidently satisfactory but there is much filling by small-scale producers. Shortages of detergents have contributed to unsatisfactory washing, and it may be advisable for the health authorities to investigate possible dangers to public health.

In 1977 the cost of imported bottles was about $J 9 million. Even if a five-year pay-off period is allowed the indicated desirable investment for glass works revitalisation (as a means of import substitution) would be $J45 million. The intended investment and pattern of revitalisation have yet to be detailed but it must be realised that the investment may only be justified if the recovery and remelting of glass is included. It will not be satisfactory if plans include provision for only selected white glass to be remelted.

The proportion of white to coloured glass in the total glass is not known and would probably be impossible to estimate. If, the glass works is presently taking only about 10,000 t/y of cullet, a considerable quantity of cullet (less actual exported bottles) needs to be provided with an outlet.

Until the revitalisation plans for the glass works have been detailed it is difficult to quantify recommendations with regard to waste glass. The interim recommendations are:

1. Establish production of coloured bottles as import substitution.
2. Organise a better collection system for empty bottles, possibly with a bottle bank and sorting centre.
3. Improve the washing of empty bottles in small-scale filling locations. Issue a specified code of practice, with inspection by health authorities.
4. Establish some useful outlet for mixed and coloured cullet. This may require study of alternative outlets for cullet if the glass works can not be develop remelting.

ALUMINIUM

The energy demand for new aluminium from Bauxite is about 300,000 Mj/t whilst the energy demand for remelting aluminium scrap is only 10,000 Mj/t. Although Jamaica has bauxite the country does not have low-cost energy, nor the market for mass production of aluminium metal. Jamaica does have a market for end products from sheet metal (steel and aluminium). There is some possibility that Jamaica could arrange special prices for aluminium ingots. Such special prices could provide Jamaica with an unusual situation in which fabrications of aluminium become significantly economic against galvanised and tinned steel - which are presently expensive imports - if Jamaica installs plant to produce aluminium sheet from imported ingots.

There is a reasonable but not quantified supply of scrap aluminium, now partly cast and partly exported. In-so-far that light engineering is a neglected part of Jamaican development it will be necessary to discover if the casting of aluminium could expand to absorb more scrap aluminium, or if the scrap must be regarded as metal available to dilute new metal fed into a sheeting project.

In terms of weight of metal, packaging outlets are unlikely to rival other outlets for sheet aluminium in the market. The significant outlets are in building and engineering. Corrugated aluminium has been shown as likely to be more satisfactory at an equal price to galvanised corrugated steel, and the general engineering sector includes many subjects for the replacement of steel by aluminium.

With a few pressure-vessel applications the major packaging outlet for sheet would be drawn cans for the drinks and processed food sectors. Drawn aluminium cans could be manufactured in relatively small factories located near the production centres of such drinks or foods. The scrap aluminium is said to be of high quality and there should be no problems in using it as dilution in melts of new aluminium.

The statistics of cans for drinks and foods are being examined for a general study on packaging of liquids. The development of aluminium cans would generate more aluminium scrap but the cans would be distributed amongst domestic rubbish. Whilst a proportion of the cans might be rescued by the organisation of collection the cost of collection would be high (aluminium cans are lightweight, making it uneconomic to rescue the cans other than at centres where cans are emptied). It is probable that the only way in which the extra scrap generated by cans could be rescued would be by division of mixed urban rubbish. Even then, the proportion of aluminium in total weight might be too low to justify the processing. It has to be realised that most of the weight of metal which would arise from a sheeting project would be in durables such as roofing or engineering components. Relatively long periods would pass before such durables contributed to scrap, other than any scrap generated in the cutting and forming operations.

Packaging aluminium needs to be of purity at least 99.8 percent, which could be a production problem in the early stages of development of sheet. Roofing and general engineering could use less pure metal and would offer more early demand for weight of metal. assisting in getting the project into a relatively advanced scale of production.

Packaging aluminium in thicknesses below 12 microns are suspect with regard to barrier performance and the market for thicknesses below 9 microns is limited other than in laminates. Aluminium foil production requires a very high level of technology and control of purity, hardness and composition. The world market for aluminium foils is declining in favour of vacuum metallisation and non-metal composites which will work in micro-wave ovens. It is probable that world suppliers of aluminium foil will try to stimulate demands by cutting prices. It is reasonable to suppose that a foil project in Jamaica would not compete in world markets, and it is doubted that the domestic market would provide sufficient demand to justify the high cost of technological inputs of foil (although thicker sheet and end-products thereof would have satisfactory demands in both export and domestic markets).

Other than foil the main packaging outlets for aluminium are:

Barrels	-	Mostly for beer
Flat lids	-	ring-pull of tear-off, not push-on lids which are better from steel.
Roll-on closures	-	soft metal rolled around bottle necks.
Bottleneck covers	-	from 0.01 to 0.04 mm foil wrapped around bottle closures, mostly for decoration.

Bottles	-	25 ml to 60 litres, mostly for chemicals.
Tubes	-	almost all squeeze tubes are now in aluminium. The correct hardness of metal is critical.
Food trays	-	mostly in 0.05 to 0.15 mm foil.
Kitchen foil	-	limited market.
Drawn cans	-	possibly the only outlet which would justify the production of sheet specific for the outlet. The sheet needs to be stiff by manganese and magnesium addition to the metal. Apart from the liquid market the cans could develop as screw-top containers for pharmaceuticals and dehydrated goods (and for some moisture-sensitive products such as cigars).

A full list should include aerosols but these require a high technical input and it would not be in the national interest to promote aerosols in applications other than where unavoidable. Atomiser packages are included under the heading of drawn cans.

A market could develop for stiff-alloy thick-wall tote boxes. It could be useful to introduce a standard box at, say, 600 x 400 x 400 mm at a weight of 6 kg to carry 50 kg. Such a box deserves a market study in anticipation of the production of domestic sheet.

TINPLATE

It is not difficult to use magnetic extraction of discarded tinplate from urban rubbish. In general, however, such extraction is not economic other than where a large can-using population supplies sufficient cans to feed a local casting industry. The baling and transporting of rescued cans is an expensive part of the operation. The more economic sources of primary and secondary steel, and their relationship to tinplate cans, are to be discussed in a future study of liquid packaging.

PLASTICS

The pattern of use of plastics in packaging in Jamaica is too varied and fragmented for the rescue and profitable use of waste plastics other than that arising in plastics processing factories. In their own interest, plastics converters already use their waste by feeding part-waste into new polymer. It is doubted that any improvements may be made to the situation.

RECOMMENDATIONS

1. that effort be made to locate 20,000 t/y of high quality waste paper from convenient sources with a view to the establishment of a paper-making facility for common wrapping paper and fluting medium. From the study it is probable that used cases from D & G and office waste would provide at least half the required weight.

2. that there is a detailed study made of available original fibres such as bamboo, sisal and banana trash, as a first stage of a feasibility study towards a pulping facility.

3. that the social conditions be examined to determine the most practical and effective system of collecting distributed waste paper, including the establishment of central collection points. The study suggests that up to 10,000 t/y of waste paper, of relatively inferior quality, could be collected from Kingston. Subject to experience of collected qualities and quantities a study should then be made of the potential use of the waste for low quality paper or pulp mouldings.

4. that Intermediate Technology Development Group be contacted with the intention of setting up a pulp moulding plant for egg trays rated at 14 t/y one shift, subsequently to be expanded to two shifts on the market develops.

5. that the market be studied for pulp mouldings in the areas of nursery plant pots, retail trays, fruit interlayers, bottle sleeves, etc., with a view to installing further plant for pulp mouldings.

6. that Government make every effort to accelerate the revitalisation of the glass industry, particularly with regard to coloured bottles.

7. that, in view of the fact that most of the glass cullet is not presently being remelted, the possibility of storing such cullet for future use should be considered.

8. that KSAC examine the various systems of disposal of refuse and make efforts to rescue the materials therein.

Benefits Arising From Recommendations

Benefits need to be examined in terms of the potential financial ecological and social influences arising out of the recommendations and any subsequent decisions. With regard to Jamaica the financial benefits are almost entirely import substitution, although it is to be understood that future financial benefits of developed exports may arise.

Paper

The recommendations with regard to paper suggest domestic production of 15,000 t/y of imitation kraft similar in quality to the reconstituted kraft presently imported from Venezuela, a possible further 15,000 t/y from digested original fibres and possibly 10,000 t/y of assorted pulp mouldings. Using 1977 values, 15000 t/y of imitation or constituted kraft had a value of about $J6 million (predevaluation $J). It is reasonable to suppose that the paper from original fibres would have a similar value, more or less according to the types of fibres discovered and digested. Since there is not presently a pulp moulding industry it is not possible to directly evaluate pulp mouldings as import substitution, or to estimate eventual weights of pulp moulded.

There would be no significant ecological benefits from the recommendations with regard to paper. The reconstitution of waste paper for paper would have limited influence on employment in the actual production but it would provide employment and income in the collection. As a rough estimate based on a weight of 50 kg per collection event there would be employment and income for perhaps 1,000 individuals part-time. There would also be income for charity, religious and social organisations engaged in collection.

Glass

The comments with regard to glass are reduced to a single recommendation that the glass industry be revitalised to make Jamaica almost self-sufficient in glass packaging. The significant cost factor in this revitalisation would be the remelting of much of the glass after use or when it becomes unserviceable. It should in due course be possible to rescue up to three-quarters of the domestic glass, and almost all the glass earmarked for export but damaged in filling and domestic transport. It would be reasonable to suppose that a revitalised glass industry could find and use at least 20,000 t/y of glass extra to the weight presently being absorbed. As direct import substitution this would have an approximate value of $J750,000 (1977 $J) in the early stages and up to $J9 million if the glass industry can develop to produce all the bottles required for domestic and export markets. Until the programme of revitalisation of the glass industry is detailed it is not possible to provide a realistic estimate of the financial benefit.

The ecological impact of the rescue and remelting of glass is mainly the elimination of broken glass. Any tourist country with beaches must seriously consider the adverse effects of broken glass on bare feet in sand and sea water. From the social point of view the main benefit would be employment in the collection and movement of cullet, although this would not be great. Most of the waste glass would arise from the rejection of bottles at filling plants, and this would not generate employment. The main labour in glass bottle rescue is in the returning of empty bottles for washing and filling, a subject dealt with in the study on liquid packaging.

Other packaging materials

With regard to the other packaging materials such as tinplate and plastics, the only obvious avenue of collection and recycling or reconstitution is through industrialsied sorting of urban rubbish and subsequent disposal of the fractions. A study is required of this subject to determine if there is financial, ecological or social benefit to justify the sorting and disposal of fractions of the rubbish. It should be noted that if there are collection systems which extract the paper and glass from the general mix of rubbish, it could be advisable to consider division of urban rubbish into only the fractions of ferrous metal (magnetic extraction, baling and casting), organic matter for composting, and the heavy fraction for land in-fill. There would then be the financial benefits of a little ferrous scrap and a significant weight of high-quality compost for horticulture.

Problems Arising From Recommendations

There are no significant disadvantages to any of the recommendations but there are financial, ecological and social problems. All the implied projects would require high inputs of capital, technology and organisation. The investment for the reconstitution of waste paper could cost up to $J10,000/t of output and even the first phase of glass revitalisation could cost £J20 million. It is necessary to carry out detailed feasibility studies to determine if there is sufficient justification for the investment, which might be better applied in the development of for example crop investment and food processing.

The necessary input of technology would be less than might be expected. The basic technologies of papermaking and glass melting already exist and require relatively little input of new technology when improved facilities for production exist. Such input could probably be obtained through international agencies at relatively little national cost, or by contracted association with paper and glass organisations abroad.

The organisation of the implied projects could present problems in the collection of waste. Careful planning would be required with respect to:

1. Individual versus organisational collection.
2. The conviction of individuals and/or organisations that waste is worth collecting and delivering to central stores.
3. Acceptance by central stores versus collection by central stores.
4. Motivation of individuals in waste collection efforts.
5. Payment systems for waste - vouchers/cash/bank credits etc.
6. Reduction of undesirables in collected waste and prevention of deliberate adulteration when waste is bought by weight.
7. Transport of waste to processing factories.
8. Stockpiling and storage of waste.

Further Studies Needed

1. Feasibility study of the manufacture of reconstituted paper from high-quality waste paper, taking into account the cost of similar reconstituted paper as imports.
2. Study the pattern and availabilities of natural fibres for paper-making in Jamaica.
3. Feasibility study of the manufacture of paper from fibres as defined by (2).
4. List various possible systems of waste collection and evaluate each system.
5. Study the pattern of waste from a selected system of collection and derive a pattern of suitable outlets.
6. Feasibility study of the manufacture of pulp moulded egg trays.
7. Potential market analysis of the various outlets for pulp mouldings in both the domestic and export sectors.
8. Feasibility of storing glass cullet pending requirements by a revitalised glass industry.
9. General study of the methods of processing urban waste with a view to extracting useful fractions.

TECHNO-ECONOMIC STUDY OF EGG PACKAGING

This study is influenced by three (3) factors viz.:

1) The fact that a significant amount of/expensive imported paper goes to waste e.g. as scrap.

ii) used paper can be recycled, and

iii) the egg trays, bought into the island with the imported fertilized eggs, will eventually be unavailable since Jamaica is now fertilizing its eggs and the rate of importation of these eggs with trays will gradually decline.

In an effort to utilize paper to the fullest and produce egg trays to fill the anticipated gap this study was done.

A techno-economic study in the packaging of eggs is a study of the technical and economic factors involved in the selection of a suitable package for the eggs.

Referring to the general development process M + P = FP ,
M is the eggs
P is the whole process of selecting a package for eggs based on the result of the techno-economic study,
FP is the packaged eggs.

From our visit to Jamaica Broilers certain information was gathered.

1. Eggs are packaged in trays for transport from the farm to the Boilers where some are packed into boxes (of dozens) and sent to the retail outlet, others are sent to the retail outlet still packed in trays. The dozen pack has roughly the same weight as the 30 tray, so no differentation is made between the two types in this study.

2. Total number of eggs consumed per week - approx. ½ mil. eggs
" " " " " " year - " 25 mil. (½ x 50)
Add another 5 mil for increase in demand
Then working quantity of eggs - 30 mil.

3. For 30 mil. eggs with 30 eggs to a tray

$$\frac{30 \text{ mil egg trays would be needed}}{30} = 1 \text{ mil egg trays}$$

4. There are three varieties of egg packages on the market -

   a. clear polystyrene (1 dozen)
   b. expanded polystyrene (1 dozen)
   c. Moulded pulp (30 eggs)

5. Since we have no information on the probable division of the market amongst the three types of egg pack, and to avoid lost time in trying to find it, it is presumed that the market will split into three equal fractions, one each for each of the package types.

   Therefore $\frac{1 \text{ mil egg trays}}{3}$ is number considered

   Approx. 300,000 egg trays

   Each finished egg trays weights should weigh 60 gm. (Information from suppliers literature and previous experience of production). Therefore to produce one egg tray we would need the 60 gm for the finished egg tray plus 20% of the weight as allowance for processing waste.

   Total amount of raw material for one egg tray would be -

   $\frac{120 \times 60}{100}$ Approx. 70 gm.

   Thus the total amount of raw material (wasted paper) need to make the 300,000 egg trays would be 300,000 x 70 Approx. 20,000,000 gm. and by calculation 1000 gm = 1 kgm
   1000 kg = 1 ton

   then $\frac{20000000}{1000 \times 1000}$ tons waste paper

Examination of plant's capacity

1. Plant capable of processing 7 kgm/hr, using a 40 hour week, then in 1 year (using 50 wk/yr) there is (40 x 50) = 2,000 hr/yr
   If in 1 hr. 7 kgm are processed
   then in 2,000 hr (7 x 2000) kgm = $\frac{14,000}{1,000}$ tons

   would be processed using one shift for the year

   On this basic production cost of one tray is very low and estimated at 25¢. (Information based on previous costing abroad).
   Price of 1 tray of eggs (2½ doz.) approx. $9.00. Here the packaging cost of the product is extremely small.

   If 1 egg tray is produced at 25¢, then the total production of egg trays from the 14 tons of waste would generate

$$\frac{25}{100} \times \frac{14 \times 1000}{70} = \$50,000$$

COST OF WASTE

Waste represents 14 tons of imported paper with a primary value of $1,000 per ton, therefore utilizing 14 tons of waste, would in effect be the rescuing of $14,000 in one year.

CONCLUSION

Bearing in mind that there are three factors to techno-economic study - financial, environmental and social, these will be discussed individually.

Financial

If on one shift an income of $50,000 is generated, then on a 5 year project sufficient ($250,000) would be generated to cover set up cost. Then too, over the years, a second shift could be introduced, thus adding to the income.

The output of the plant (14 tons) is lower than the estimated annual demand (20 ton) - it being accepted that initial growth will not be to the full demand. When the 14 tons from one shift is being demanded, then the second shift may be introduced to a total of 28 tons, in anticipation of further growth.

From the environmental consideration

The production of egg trays is not hazardous,
there is no problem of disposal of old unwanted trays since these are included in subsequent repulping for more trays,

water used in the process is constantly being recycled.

Social factor

it would provide employment,

collection of waste (by small boys),

production of egg trays,

The provision of suitable packaging for eggs in the wider market could improve standards of living and reduce transport costs for eggs.

Packaging Materials Imported into Jamaica 1977

	$J
Kraft Paper	5,400,000
Kraft paperboard	6,000,000
Bottle cork	1,300
Agglomerated cork	94,000
Cigarette paper	151,000
Common wrapping paper	90,000
Paperboard	1,300,000
Corrugated cardboard	1,200,000
Paper crinkled and crepe	78,000
Waxed paper	222,000
Other paper, coated	1,752,000
Paper bags	77,000
Cardboard boxes	2,500,000
Other packing containers of paper/board	2,700,000
Cigarette paper cut to size	35,000
Sacks and bags of jute	200
of other fibres	17,000
White glass cullet	14
Closures for glass	200
Made up cans	1,700,000
Casks, drums and similar	170,000
Tubular and collapsible containers	400,000
Compressed gas containers of steel	260,000
Aluminium containers for gas	550
Crown corks	74,000
Bottle caps of base metal	390,000
Stoppers of base metal	296,000
Beer/wine bottles	760,000
Complete wooden boxes	400,000
Casks, barrels, vats etc.	70,000
Prepared glues	186,000

High polymer plates, films ready for use	520,000
not ready for use	1,300,000
Other forms of high polymers	3,800,000
Tinplate sheet	6,500,000
Tinfoil	1,500
Products of regenerated cellulose	480,000
Cellulose sheet not ready for use	730,000
ready for use	1,300,000
Polymerisation products	7,500,000
as plates	280,000
Other plastics plates and films	800,000
Printing inks	65,000
TOTAL	$49,620,764

WITH REGARD TO THE PACKAGING OF LIQUIDS IN JAMAICA

Current packaging used for liquids in Jamaica includes tinplate cans, glass and plastics bottles, and paperboard cartons. These have a high importation cost with relatively little recovery of the materials. This study is consequently an investigation of packages and liquids to discover areas of potential standardisation (the grouping of liquids into similar packages), to suggest subjects for future specific studies, and to seek methods whereby packages may be improved in terms of cost and performance.

BACKGROUND

Discussions have indicated that:

1. Tinplate can production is expensive and the cans are inferior to many cans used in world trade. The problem is evidently the age and condition of the can-making plant.

2. Bottles are produced in glass and plastics.

   (a) Glass

   Domestic production of glass bottles is only in white, all the coloured glass bottles being imported. All the coloured glass and much of the white glass is not remelted for new bottles.

   (b) Plastics bottles are manufactured. They are of reasonably high quality but output from the facility is frequently reduced by shortages of polymers.

3. Carton stock is all imported. There are presently no plans for domestic board production or coating board.

Imports of common liquids total approximately 58,500 t/y if imported dried milk is included as its reconstituted liquid equivalent. Exports of common liquids total approximately 82,800 t/y. Statistics for domestic production of liquids are far from reliable, being confused with import and export statistics. Available statistics suggest a production of about 400,000 t/y of common liquids. Nearly three-quarters of the imported liquids is dried milk for reconstitution. Otherwise the major imports are lubricating oil and edible oil. About three-quarters of exported liquids are enging oils and molasses shipped as semi-bulk. Of the imported liquids, disregarding the milk, most products could be developed as domestic manufacture. It is probable that the difficulties in the packaging industry have a significant adverse effect on import substitution and exports.

For the purpose of the study a list of liquids and factors which are likely to affect liquid packaging was made. Each liquid was identified with appropriate factors and the liquids were then classified according to common factors. The classification was to:

a) discover groups which could have common packaging.

b) with the help of trade statistics to establish orders of priority for treatment in the study.

In the time available it was not possible to establish actual trade values of the groups so certain abviously-important liquids were selected for treatment in this interim study.

See;

Appendix 1 - Relationship of individual liquids to packaging factors.

Appendix II - Trade values of individual liquids.

The product groups identified were:

Product Groups	Recorded t/y trade
1. Sensitive, widely distributed, little hope of rescue of empty packages.	
Milk	43,000
2. Light-sensitive carbonated drinks.	
Beer	70,000
3. Carbonated drinks, not light-sensitive.	120,000
4. Alcoholic spirits	
5. Concentrates of flavour for dilution.	
Condensed milk	31,000
Fruit Juice concentrates	1,400
Sugar syrups	180
6. Edible oils, sauces and vinegars	
Edible oils	17,000
Vinegar	
Sauces	
7. Insensitive, non-food, non-corrosive	
Lubricating oils	4,000
Polishes & creams	
8. Sensitive non-food corrosive or toxic	
Detergent	5,000
Liquid cosmetics	
Disinfectants	350
Insecticides	90
Glues/adhesives	

9. Preserved with sugar

10. Preserved with sinegar

11. Preserved with salt

12. Votatile, poisons

13. Votatile, non-poisonous

Under normal circumstances the above table would be completed to provide an order of priority of products and groups for attention. In the limited period of study it has not been found possible to complete the table. Consequently, priority has been given to milk, fruit drinks, beers and sodas, engine oil.

It is anticipated that the above table will be completed some time in the future.

The liquids which were selected as being obviously important were:

1. Milk
2. Beer and other fermented drinks
3. Other carbonated drinks
4. Alcoholic spirits
5. Edible oils
6. Engine oils
7. Paints and adhesives

Milk

Representative of the group of sensitive products.

Milk is an extremely sensitive organic product which can be given shelf life by processing. The sensitivity is to micro-organic contamination and shelf life is normally by heating to destroy micro-organisms. Since heating affects the flavour it is usual to use the minimum heat treatment within the expected shelf life. For example:

Pasteurisation is mild heat treatment calculated to cause little change of flavour but to give a shelf life of a few days (longer if the milk is refrigerated than if at room temperature). The function of the package is to exclude contamination for a few days. Normal packaging is glass if the distribution is such that bottles may be rescued, plastics bottles or sachets or cartons if the packages may not be rescued. In Jamaica, glass bottles may be discounted because there is not effective system of rescue of bottles. The choice is of plastics bottles, sachets or cartons. All these packages use imported materials. It is not probable that there will be domestic production of polymers for the plastics bottles amd sachets but it is possible that in the future there will be coated board from domestic resources for cartons. The cost structure is ill-defined but a cost of 6 cents per litre of milk has been stated for purepak cartons. It will be necessary in the future to examine other carton systems such as Perga and Blokpak.

Ultra-High-Temperature (UHT) is short-term high-temperature treatment which gives a higher degree of preservation. If a package is able to exclude microbial infection and also to exclude oxygen the shelf life of contained milk should be several months without refrigeration. The remarks for pasteurised milk apply but the carton board needs to have an extra barrier layer, usually aluminium foil, in the carton wall. Consequently, cartons for UHT milk are more expensive than those for pasteurised milk but there is relatively little restriction on the range of market. In any economy it is worth calculating the comparative costs of using only UHT milk in the more expensive cartons and of using part UHT part-pasteurised milk to save carton costs (extra packaging cost versus the cost of lost milk in distribution).

Sterilised is milk heated to the point where almost no micro-organisms survive. The heating changes the flavour and such milk is not very popular. The conventional package is a glass bottle but there is no technical reason why cartons should not be used.

Concentrated is milk which has had much of the water removed. The evaporation is by a heat/vacuum process which is effective sterilisation. The common forms of concentrated milk are evaporated and condensed, the main difference being the relative solids contents. Sugar is commonly added to condensed milk to assist in the preservation. Concentrated milks developed for long-term storage and convenience of carrying. The accepted packages are tinplate cans and it may be doubted that any other type of package could offer similar satisfaction.

Dried is milk with almost all the water removed. There are two main types - drum dried and spary dried - but both may be considered together in this study. The powder has a large surface area of granules and this surface area is sensitive to attack by moisture and infection. Common packaging is any type which will inhibit the entry of moisture or micro-organisms, selected according to the required shelf life. For a relatively short life (up to a month) it is usually satisfactory to use a thick-wall polyethylene bag, preferably with an outer light-weight paperboard carton. For long term storage (up to a year) it is necessary to use the absolute barrier performance of metal as tinplate or aluminium. For intermediate shelf lives there is not technical objection to the use of coated paperboard cartons.

Flavoured milks are mostly marketing developments which offer variations of flavour but also allow more heat processing than that for pasteurised. The change of flavour by heat processing is conveniently masked by the flavour (and in fact contributes to coffee and chocolate flavours). Flavoured milks sell in the same marketing conditions as pasteurised milk and the comments with regard to packaging apply.

Note:
Milk is a health food with a balance of carbohydrate, protein and fat. There are other similar liquids derived from oilseeds and nuts. Within this study such liquids are accepted as 'milks' and the remarks on packaging apply.

Milk Packaging

The selection of packaging types requires examination of:

1. The hoped-for shelf life
2. The handling conditions
3. The convenient volume of sale
4. Disposal of the empty container

These factors also influence the form of milk distributed, and the structure of the distribution pattern. A normal structure of distribution is:

a) Semi-bulk collection from production, in which temperature, period of waiting, and infection may not be well controlled.
It is usual for semi-bulk metal containers to be used - metal because the high heat conductivity of metal helps in cooling operations.

b) Bulk movement, almost always in special tankers, to processing and bulk breaking centres, The processing depends on the condition of the milk and its destiny. For local distribution it is common to split processing into low and high levels of preservation. Part of the processing may be conversion to dried milk for storage and long-distance travel. Jamaica uses dried imported milk supported by fresh milk, calling for a reprocessing stage of reconstitution. In theory the reconstituted milk is similar to the milk arriving from stage A but with less need to compensate for earlier errors of handling.

c) Blending and bulk breaking into retail units. There are situations in which it is required to move parts of bulks to regional centres for local packaging into retail units or for dispensing from semi-bulk units. For example, some feeding programmes and institutional catering find it convenient to buy as semi-bulk, as do some companies using milk as a food component. Such semi-bulk distribution may be in metal containers or plastics containers or bag-in-box systems. Semi-bulk distribution is less expensive than travel in retail packs, and Jamaica should urgently examine the benefits of promoting such distribution.

Milk distribution

There has not been time within this study to examine the Jamaican distribution. In most countries, milk is regarded as a health food distributed through normal retail trade and through institutions and, if necessary, through charitable feeding programmes. Effective distribution through retail trade is influenced by access and incomes, it being common to most countries that those who need the milk most are the more difficult to reach and the least affluent. Hence, the retail price formation is important, this being the result of:

1) Initial milk cost
2) Transport cost
3(Packaging cost
4) Profit margins

An economic study would be justified of the retail price formation for milk in the various sectors of the Jamaican population.

Institutions which dispense milk are catering establishments, hospitals and schools. In-so-far that Jamaica relies on dried milk there is a question as to whether such establishments should accept dried milk for their own reconstitution or accept milk which is already reconstituted. As a rule, reconstitution by institutions is rarely satisfactory but the delivery of dried milk instead of liquid milk has economic advantage . There would be potential economic benefit in the trial marketing of bag-in-box semi-bulk milk (5 and 10 litre) using, for example, the P rgall system. Pergall is by Bowater Packaging, Gatehead, U.K., and is commonly used for milk.

Losses of milk in Jamaica appear to be high but they may be found to be less than apparant by a survey. The efficiency of refrigerated display in retail outlets is suspect and there is much visible rupture of cartons from rough handling. (Tetrabrink more than Perga). Not only for milk, there would be advantage in the setting of standard conditions for refrigerated display cabinets - with inspection and corrective leglislation.

Beer / Other Fermented Drink

Beer is a product of fermentation, sold for its flavour. The flavour is derived from a delicate mixture of organic components, accenturated by carbon dioxide gas. The carbon dioxide gas is under pressure and it acts as an effective preservative. The only essential difference between beers and other carbonated drinks is the delicate mixture of organic components in beers - other carbonated drinks use less - delicate components. One major sensitivity of beer components is to ultraviolet light, suggesting that packages for beer should be opaque. One selling point for beer is its clarity, and suppliers specify coloured bottles when beer is packaged in glass. There are two major divisions in the beer industry, that producing beer which is sold whilst actively fermenting and that producing beer in which fermentation has been completed and stopped. The active beer, known variously as real ale, native beer, etc., is carried under light pressure to places for early consumption. The other beer, sometimes known as chemical beer, is carried under high pressure and it has a sufficiently long shelf life for drinking to be delayed. In some countries there has been some movement of native beer in paperboard cartons, and there has been some efforts to design plastics containers for retailed beer. In general, however, retailed beer is packaged in tinplate cans or coloured glass bottles.

In theory, cans are used where it is uneconomic to rescue the empty package, whilst bottles are used where empty packages may be rescued for refilling. This theory has been confounded by developments such as:

1) Ring-pull can opening. There has been promotion of cans in areas where return-journeys are economic, the promotion being based on the suspect fact that opening a ring-pull can is easier than using an opening tool (which is easy to forget if the beer is taken to beaches or other external drinking sites).

2) Lightweight glass bottles as direct alternatives to cans where return of the containers is unlikely.

3) Party cans, which hold 2 to 4 litres. A glass bottle containing more than one litre of highly-pressurised liquid becomes a lethal hazard when dropped and broken. Party cans have done much to promote preferences for canned beer.

Consequently, in world beer trades there is no longer a sharp division of cans for single-journey distribution and glass bottles for multiple-journey distribution, although glass bottles are still favoured if they may be rescued after emptying.

The main question with regard to Jamaican beer is whether or not to introduced canned beer. Distribution is aplit three ways:

Direct collection from the bottlers
Delivery to places where the beer is drunk
Through retailers, most of whom do not allow for the return of empty bottles

There is no doubt that collection from the bottlers would benefit from the introduction of cans. The unit load would be lighter in weight and cans are more convenient for drinking on vacation journeys. The use of cans would reduce the hazards of broken glass on beaches, and the availability of an alternative glass would allow the banning of glass bottles on beaches. On the other hand, tinplate is an import and its use for beers would transfer some significant income from the domestic glass factory to foreign steel interests. There is no economic method of collecting and remelting used tinplate cans for such a relatively small number of cans distributed widely.

There is no significant extra cost in collecting empty bottles from drinking houses which accept reasonably large numbers of full bottles. Nor is there any evident pressure from the drinkers for beer to be supplied in cans. The introduction of cans, which take about one half the space of a beer bottle, could bring about a reduction of transport and storage cost, and with inventory of only full cans of beer there would be easier stock control by the drinking houses. On the other hand, there would be a pattern of problems of disposal, the costs of which would inevitably be passed on to drinkers. It is doubted that drinking houses would welcome canned beers.

Much the same comments apply to sale through retailers, with the added complication that retailers do not evidently wish to handle empty bottles. Consequently, the retailers would probably welcome canned beer because it would transfer the problems of disposal away from their premises. The sale of beer in cans would also allow customers to increase their sizes of purchases beaause a dozen cans of beer are as easy to carry as half a dozen bottles.

Other Carbonated Drinks

The significant difference between beer and other carbonated drinks is that beer is fermented to produce its own carbon dioxide (but may have extra carbon dioxide introduced) whereas other carbonated drinks are unfermented flavours in water with the carbon dioxide introduced as an addition process. The flavours may be natural or synthetic, or both together.

In general the packaging and routes of distribution for carbonated drinks are similar to those for beer, excepting that beer needs coloured bottles whereas carbonated drinks which do not contain natural flavours may travel in white bottles. In fact white bottles have some sales advantage for some carbonated drinks.

Alcoholic Spirits

Alcoholic spirits are distilled to increase the alcohol content so that the products have extremely long shelf lives. In some foreign countries some of the lower grades of alcoholic spirits are packaged in plastics bottles but in general the spirits are expensive products bought according to brand identification. The high prices justify the cost of good quality glass bottles, the design and construction of the bottles being an important part of the identification.

There would be some economic advantage in standardisation of spirit bottles but the distillers would probably resist standardisation and there could be some loss of export markets. For the domestic markets it is possible that spirit bottles could be standardised in design and construction, but with identifying labels. In-so-far that spirits are not carbonated it is possible that the standard bottles for spirits on the domestic market could be used for other liquids such as syrups, squashes, etc. It would be necessary in this case to have another standard bottle, clearly different in design and construction, for toxic products. The advantages of having two such standard bottles for long-life non-carbonated liquids would be:

1) Instead of importing bottles for spirits the bottles could be by long-run production in Jamaica, the extended market providing the justification.

2. Local shortages of bottles would be avoided.

3) A return system could be instituted with a bottle bank.

EDIBLE OILS

Edible oils are vegetable oils sold either as common cooking oil or as identified oils which are bought according to their origin . Common cooking oil is frequently a mixture of oils , variable according to supplies and relative costs . Identified oils are identified according to the vegetable from which they are derived (Olive , sunflower , safflower , corn , etc) . The technical characteristics of the packaging for both is identical but the sales appeal characteristics differ . Jamaica could develop surplus production of edible oils including identified oils for exports . The first requirement, however , is to rationalise the domestic packaging situation . At present the oils are in glass and HDPE bottles which are non-returnable and are frequently in short supply . There is a requirement to build up a reserve stock of standard bottles .

Engine Oil

The forecourt market for engine oil is approximately 4 million litres of which 2 million are in tinplate cans. This is an import liability for tinplate which is used once and then discarded, One alternative is to supply oil to garages and gas stations in tankers to fill static semi-bulk tanks for dispensing loose oil to customers. This would involve high capital investment and, although the system may be considered later, at this stage it is advisable to seek a system which used existing containers.

The oil could be supplied to garages and gas stations in 45 gallon drums furnished with liquid-proof air vents and taps. Such drums could serve for dispensing loose oil or for filling suitable retail containers at the point of sale. It is suggested that a standard one-gallon HDPE plastics container (vividly coloured to differentiate from any similar container used for edible liquids) be sold by garages and gas stations so that customers may own a container for refilling at the point of sale. The drums would be returned to oil companies for refilling and, when the drums had reached the end of their useful life for oil they would be used for bitumen. This would eliminate any need to use new drums for the one-trip transport of bitumen, further saving imported steel plate.

One alternative would be for empty containers to be exchanged for full containers at the point of sale but this would bring a risk of contamination if customers returned fouled containers.

It is suggested that the tinplate quart cans be retained as an alternative but that a price differential be introduced to discourage the tinplate. For example, the price per quart in tinplate could be $3.50 and the price of loose oil could be $2.50 (allowance being made for reduction in cost of bulk supply and tin can). In this case customers would save $4.00 per gallon. The national saving of tinplate would be of the order of 120,000 square meters, which would be better applied to food canning than to oil. There would also be some saving of galvanised drum steel by elimination of the use of new drums for bitumen.

PAINTS AND ADHESIVES

Paints and adhesives may be considered together because paints are adhesives to one surface only . There are two types of product to consider :

1. Solvent-based products which rely on strong solvents to attack surfaces , and which must consequently be packaged in materials capable of resisting such solvents .
2. Water-based products which do not in their original state attack surfaces and consequently do not require packages of outstanding chemical resistance .

For the sake of standardisation it is convenient to ignore the differences and to use like packaging for both types . The conventional packaging is heavy-duty tinplate or plastics selected according to the solvents . The common plastics used are HDPE or polypropylene . With regard to Jamaica , both the tinplate and plastics would be imports so there is little economic difference other than the unit costs . Although plastics containers would have some re-use value they are usually too dirty after use for the after-use to be significant .

It is to be noted that , if engine oil is packaged in drums for retail dispensing as loose oil , there will be idle canning capacity for up to 2 million litres available . Subject to investigation , this capacity could be diverted to the filling of paints and adhesives , allowing increase in paint and adhesive production as import substitution and for export . Such increase would only be of benefit if it included the use of domestic materials . A study is needed of the possible development of domestic products , the study being phased as an initial study of potential vegetable oils and resins

PACKAGE TYPES FOR LIQUIDS

Glass bottles and jars

Glass bottles are manufactured in Jamaica to a limited extent using domestic raw materials other than the soda ash . In 1977 imports of soda ash were about 5000 tons costing about $J 750,000 .
Since 1977 the glass industry has declined by the closure of one of the furnaces which manufactured coloured bottles . Present production is about 27,000 t/y , all of which is white glass . The output is not sufficient to satisfy demands , so Jamaica has to import some white and all coloured bottles . Finance is being sought to revitalise the glass industry but the extent of improvement which is intended is not known . The constraints on productivity have led to the present high imports of glass containers , about 17,500 t/y valued at $J 9 million/y . The constraints have also caused the prices of bottles from domestic production to be about double those of imported bottles , about 50 cents per bottle against 25 cents .

Glass is brittle , causing package walls to be thick , consequent packages heavy and expensive . Where the product value does not justify expensive packaging glass bottles need to be returned for refilling . In Jamaica , bottles for beer and soft drinks average 15 journeys , giving a per-journey cost of 1.7 cents for imported bottles and 3.3 cents for domestic bottles . There would be economic advantage in having more efficient means of collecting empty bottles , standardisation and the development of lighter-weight stronger-glass bottles .

Plastics bottles and jars

Plastics bottles and other containers for liquids are manufactured in Jamaica using imported raw materials . The proportion of imported polymers used for packaging is not known . Productivity has been inhibited by problems of supply of raw materials . Present production of bottles uses HDPE . It is not known how far interest extends into other polymers for bottles . Lack of time prevents a detailed study of the various outputs of plastics containers , which include other forms of containers than bottles , and many of these other plastics containers may or may not be used for liquids .

Plastics are not brittle so package walls may be thin , allowing less material per bottle . Consequently plastics bottles are sufficiently inexpensive for single-journey distribution . Plastics bottles may have flexible walls for squeeze bottles , which is important in the detergent , pharmaceutical and sauces sectors .

Composite cans for liquids.

Composite cans usually are built of three materials - an inner layer in contact with the product, an outer layer to carry decorative print, and a stiff middle layer. It is common to use film or foil for both the surfaces and to hold them apart with paperboard. Recycled paperboard is satisfactory for the middle layer. The usual construction is by winding the layers together and closing the ends using metal or plastics discs. The market developed for engine oil but there has been recent developments of drinks and snack foods in composite cans.

About half the cost of a composite can is the ends. In general, the cost of a composite can is about 75 percent that of its equivalent tinplate can. Economic production rates on available equipment vary from 50/minute upwards - 300/minute being a common rate for composite oil cans for one-litre packages.

Tinplate cans

Tinplate cans are manufactured in Jamaica to a limited extent using imported cut tinplate sheet. Imported tinplate in 1977 was about 9250 tonnes with a value of about $J6.5 million. Present production is of three-piece soldered cans on equipment which would benefit from improvements. The situation with regard to welded seams, tinfree steel and drawn steel cans needs investigation. Tinplate cans are light-weight with relatively rigid walls, and are excellent barriers for long term storage. There are some products for which cans are highly desirable if not essential. It is possible that in future Jamaica will develop drawn aluminium cans. Due to relatively small demand and the costs of imported tinplate it is not probable that Jamaica will be able to manufacture tinplate cans at prices which encourage competitive trading.

Aluminium cans

Aluminium cans are not manufactured at the present time but studies have shown that it may be possible to include aluminium drawn cans in a broad project of aluminium sheet production. Aluminium cans have softer walls than steel cans, and it is not possible to make comparative comments until more is known about intentions with regard to aluminium sheet.

Wound composite cans

Wound composite cans are produced by winding layers of paperboard, aluminium foil and decorative facing paper. They are not manufactured in Jamaica at present but manufacture is being discussed. Wound composite cans are becoming increasingly popular in world enging oil markets.

Paperboard cartons

Purepak and TetraBrink are imported and used for milk and fruit drinks. Present imports are not known and, since the filling is done by many companies an accurate assessment would be difficult in a short period. There is discussion with regard to the production of suitable coated board in Jamaica. Cartons have limited barrier performance so their applications are restricted to short shelf-life products.

Can Making

The production of large rectangular-section cans has proved economic as a manual operation but the production of smaller round-section cans is scale-sensitive. Where tinplate is relatively inexpensive and a canning demand is conveniently nearby, low-cost cans are produced at rates of up to 600/minute, It is not economic to transport empty cans for more than a few tens of miles, such cans being mostly air. If tinplate costs are not too high it is possible to produce cans by small-to-medium scales suited to local canning demands. Such cans are more expensive than the mass-produced cans but the extra cost is frequently offset by the reduced transport costs. According to the local demands there are several scales of production by:

1) Purchase of ends and flat blanks for making up.
2) Purchase of ends and flat sheet for cutting blanks for making up.
3) Purchase of flat sheet for cutting blanks and also the pressing out of ends.

Since such can making may be scaled down to very low levels of output it is worth looking for some relatively-concentrated demand for cans to justify local can-making. Intermediate Technology Development Group can advise on Sheetech or similar equipment.

Alternatively, further study may show justification for a project of drawn cans with welded seams. Such a project would need to be related to the proposal for domestic aluminium sheet, drawing being a process which concerns both aluminium and steel. Plant cost for drawn steel cans is about $J20 million per line. Welded seams are less likely to leak than soldered seams and they are becoming less expensive than

soldered seams. The capital cost for welded or soldered is about the same but the cost for welded should reduce as more producers of welders offer their developments. One point to appreciate about drawn cans is that they may be tapered so that they nest for lower-cost transport, suggesting that Jamaica could hope for some regional export business in empty drawn cans.

As a case-history example, the first producer of drawn steel cans in Europe was Mardon Illingworth with a potential output of 230 million cans/year. The drawn cans replaced conventional three-piece cans without change of handling or filling techniques. Production is from 10-tons reels, six cans being pushed out by each stroke from a one-metre width of steel plate.

Plastics film sachets

Sachets are manufactured in Jamaica and are used for a number of retailed drinks. There has been little or no development of bag-in-box, which is the use of a flexible plastics sachet in a paperboard carton. There is no polymer production in Jamaica and the use of sachets is too fragmented to qualify.

Paperboard cartons

There is information on the range of products which are, or have been, filled into Purepak cartons. The information is much the same as that issued relative to other paperboard cartons such as Blockpak or Perga. Care is needed in the acceptance of such lists because much of the information relates to sophisticated short-period distribution with effective refrigerated display. The refrigerated display in Jamaica leaves much to be desired and much of the distribution is neither sophisticated nor short period. In the examination of the list it is also important to appreciate that claims of room temperature storage refer to temperate room temperatures. Tropical room temperatures could for some products reduce the expected life to one-tenth of that stated.

The continued and expanded use of paperboard cartons should be with future national intentions in mind. The important considerations are:

1) It is possible that Jamaica could develop the export of air-freighted short-life products (as well as long-life products) in cartons. Cartons are lightweight, lower in cost than tinplate cans, and are acceptable packaging in many importing countries.

2) It is possible that Jamaica could develop its own coated board, which could reduce unit costs. Such board could be from imported virgin pulp, virgin pulp from domestic fibres or board from waste paper reconstitution. The coating could be wax or polyethylene,
o or both, and the board could be related to a laminator to include foil.

Economics

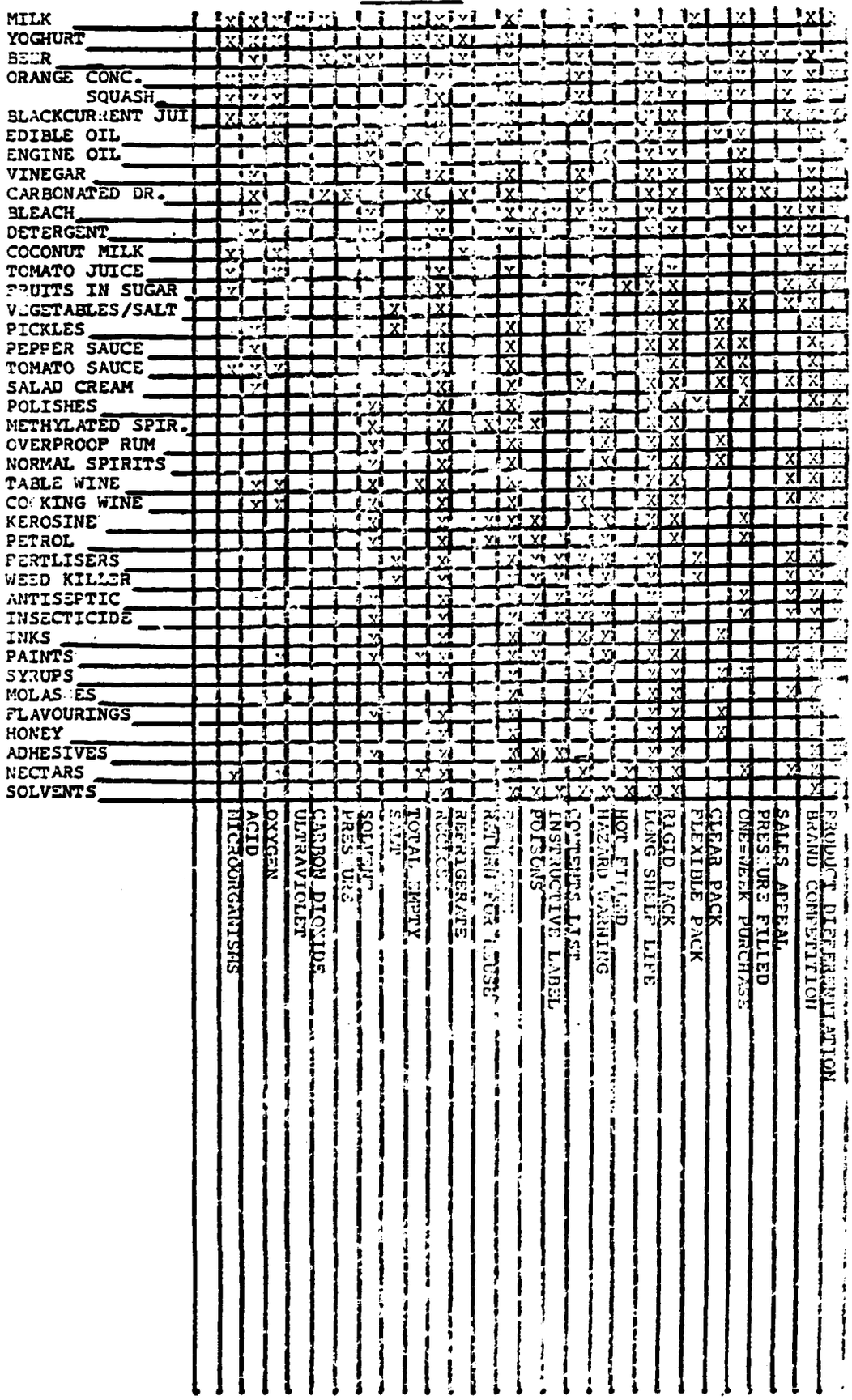
In 1977 the packaging of liquids resulted in the following values of imports:

	$J
Containers for engine oil	1,346,000
Bottle corks	1,300
Agglomerated cork	94,000
Closure for glass	200
Made-up cans	1,700,000
Casks, drums and similar	170,000
Crown corks	74,000
Bottle caps of base metal	390,000
Stoppers of base metal	296,000
Beer/wine bottles	760,000
Tinplate sheets	6,500,000

The plastics imports were of the order of $J7.5 million for polymers and plastics plates plus $J800,000 for films. It is not calculable how much of this plastics was applied to packaging liquids. Also, much of the tinplate would be applied to dry goods. It is probable that the 1977 import bill for packaging for liquids was about $J10 million of which about half was tinplate. This would be about 20 percent of the total packaging import values.

During the period of this interim study it was not possible to obtain sufficient reliable information on the numbers of containers used for liquid packaging. Completion of the study is delayed until further information can be obtained by contacting the various users of the containers.

APPENDIX I


MILK
YOGHURT
BEER
ORANGE CONC.
SQUASH
BLACKCURRENT JUI
EDIBLE OIL
ENGINE OIL
VINEGAR
CARBONATED DR.
BLEACH
DETERGENT
COCONUT MILK
TOMATO JUICE
FRUITS IN SUGAR
VEGETABLES/SALT
PICKLES
PEPPER SAUCE
TOMATO SAUCE
SALAD CREAM
POLISHES
METHYLATED SPIR.
OVERPROOF RUM
NORMAL SPIRITS
TABLE WINE
COOKING WINE
KEROSINE
PETROL
FERTLISERS
WEED KILLER
ANTISEPTIC
INSECTICIDE
INKS
PAINTS
SYRUPS
MOLASSES
FLAVOURINGS
HONEY
ADHESIVES
NECTARS
SOLVENTS
MICROORGANISMS
ACID
OXYGEN
ULTRAVIOLET
CARBON DIOXIDE
PRESSURE
SOLVENT
SALT
TOTAL EMPTY
REFRIGERATE
POISONS
INSTRUCTIVE LABEL
CONTENTS LIST
HAZARD WARNING
HOT FILLED
LONG SHELF LIFE
RIGID PACK
FLEXIBLE PACK
CLEAR PACK
ONE-WEEK PURCHASE
PRESSURE FILLED
SALES APPEAL
BRAND COMPETITION
PRODUCT DIFFERENTIATION

ANNEX 1

Visits and Contacts

West Indies Pulp and Paper Limited

19 West Kings House Road, Kingston 10.

Mr. McLaughlin	-	Superintendent
Mr. Jolly	-	Assistant General Manager
Mr. N. Jones	-	Production Manager
Mr. Nicholson	-	Sales Representative
Mr. Gayle	-	Project Engineer
Mr. Letman	-	Mill Engineer
Mr. Baker	-	Mill Manager

(Note that visits were made to the offices, the corrugated case factory and the plant making tissue from waste).

West Indies Glass Company Limited

1E Ashenheim Road, Kingston 11

Mr. L. Mason	-	Chief Accountant
Mr. B. Francis	-	

(Note that West Indies Glass are also concerned with plastics bottles)

Metal Box Company Limited

196 Spanish Town Road, Kingston.

Mr. Robert Coote	-	Service Manager
Mr. Milner	-	Assistant Director

Thermoplastics Limited

Twickenham Park, Spanish Town

Mr. C.R. Scott	-	General Service Manager
Mr. E. Brown	-	
Mr. H. Hill	-	Production Manager
Mr. L. Pinnock	-	Assistant Plant Manager
Mr. Matthews	-	Production Manager

Food Specialities Jamaica Limited

Mickleton Factory, Bog Walk

Mr. Patrick Henry

Mr. Sandy

Jamaica Broilers Limited

15 Hope Road, Kingston 10.

Mr. Carlton Levy

Jamaica Bauxite Institute
15 Caledonia Avenue, Kingston 5
Miss Kerby Clark
Mr. K. Duncan

National Packaging Corporation Limited
38 Half Way Tree Road, Kingston 10.
Mr. Tony Simmons

Forestry Department
173 Constant Spring Road, Kingston 8
Mr. Roy Jones

Ministry of Agriculture
Hope Road, Kingston
Mr. Fred Zennie

Desnoes and Geddes Limited
214 Spanish Town Road, Kingston 11
Mr. Tony Kelly

Grace Food Processors Limited
64 Harbour Street, Kingston
Miss Mabel Tenn
Mr. Keith Jones

Challenge Enterprises Limited
5 Molynes Road, Kingston 10
Mr. Pete Scott

Benjamin P.A. Manufacturing Limited
97 East Street, Kingston
Mr. Douglas Scott

Federated Pharmaceuticals Company Limited
1 Bell Road, Kingston
Miss Daphne McHardy - Manageress
Mr. Hugh Graham - Technical Manager

ANNEX II

PRODUCT	COMMON PACKAGE	1975 t/y PRODUCTION	1977 t/y IMPORTS	1977 t/y EXPORTS
Detergent	Bottles G or P	5000	70	140
Lubricating oil	Tinplate	25000	8000	28000
Paint/Varnish	Tinplate	1500	136	990
Rum	Bottles G	20000		10000
Alcohol	Bottles G or P	3500	140	160
Carbonated drinks	Bottles G	120000	26	49
Beers	Bottles G	70000		350
Edible oil	Bottles G or P Plastics g/can	13000	4000	
Condensed milk	Tinplate	31000	264	
Molasses	Tinplate & drums Bottles G or P	120000		31000 (5 in cans)
Dried milk for reconstitution		Becomes 42000 liquid		
Liquid milk	Paperboard	1300	590	
Sugary preserves	Tinplate		24	200
Fruit juice conc.	Tinplate Bottles G		18	1400
Fruit juice	Tinplate		370	7000
Tomato juice	Tinplate			169
Other veg. juices	Tinplate		326	190
Vinegar	Bottle G		10	15
Pickles	Bottles G		200	100
Canned veg. in liquid and dry	Tinplate		376	256
Tomato paste	Tinplate		280	
Honey	Bottles G			25
Syrups	Bottles G or P		170	9
Tomato ketchup	Bottles G or P		140	75
Sauces/seasonings wet and dry	Bottles G		133	243
Still fruit drinks	Paperboard Plastics film		142	47
Wines	Bottles G		63	353
Cosmetic liquids	Bottles G or P		170	840
Polishes wet & dry	Bottles P		45	640
Disinfectant	Bottles G or P		350	110
Insecticide	Bottles G or P Aerosols		90	37
Adhesives	Tinplate		300	454

Training Programme in Techno-economic studies - Allen Jones , June 1 to September 1

JUNE 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

(Visits to suppliers and users of packaging to study the situation)

West Indian Paper & Pulp
West Indian Glass Co
Metal Box
Thermoplastics Ltd
Food Specialtdes Ltd
Jamaica Beoilers
Jamaica Bauxite Inst.
National Packaging
Ministry of Agriculture
Grace Foods

(Selection of priority subjects)

JULY 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

(Started studies of Waste , packaging of liquids and pharmaceutical packaging)

Forestry Dept
D&G
Grace
WIPP
(Waste Study completed and presented to Packaging Comm

AUGUST (Studies completed)

1. 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 END

WIPP Freetown
Challenge
HURRICANE ALLEN
Federated Pharmaceuticals
Challenge Benjamin
ROUND TABLE
PACKAGING COMMITTEE

(Yvonne Allen document on principles of Techno-economic studies)

(Allen Jones terminal statements for Packaging Committee and UNIDO)

ANNEX III

The counterpart was asked to prepare a brief statement of the functions of techno-economic studies and the techniques of their production. The following is the statement:

TECHNO ECONOMIC STUDIES

Miss Yvonne Allen
Techno-economic study officer
Packaging Laboratory
Jamaica Bureau of Standards

INTRODUCTION

Developments are concerned with the processing of resources to finished products. These resources, whether particles of soil, drops of water, dollars of foreign credit, animals of human beings, should be used to the best advantage for the general welfare of the country.

In this case it is, therefore, imperative to decide carefully how each of the resources should be processed to gain maximum benefit. Recently it was discovered that a logical approach to this decision is to study the resources and processes from various points of view, taking into account the various influences of the situations and activities on finance, the environment and the social scene. This approach results in a techno-economic study which should be specific to a period and as comprehensive as the time will allow. There is no sense in making a study absolutely comprehensive for, apart from taking a very long time, being almost impractical, such a study would contain facts that would be no longer applicable to the final situation and would be useless. A study should have some real value at the time of issue and should also contribute to the building up of education and information.

Definition of a techno-economic study

A techno-economic study is a critical examination of the technical and economic factors involved in the processing of resources as defined by the formula M+P =FP, where M relates to a material or other resource to be processed, P to a process, and FP to a finished product. In packaging this formula is interpreted as M being the product to be packaged, P the selection of appropriate packaging and FP the product finally packaged (Packaged Product).

Types of Techno-economic Studies

There are two types of study :

1. A general or broad study - and -
2. A specific study.

General Study

A general study is one in which a number of similar products (M) and the various package types (P) which could be used are investigated. As a rule, a general study does not provide detailed information for a decision to be made but it provides background information from which subjects may be selected for specific studies.

Advantages
1. provides a source of information from which specific studies may be chosen.
2. increases the range of useful contacts and known sources of information.

Disadvantages
1. requires further effort in the form of concentrating in greater detail on a specific subject to provide real benefit.
2. takes more time and effort in that a number of materials and or processings are examined.
3. it does not have an obvious conclusion.

SPECIFIC STUDY

A specific study is a detailed examination of one product or process (m or p). It is specific to a date and a product or package and may be used to provide the information for a decision to be made.

Advantages
1. it provides early possibilities of obtaining real benefits.
2. only specific information sources need to be contacted, this resulted in a limited number of information sources to be contacted and less time.

Disadvantages
1. any unexpected changes in a situation could make results invalid.
2. the use/influence of other technologies and economic factors not applied - only the specific subject is examined.

EXAMPLE

An example of a general study could be the packaging of liquids and a specific study arising from that could be the packaging of milk (one liquid).

for the General Study on the packaging of liquids one would need to know:-

i. what liquids are involved
ii. whether or not to include liquids in liquid/solid mixtures - say the brine in a can of peas in brine.
iii. what is the present packaging used for each liquid
iv. what alternative packages can be used for each
v. which package has most benefit for each in terms of finance, ecology and social.

For the Specific Study on The Packaging of Milk one would include:-

i. how much milk is available
ii. where does it go - who uses it
iii. the present packaging used
iv. alternative packaging and which package is best in terms of finance ecology and social.

Factors Affecting Study

Each study is influenced by:-

i. how much time is available
ii. the number of information sources available and whether or not they are reliable
iii. the need for short-term benefit (specific study) or for education and the building up of a background of information (general study)

Procedure for a Techno-economic study

The procedure for a techno-economic study would include:-

i. the selection of a topic
ii. investigation of the topic
iii. arranging the information in a set format
iv. tentative proposal/suggestion to assist in the making of a decision.

The Selection of A Topic

There are no fixed rules for a selecting topics for study but observation of technical and economic situation will indicate areas of weakness which would justify the cost and effort of studies.

Some of the indicated areas of weakness may relate to a financial value, such as the value of import substitution and this financial value may be used to indicate the depth of study (general or specific).

Finance is not the only consideration, one must also look at the benefits which may arise from the social and environmental points of views. There are two important social aspects to be considered - employment and welfare.

The main interest from the environmental point of view is, not to deplete resources beyond recovery.

According to the accepted economic theories of Adams and Ricardo, every resource (every particle of land or water, every person, every drop of oil) has a contribution to make to the community which brings to that community the most benefit.

Investigation of the Topic

The main objective is to obtain technical and economic information about the subject from all available sources. For most subjects it is possible to discover certain focal points of information (plants), collated statistics, previous reports, major industrial concern, individual experts etc.

Initial concentration on these focal points provides the broad outline of the technical and economic factors. From such an outline, it is possible to find areas of ignorance and deceit. It then becomes necessary to extend the range of sourses of information.

How far the investigation goes depends on how deep the study is to be and how reliable is the extra information found.

It is essential to discover only those facts which have value in the decision making and in the determination of conclusions.

One difficulty in techno-economic studies is the determination/detection of the level of credibility of the information obtained, since not all information obtained may be reliable. Information may be falsified by intent for commercial or political reasons, by ignorance and prejudice. But if any information is suspect, the study should include a statement to that effect.

Arranging the information in a set format

One accepted format for a techno-economic study is:-

TITLE - should be accurate and descriptive without too many words.

DATE - of issue

PERIOD AND LOCATION OF STUDY -

AUTHOR

STATEMENT OF JUSTIFICATION FOR THE STUDY - why it is considered reasonable to use valuable time and energy on the study.

BACKGROUND INFORMATION - of the subject under study, not too expansive

TECHNICAL INFORMATION - restricted to information which has a direct bearing on the subject.

ECONOMIC INFORMATION - restricted to information which has a direct bearing on the subject.

ANALYSIS AND CONCLUSION - just a statement of conclusion, preferably as one sentence but accurate and unlikely to be mis-interpreted.

TENTATIVE PROPOSAL/SUGGESTION TO ASSIST IN THE MAKING OF A DECISION

The advantage of a decision based on the conclusion, together with disadvantages, may be included but are not necessary. The study is to help some person to decide. The person responsible for decision making should not be influenced by any opinion in the study, only by the facts.

Intermediate Technology Development Group Ltd.
Industrial Services

PROJECT BULLETIN

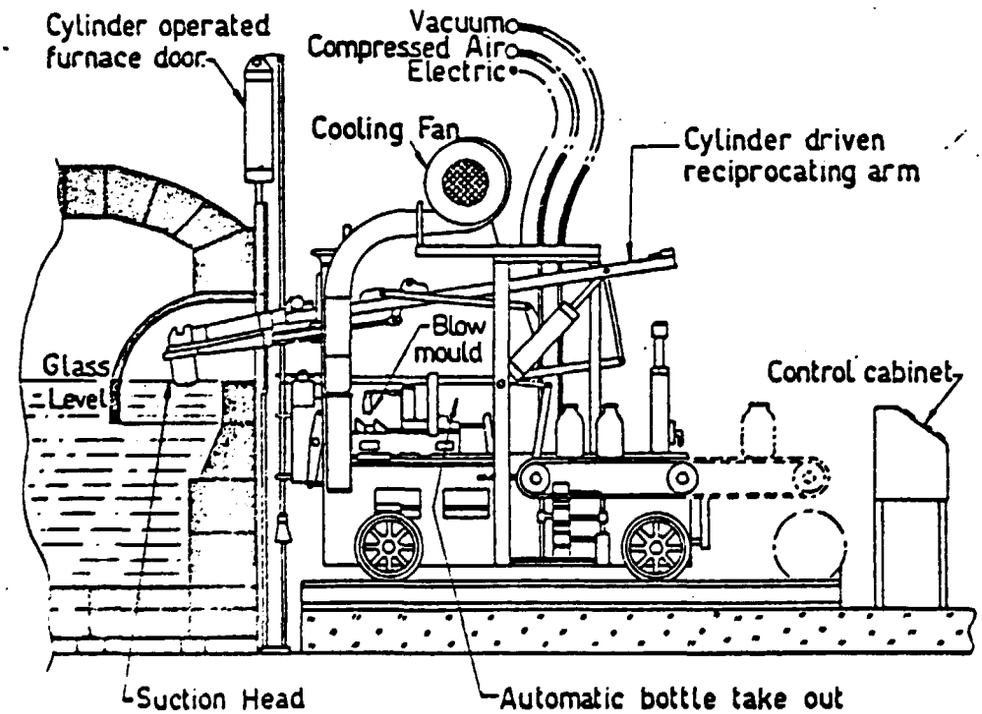
GLASS BOTTLE MANUFACTURE

The Reintroduction of Suction Forming Technology

ITIS is implementing a programme to field test and redesign the single head suction glass moulding machine. Particularly suited to the needs of small expanding markets, this machine can produce short runs of high quality bottles in a wide range of shapes and sizes. The project is being undertaken with a major UK glassworks equipment manufacturer and involves testing two reconditioned machines under factory conditions in developing countries. Assessment of the machines' performance will aid the redesign of an improved model incorporating an hydraulic drive system. Subsequently the new machine will be field tested in the UK and developing countries to demonstrate its commercial potential.

The suction moulding process, originally developed in 1903, is being reintroduced to fill an observed technology "gap" between the small and large scales of production. On the one hand, low volume bottle production is typically undertaken using hand-gathered furnaces and semi-automatic moulding equipment. This technology depends heavily on the availability of local glass making skills and regular worker attendance. Twelve skilled operators are needed to produce 3,600 bottles (100g) per 24-hour day, and consistent quality is difficult to maintain.

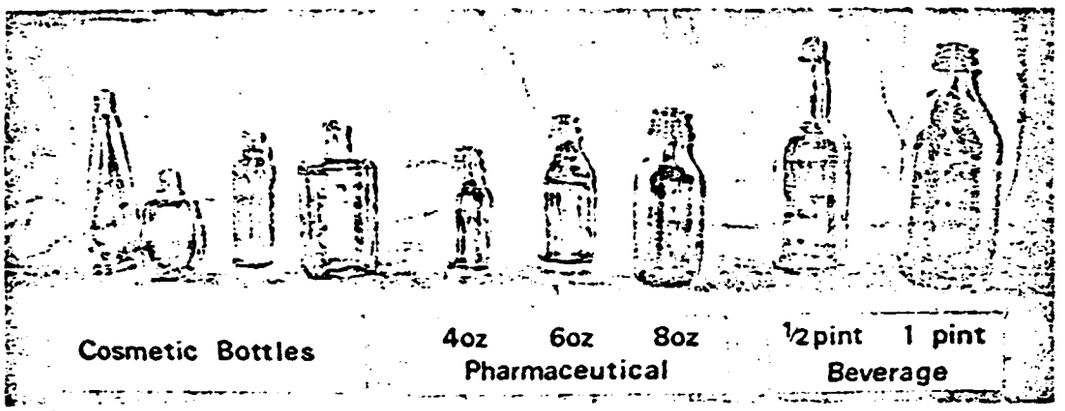
PROPOSED LAYOUT OF REDEVELOPED MACHINE



Machine operation: Suction head gathers glass into mould. Reciprocating arm transfers preformed glass glob to blow mould. Bottle is formed by compressed air being blown through neck ring.

High volume production, on the other hand, utilises fully automatic individual section (IS) machines. The total investment required, including ancilliary equipment, is substantial and as with all complex machinery operation and maintenance requires highly skilled personnel. Even a small unit produces at a daily rate of 80,000 bottles (100g) and consequently small runs are uneconomic.

The redeveloped suction machine is seen as a direct alternative to the semi-automatic equipment but offering a higher output of 12,000 bottles (100g) daily, higher quality and better labour productivity. The equipment requires supervision by only one skilled operator and can run continuously, ensuring optimum use of melted glass and a steady production rate. The suction technique for gathering glass guarantees that bottles will be of exactly the same weight and the fully automated forming process ensures that the product is dimensionally constant. In the redesigned machine the product capacity and size range, presently 50g - 350g, will be considerably expanded due to the flexibility of hydraulic drive.



A variety of bottles prcduced on a suction machine.

Consistency of product quality is particularly desirable to major users of glass packaging materials. Pharmaceutical and cosmetic manufacturers, operating in developing countries, have already expressed interest in suction moulding. Currently, such operations must either import glassware or over-buy containers to meet the minimum orders required by large scale local glass producers. The inavailability of good quality glass containers has, historically, been a deterrent to production opportunities in developing countries, notably in the food and beverage industries.

The original glass suction machines were mechanically driven and as a result the potential output and flexibility of this method of forming was never fully realised. With modern technology this potential can now be exploited and in collaboration with our UK and overseas partners the machine will be developed to make the technology competitive. Three glassware producers will participate in the programme of field tests. Two have already been identified, one in the UK and one overseas. A third producer from a developing country is being sought.

For further information contact: ITIS, Myson House, Railway Terrace, Rugby, UK. Tel. (0788) 70126. Telex 311208. (Ref.169/6/80).

Intermediate Technology Development Group Ltd.
Industrial Services

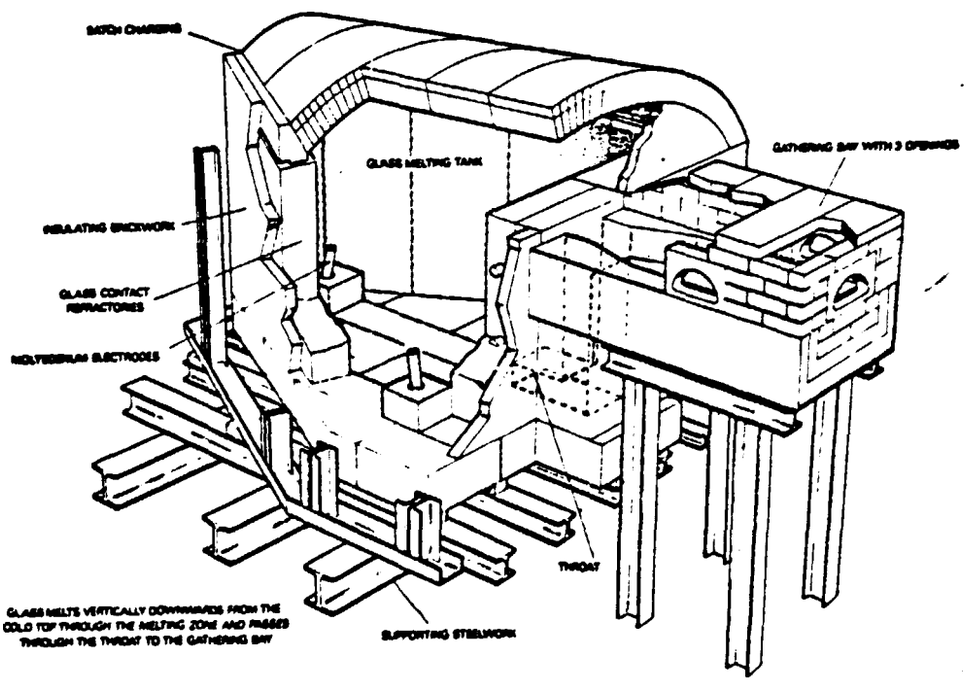
PROJECT BULLETIN

ELECTRIC GLASS MELTING

A New Design for a Small Scale Electric Furnace

ITIS has undertaken a project to introduce electric glass melting to Sri Lanka. A new design of electric furnace created specifically to meet the needs of the small scale producer is being built as part of a new 5 ton/day glass plant. The furnace has been designed by the UK company Penelectro International Ltd. a subsidiary of King, Taudevin & Gregson Ltd. (KTG).

The project is intended to demonstrate the technical and economic viability of electric melting as an alternative technology for Sri Lanka's declining small scale glassmaking industry. The six remaining small scale producers, accounting for some 20% of the market and employing 1,100 people, use furnaces designed when fuel costs were one third of total running costs, the burner system using a fuel oil/kerosene mixture. The plants, whose average capacity is 3 tons per day, are only suited to the melting of cullet (used glass): product quality is low.

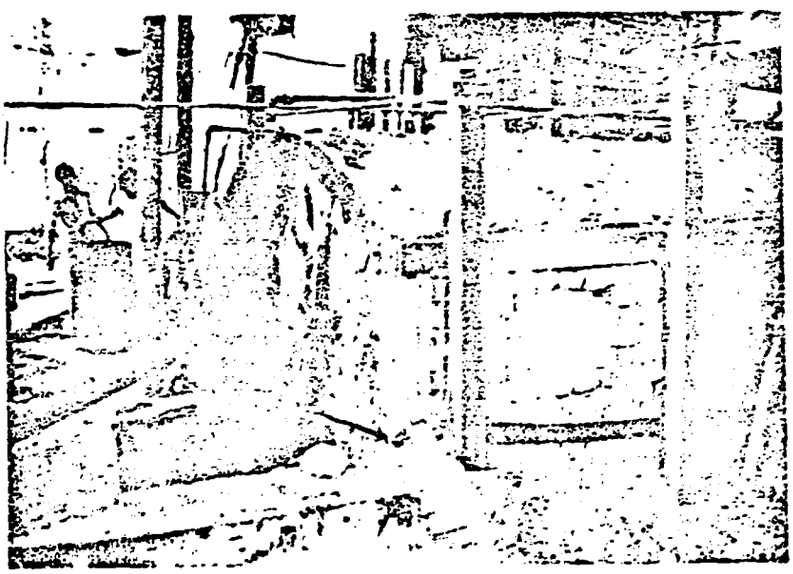


5 TONS/DAY ALL ELECTRIC FURNACE

The escalation of fuel prices and increases in the price of cullet have caused serious problems for the small scale producers. Unit costs have risen two fold in three years but could not be passed on to the consumer in part due to competition from inexpensive better quality imports of glassware following the lifting of import restrictions in 1977. Since that time, three small scale producers have ceased production.

It was in the light of these developments that the Sri Lanka Industrial Development Board first contacted ITIS for assistance. Following an exploratory visit by an ITIS Industrial Adviser, a second visit by an ITIS funded team including an engineer from Penelectro and an economist resulted in a feasibility study on the introduction of electric melting in Sri Lanka.

An electric furnace offers a number of advantages. Operating at higher temperatures than the existing oil fired furnaces and able to use locally available raw materials instead of cullet, the quality of the glassware produced can be significantly improved. Most important, however, is that glass melting in an electric furnace consumes only 40 therms/tonne of glass which is less than one third the consumption of the existing oil furnaces at 140 therms/tonne. As the unit cost of electrical energy in Sri Lanka is currently similar to that of oil energy, and likely to remain favourably priced with a major hydro-electric scheme coming on stream in 1981, electric melting is an attractive economic proposition.



One of the existing oil fired furnaces.

To meet the particular needs of the small scale producer, Penelectro have designed a simple electric furnace for low volume production of standard quality glassware. The capital cost of the furnace, however, although low by European standards, nonetheless represents a major investment for any Sri Lankan small scale producer. ITIS has therefore offered financial support to one of the producers to install the first furnace of the new design. ITIS' contribution covers Penelectro's design fee and the costs of commissioning the new furnace. The producer himself, together with a local commercial bank, are financing the major part of the investment capital required.

ITIS anticipate that the electric furnace for Sri Lanka will prove an attractive proposition for other developing countries. The capital cost is significantly less than the conventional European equipment package, in part because certain components are being sourced from India and Sri Lanka. After the furnace has been commissioned in Sri Lanka, it has been agreed interested parties from other developing countries may visit the plant.

For further information contact: ITIS, Myson House, Railway Terrace, Rugby, UK. (Ref. 06/2/80).

ANNEX V

The conclusion of the mission were briefly presented as a written paper to the Packaging Committee on the 27th August 1980. The open table discussion held on the 28th August dealt with much the same subject matter. The written paper was as follows:

TECHNO-ECONOMIC STUDIES

What they are and why in Jamaica

All developments are concerned with the processing of resources to semi-finished or finished products. Each and every handful of soil, drop of water, unit of energy, dollar of finance, each and every plant, animal and human being needs to be processed so that it contribute as much as possible to communal health, wealth, welfare , comfort, culture and stability. In a country such as Jamaica, with no oil, a relatively small population and a temporary shortage of money, it is important to process everything and everybody to the best possible advantage - from both the short and long term points of view.

Twenty years ago the situation would have been dealt with by a number of independent technical, economic and social studies - probably in isolation with some co-ordinating authority trying to relate one study to the rest. About ten years ago it was realised that a fragmented approach was not satisfactory and that studies should be made in one location with due regard for the influences of problems and solutions on all aspects of the community - financial, ecological and social. Such studies have earned the title Techno-Economic but should rightly be Techno-Economic-Ecological-Social - but such a title sounds pompous and it wastes too much paper and ink. One must not, however, forget the ecological and social aspects. Jamaica could make a lot of money quickly by cutting and selling all its trees - but would be converted quickly to a barren wilderness. Jamaica could short-term solve many problems by banning all imports and further devaluation the dollar - but would very soon become a most miserable place to live, with inevitable social consequences.

A study needs to be as comprehensive as possible within the limits of facilities and time. One of the problems is deciding how comprehensive a study should be to be effective short-term and long-term. The benefits are, or should be:

1. Instantly direct
2. Contributory
3. Educational

It must be stressed that a study does not itself make a decision. It processes facts and opinions without prejudice or favour, so that some authority may make a decision. The format, which is always changed according to circumstances, is:

1. Title, date, period of study and location.
2. Justification for using valuable time, money and skill on the study.
3. Sufficient background information to help understand the text.
4. Technical and economic, ecological and social information.
5. Conclusions and tentative proposals, with some comment on the possible benefits and misfortunes from the proposals.
6. A statement of further studies needed.

There are two main types of study - specific and broad. A specific study is specific to one resource or one process or one end result, and it is specific in time and place. It is concerned with instantly direct benefits which could arise if some authority makes a specific decision. For example, Miss Allen did a very brief study of pulp moulded egg trays. This implied benefits from the introduction of one ITDG pulp moulding machine to process waste paper. The machine capacity was found to match the demand arising because Jamaica will not have imported trays when Jamaica fertilises its own eggs, and to be suitable for the expanding of output later.

A broad study looks at a sector of activity, inter-relating many resources, processes and final products. It uses previous specific studies in their contributory capacitues and it may contribute to some greater study such as national five-year plan. Most of the benefits are educational insofar that it provides a technological and/or economic picture out of which subjects for specific studies may be extracted.

Most important, it indicates orders of priority for specific studies. For example, we have done a study of the packaging of liquids which, given more time, would have been a classic broad study. In the beginning it was intended to lift pharmaceutical liquids out for a specific study but it became obvious that pharmaceuticals should have a much lower level of priority than other liquids - despite the fact that all pharmaceutical packaging is expensively imported. Consequently, what we had recorded for pharmaceuticals was retained as useful background for some future study of pharmaceuticals.

It should be appreciated that under the best circumstances any study takes time. During the three months period my main function has been educational - trying to create a situation in which useful studies may be generated. The facilities and co-operation from UNDP, the Bureau, the Packaging Laboratory, and industry have been excellent - far better than any experienced in any of my previous locations. Not only was there a counterpart from the day of arrival, but the counterpart was sufficiently educated and enthusuastic to take over before the day of departure. She will need a lot of help in the near future and I am certain you will provide it.

Waste

Whichever God one serves provides mankind with raw materials which mankind should use to the maximum extent before throwing them away. Societies which have experienced real scarcities, either by wartime blockades or by extreme poverty, appreciate the value of used materials. Societies which have not known real scarcities do not appreciate the values of the materials they throw away. It is important that Jamaicans develop an appreciation of the values of the materials they throw away.

In 1977 the imports of packaging materials had a value of $50 million. Of this, about 21 million was for paper and 9 million was for metals. Glass packaging had a value of a little more than 10 million and it was not possible to isolate packaging plastics from other plastics imports. Insofar that paper waste is relatively easy to process for reconstituted paper and pulp mouldings, and insofar that paper dominates import values, paper was given priority in the waste study.

The cost of metals is also high but metals are difficult to rescue and remelt, as are plastics. Glass packaging, with a similar importation cost to that of metals, was given priority in the study for two major reasons. Jamaica has a glassworks which could be revitalised to considerably reduce the imports. Glass bottles, imported or home-made, are mainly used in return-journey distribution whereas tinplate cans are fit only for single-journey distribution. In other words, the 25 cents costs of a tinplate can represents one journey only and it is mostly import which cannot be replaced by domestic developments, whilst the 25 cents cost of a glass bottle represents a possible 15 journeys, meaning that it contributes 15 times as much as a tinplate can, and there is some possibility that the glass bottle might be from domestic manufacture.

So, our priorities were paper, as a major import which is easy to reconstitute, and glass, which contributes a low journey cost in distribution and is also easy to reconstitute.

Paper

Virgin pulp is made from fibres which have been digested to make their surfaces more likely to lock together as a web. Once the fibres have been digested they may be repeatedly repulped by brutal mixing in water, the pulp being useful for more paper or pulp mouldings. Repulping damages the fibres to cause a loss in strength of about 20 percent. Repulped virgin paper manufactures to reasonably good reconstituted packaging paper, somewhere in quality between the presently imported USA virgin kraft and the presently imported Venezuelan reconstituted kraft. Fibres which have been many times repulped are too weak for more paper but are suitable for pulp mouldings.

Jamaica uses about 60,000 t/y of paper, much of it already reconstituted. About 6000 t/y of waste is converted to tissue but there has been little real effort to collect more waste. It should be possible to collect and process about 20,000 t/y, and the indication is that Jamaica should have domestic papermaking and pulp moulding. The possibilities have been, and will continue to be studied. If one appreciates that the original imported paper cost Jamaica about $1000 per tonne, the potential benefits from import substitution are obvious.

A massive feasibility study is suggested including many more authorities than the Bureau. As a platform for such a study the following is proposed:

1. A full study of Jamaica fibres, existing and potential, to discover which could make paper. The priority fibres appear to be bagase, banana trash, forest trimmings and sisal grown or marginal land.

2. Meanwhile, the establishment of pulp moulding for egg trays, fruit trays, retail trays and nursery plant pots, starting with the small-scale ITDG unit already familar to Jamaica.

3. Further study of the complications of waste collection and the subsequent organisation of a collection system.

4. Re-activation of the presently idle papermaking machine or, if this machine is too far gone, the installing of a papermaking machine rated at 10-15,000 t/y.

Small working party is needed to make communal contact with ITDG, UNIDO, the various companies engaged in pulping and paper reconstitution and anybody else with expertise or experience to offer. This working party will need to visit some of the many functional units now operating in the world.

Glass

Glass may be remelted repeatedly with very little loss of quality but the recipe of a glass used for an application is important. If Red Stripe bottles are remelted for more Red Stripe bottles the glass becomes an everlasting resource. If the glass waste (cullet) is mixed in remelting the new bottles have uncertain recipe and may have to be directed at some other liquid. For beer and other liquids in return-journey distribution it is important not to deviate from the proven recipe because this could result in fewer journeys per bottle, which is adding costs to distribution.

Total glass packaging in Jamaica is about 17,500 t/y imported and 27,000 t/y domestic production, with about 40 per cent of the domestic production using waste glass. The first reaction is to propose that the glass works be revitalised to 40-50,000 t/y and that almost all imported glass be discontinued. It is not quite so simple.

The total glass is mixed in colour and recipe. The glass works can remelt only white glass and it is probable that the white glass being remelted is not of one recipe. There is no outlet for coloured glass and no statistics as to how much waste glass is of which colour or of which recipe.

The primary need is consequently a market study to list how much of each type of glass is needed by the economy. This needs to take into account the fact that some glass is exported and is mostly fixed in recipe, whilst standardisation in the domestic market could reduce the range of glass types needed.

Revitalisation of the glass works will include organising production so that runs may be long to save money. It will have to be determined how the cullet fits into the melting programme and if it will be possible to run one line non-stop on cullet. There is a glass expert coming so that problem can be left to his attention.

It is worth looking into the possibility of installing a small-scale bottle factory for pharmaceutical bottles from mixed cullet. The big litre and half-gallon bottles for pharmaceuticals may be economic for the existing glass works suitably revitalised. It is not possible that the smaller pharmaceutical bottles, even if fully standardised, will be as economic as other bottles for the existing works but they could be economic on a small 3 to 5 t/day unit working from the mixed, mainly brown, cullet which is not wanted by the existing glass works and which would probably be lowest-cost if not free from the users of brown bottles. In fact the users of brown bottles might seriously consider undertaking the pharmaceutical bottle production to commercialise their own waste.

Anticipating the question, pharmaceutical bottles are sufficiently small for accurate recipes to be less necessary, providing the maker does not bring in high technology for very thin walls of bottles. The cost structure in the pharmaceutical trades will support relatively heavy-weight bottles and it is always possible to add a little extra colour to maintain a good brown colour. Also, the remelting process sterilises the glass effectively so there is no need for such bottles to be of virgin glass. The IRDG design of small-scale plant is in the study on waste. It was designed for Sri Lanka, which has similar problems to those in Jamaica, and there are ways in which somebody from Jamaica can be financed to have a look at the Sri Lankan plant.

PACKAGING OF LIQUIDS

Jamaica is a wet country in many senses of the word. The rainfall is sufficient to allow the cultivation of water-demanding crops, even when it is not augmented by passing hurricane. The exporting of liquids is vital to the economy and the liquids on the domestic market are both varied and voluminous. The packaging of liquids in Jamaica costs the country about $10 million per year, about half of this being tinplate.

The cost estimate is vague because there is no information on for example how much tinplate is used for dry goods and how much is used for wet goods such as fruit in syrup. In the time available it was not possible to calculate how much of the imported packaging was for re-export as filled containers, how much was for one-journey distribution and how much was for multiple-journey distribution.

A good techno-economic study would have started with the grouping of all liquids into sectors of similar packaging demands, followed by an estimate of the value for each sector, whereby it would be possible to establish priorities. Time being limited, the correct procedure was impossible so we broke the rules and simply picked out liquids which we thought important. The importance was measured from two points of view:

1. Whether the liquid had sufficient volume of sale for any implied changes of packaging to have economic significance.

2. The range of selected liquids should cover most if not all of the packaging problems of liquids.

In the effort to group the liquids, 42 liquid types were listed against 27 packaging considerations, leading to 12 groups which had common or similar factors. It was not possible, however, to give the groups financial significance and, because time waits for no man or woman, we picked out milk, beer and other fermented carbonated drinks, non-alcoholic carbonated drinks, strong alcoholic drinks, edible oils, engine oil and paints and adhesives. Subsequently the paints and adhesives were dropped from the list.

Since the full study will be issued there is no point in presenting the final and full details on this occasion. With the understanding that future findings may invalidate some of the facts and opinions, the major findings so far are:

1. Paperboard cartons are performing well for milk packaging but some improvements in sealing may prove to be necessary.

The per-journey cost per carton is about the same as that of a glass bottle in return-journey distribution but it is doubted that any beneficial use can be found for used cartons even if they could be collected . The use of cartons could be considerably extended, particularly if Jamaica manufactured its own coated board. Such board would be of two grades:

A. From virgin pulp for foods including such things as air freight exported fruit salad.

B. From repulped waste paper for non-food.

2. Glass is performing well for beer but improvements in handling are required to reduce the breakages and transport costs. It would be worth looking into larger units, say one-litre bottles, but not until handling improves.

A dropped one-litre bottle of pressurised liquid can be lethal. It would also be worth looking into large party-size cans, say half-gallon.
The canning of beer would save time, trouble and cost in distribution and it would extend the market into areas of single-journey distribution - but it would increase both the national cost for imported tinplate and the personal cost of buying beer. A social study is needed to discover if customers would pay the extra 25 cents per unit as a premium for the convenience of being able to carry a dozen cans instead of half a dozen bottles. The relationship of cans to bottles for beer is a complexity of economic, environmental and social issues. One must consider, for example, the fact that broken glass has the same refractive index as sea water and one cut foot on a juvenile tourist could cause parent tourists to be not very happy about Jamaica beaches. Also, many countries have realised that glass bottles are effective missiles and weapons when sports fans and others become excited.

3. The remarks about beer apply to other carbonated drinks excepting that some other carbonated drinks should be in white glass. not brown. It should be possible to standardise the bottles, although a firm stand may be necessary against some companies who insist on identification through the bottles shape and embossed markings. For future attention it should be noted that Jamaica may in the future have domestic aluminium sheet production, from which drawn cans may arise, and the provision of drinks in cans could extend the market. Also, a careful watch is needed on world development of PET plastics bottles. These have only one tenth the weight of glass bottles and they allow the sale of unit volumes up to two litres.

A dropped PET bottle full of two litres of carbonated liquid is not lethal, as glass would be at that volume. A 2-litre PET bottle would have fairly wide application beyond its use for pressurised liquids. Study may show that the extra importation cost for PET would be much less than the saving in transport costs arising from the lighter weight and tougher bottle.

4. Much of the bottled strong alcoholic drink is for export where the bottle shape is part of the product identification. Such use of the bottle for identification is not necessary for the domestic market, and there would be benefit from the introduction of a standard spirits bottle. The standard spirits bottle would inevitably become the standard bottle for such drinks as syrups and squashes. As a standard design it would allow long runs at the glass works and assist in the recovery of bottles for refilling. Unfortunately the standard bottle would also be used for the occasional toxic product and serious thought should be given to the definition of two standards, of completely different designs, one for food and one for non-food.

5. World experience is that edible oils should be in plastics bottles because the plastics bottles are lightweight and unlikely to be collected for re-filling. Even if collected the cost of cleaning is very high and is not always satisfactory if the previous oil had become rancid (or, as is common, if the user repeatedly poured the oil back into the bottle from deep-fry pans). It is common where tinplate is not expensive for semi-bulk cans to be used, and there have been trials with paperboard cartons. Further study may show some valid alternative but present opinion is that the existing HDPE plastics bottles, as single-journey packages, are satisfactory.

Standard pint and gallon bottles are required but, because the containers are not to be returned for re-filling there is no need for another standard for toxic liquids.

6. Engine oil warrants detailed study because at present it is responsible for the importation of about 120,000 square metres of tinplate cans or blanks. As a product, engine oil is unlikely to damage any non-porous packaging material other than some lower grades of polyolefines (which absorb oil and become weak). World market are consequently studying many alternatives according to local economics and conditions of sale. Tinplate is popular for gallon units but units of one litre or less may be in composite cans of wound paperboard with an aluminium foil liner or in HDPE bottles. As long-term development the composite cans are interesting for Jamaica because they would provide an outlet for processed waste paper. The development of domestic composite cans would need some large outlet to provide sufficient production for composite cans to be adopted for other products, notably household chemicals.
   Possibly the best system to adopt at present is to supply engine oil in 45 gallon drums (with a pilferproof filling cap and tap) to forecourts, and to sell one-gallon HDPE containers of special design for customers to take to forecourts for filling. Obsolete drums would have value as bitumen drums, making it no longer necessary to use new drums for bitumen. If the price of loose oil and canned oil were adjusted, market pressures would reduce canned oil other than where absolutely necessary. If prices of canned oil were increased one dollar per litre and loose oil was priced two dollars below canned oil, and if the savings in distribution costs were appreciated, the advantages would not only be the elimination of tinplate imports.

PHARMACEUTICALS

Mention has been made of pharmaceutical liquids, with a tentative suggestion that a 3 to 5 t/day bottle unit be installed to use mixed cullet. The proportion of pharmaceuticals which must use glass is less than might be supposed. There is Jamaican development of small plastics containers similar to those finding increased use in Europe. The European ventures have a range of volumes of 20 ml to 590 ml in five stages, with closures which are tamper and child proof. It is doubted that the Jamaican market needs such sophistication, certainly in the early stages until the market pattern clarifies. The small plastics containers have many non-pharmaceutical outlets to be developed.

Before an effective techno-economic study of pharmaceutical packaging can be done there is a need for a market survey to determine:

1. The groups of products and their relative importance.
2. The proportions of groups of products which must be in packaging as used elsewhere.
3. The possibilities of domestic manufacturer and bulk-breaking.

One technical development which will help pharmaceutical packaging will be wider acceptance of HDPE instead of LDPE for film. HDPE has a much lower moisture permeability than has LDPE. For hygroscopic powders there would be benefit from the use of double-layer film packaging - one or more sachets in a sealed film larger sachet.

MONEY SAVINGS

Money is saved in packaging by:

1. Reduction of the quality of made-up packaging which is brought into the country. Examination of the retail displays reveals a very large number of foreign goods brought in with packaging designed for competitive foreign markets. Some of this foreign packaging may be desirable if not essential, but most of it arises from importers buying 'as is' instead of 'as could be'. One function of the Packaging Laboratory in the future should be to examine imported foreign finished products with a view to eliminating some of the packaging.

2. Correct design of packages. A package should do what it is supposed to do - no more and no less. The Packaging Laboratory will shortly have a range of test equipment and skills to tell if packages have too much puncture or stacking or dropping strength.
One special aspect of design is the making of designs specific to the market. This is what most people mean when they talk about appropriate technology.

   Most package design are either:

   A. Original designs expensively produced to cover the widest range of market conditions, as when a detergent carton or a branded tea is packaged for world-wide sales. Because such packages face many collections of hazards and sales conditions, they are always over-packaging.

   - or -

   B. Imitations of existing package types for similar products. These also are overpackaging.

3. Standardisation, by which I mean mostly voluntary standardisation not legislated standardisation. Voluntary standardisation allows longer production runs in package manufacture, ability to order small lots of packages at lower costs, less expensive transport, better space utilisation and, often forgotten in discussing standardisation, ability of trades to negotiate freight rates for unit loads. Voluntary standardisation concerns all material aspects of packaging - paper specifications, board specifications, can shapes and sizes, bottles, cartons, cases, film sachets, etcetera. Jamaica has gone further than many countries in reducing the range of packages but this does not mean that more cannot be done. Of course, there are always those who claim that packages must be individual or sales will drop and people will be made unemployed. It cannot be stressed too much that when a country is passing through a temporary phase of unfamiliar poverty, money spent on promotion is misdirected money if it could be used to improve qualities, quantities and prices.

In the revitalisation of an economy there are certain rules which should be applied:

1. Remember that people are sensitive but will, if given reasonable explanations, accept changes. They will accept reconstituted paperboard instead of glossy white virgin board. They will accept two-colour printing instead of glorious technicolour. They will accept Pepsi in the same bottles as Cream Soda. But - only if they are tols why the change is done.

2. Anything which can be home-made should be home-made. At face values many examples of domestic manufacture seem to be more expensive than imported similar goods. Remember, however, that when goods are home made most of the money is kept within the country but when goods are imported most of the money, including freight costs, goes out of the country.

3. If goods must be imported it is better to import as semi-bulk and to bulk-break into packaging designed for the market.

4. Establish communication and co-operation. Spread advice and information. It would be worth producing some simple document to encourage better packaging, reaching out beyond the limits of package production and filling by major users. One previous expert pointed out that fresh vegetables were in polyethylene film without holes. Consequently the losses are high and the qualities are poor from sweating. Those who put vegetables into bags still do not allow ventilation. This is only one of many instances where a little directed publicity could save the country a lot of money.

5. Concentrate on improvements in handling and retailing. When goods are scarce there is little consumer rejection of poor qualities and unsatisfactory packaging. Consequently, shopkeepers and suppliers do not make sufficient effort to maintain standards of cleanliness and protection of products against hazards. Handling and retailing in Jamaica is by no means as bad as in some sellers markets but it could become so. This is the time to establish a rigid code of practice and to enforce it because it is in handling and retailing that the expensive losses occur. Any efforts to economise in packaging costs by better design, standardisation and import substitution will be wasted if handling and retailing hazards are allowed to deteriorate.

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This has been a brief survey of conclusions and opinions do far. In three months it is impossible to make any significant contribution other than guide somebody so that she becomes a good techno-economic student sooner. Miss Allen will require much co-operation and assistance if she is to help you to help yourselves. From my experience Of Jamaicans so far I am certain she will get it.

ADDENDUM TO "RECYCLING AND RECONSTITUTION OF PACKAGING MATERIALS" IN JAMAICA

Prepared by Miss Yvonne Allen , 22nd August 1980 .

Factors contributing to the problems of collection of waste and containers for recycling.

1. Preference for imported goods

Jamaicans show a preference for imported goods, with the justified opinion that imported goods are better in quality and are frequently better value for money. This preference discourages interest in the use of local materials, including waste, for manufacture. There is world resistance to the acceptance of lower standards, particularly in countries which have not passed through a dramatic crisis in which materials and imports of quality were forcibly denied. The activity in Europe with regard to waste recovery stems from the wars and in many countries there is interest arising from extreme poverty. With regard to Jamaica there has been sufficient publicity about waste recovery throughout the world for Jamaica to be aware of the need without suffering extreme misfortune. The awareness, however, needs to be increased by education ofall sectors of the society.

a) Producers need to use research and design skills to ensure that products are made from materials which have qualities exactly to satisfy requirements, and quantities of material per product for satisfactory performance should be just sufficient - no more no less.

b) Distributors need to organise distribution so that products and materials are used to the maximum benefit before being discarded and then the products and materials are directed into some beneficial application.

c) Consumers need to be made constantly aware that used materials have some contribution to make towards economic recovery, and to assist in the rational rescue of such materials for re-use.

2. Intensive advertising & promotion of foreign products

Jamaicans have been subjected to intensive advertising and promotion designed to create a false sense of value about foreign products. They have been encouraged to develop a 'throwaway' society motivated by the obsolescent theory that capitalised mass production results in better qualities at lower unit costs and the progress depends on the maximisation of spending power in the markets. Jamaicans need to be convinced that the functional characteristics of products are more

important than the sensual and status characteristics of products. To some extent the recent shortages of products, which hardly justify the description of shortages by world standards, have encouraged economy amongst consumers. It is unfortunate, however, that shortages of imported products have not coincided with the introduction of alternatives from domestic production. There is danger that when the economy recovers the consumers will continue to seek foreign products (because no domestic alternatives have been provided) and will continue as a 'throwaway' society (because revived circulation of spending power will encourage more effort in the promotion of false values. Packaging is a vital component of the throwaway philosophy and, through labels, is an agent of the generation of false values.

The lack of suitable educational programmes

An educational programme for the general public should be based on national pride and common sense. From the national pride point of view reminders are necessary of the contributions of individual efforts to communal and national benefits. The benefits to be emphasised are the ing of foreign exchange and the elimination of temporary shorta From the common sense point of view there is a need to supp e facts about products and discourage much impulse buying. A purchaser needs to be made aware of how much extra he or she is paying for overpackaging and of the potential value of the material of the package as an item of disposal.

4. Lack of organised system of collection

Such an educational programme will take time and it can only be partly effective. With regard to the rescue of packages and materials it can not be of actual benefit without some organised convenient system of collection. However induced to save, the individual consumer cannot be expected to contribute more than the simple division of waste into major groups and the placing of individual fractions of waste near to the place of use. For example, it is possible that housewives may be persuaded to bundle clean waste paper, place used bottles in a suitable container and put all other waste into a general waste container. They could possibly be persuaded to take bundles of paper and bottles to a collection point very near to the household, but not over any significant distance. Consequently, with regard to public waste it would be essential to organise either:

a) Many small-scale collectors paid to carry household waste divisions to nearby bulking depots for subsequent bulk collection - or

b) Multiple journeys for waste collection vehicles so that each journey relates to one waste type. For example one vehicle could call weekly for paper, another vehicle for bottles and yet another for mixed other waste. In-so-far that the volume of divided waste would be the same as that of undivided waste the total volume-distance required for vehicles would be the same but each vehicle would have a longer round of collection for a specific division of waste types. The cost of collection would be the same but the final bulk of waste would be suitably divided for processing.

In due course Jamaica could contemplate the mechanical division of mixed waste but it is doubted that it would be economic. General world opinion is that such processing of mixed waste is only economic for urban concentrates up to ten million people, and then only if the economy has outlets for all components.

5. Meagre income for small-scale collectors

(a) Paper

Small-scale collectors are motivated mainly by possible income. Subject to study of the economics it may be presumed that processors of waste will pay for clean waste about half the price they would pay for virgin raw materials. For example, clean waste paper to the pulping mill should cost about half the price of virgin pulp. A mill capable of buying virgin pulp at $200/t would expect to pay $100/t for clean waste paper for pulping. A bulk dealer in waste paper would, subject to analysis of handling costs, pay £50/t for small lots from small-scale collectors. This is only 5 cents per kilogramme or about $1 for a bundle which is easy to carry. At such prices the small-scale collectors will not carry bundles for any significant distance or deliver to depots if there are any time-wasting delays.

(b) Glass

Much the same remarks apply to glass but with the added complication that glass would be collected for two purposes - re-use of bottles and the provision of cullet for remelting. At some stage of the movement the glass would have to be sorted into individual types of bottles and into bottles versus glass for remelting. Small-scale collectors might divide bottles into types but they could not be expected to isolate chipped and over-worn bottles which should go into the cullet. Also, bottles are heavy and the distances of travel are significant.

If a handcraft holds 100 bottles at the present return value of 10 cents the potential income is only $10 less any payment made to the original user of the bottles. Even $5 per load would not be economic unless the small-scale collector could simply dump all bottles and cullet at a nearby depot, leaving others to worry about the sorting.

6. Household waste

In view of the difficulties of conviction of housewives, the very high cost of installation many depots, and the improbability of recruiting small-scale collectors, it does not seem probable that household waste could become a useful source of materials for recycling or reconstitution.

7. Coordinating institutional collection

Many countries use institutional collection. This concerns churches, scout groups, schools, Government departments, offices and the like, where a number of persons are willing to contribute to common welfare. Within the term institutional collection one must also include some centres of waste-generation such as supermarkets, offices and companies accepting packaged goods for processing. In voluntary orgainsations the motivation for collection is financial, individual members donating personal waste and collection effort to make ready cash. In the centres of waste generation the motivation is economic in so far that the centres are anxious to lose waste which has no obvious direct value but which costs money in storage and disposal. In government departments and offices it is necessary that information on paper should be destroyed by paper shredders. It is important that the voluntary organisations associate themselves with centres of waste generation as sources of waste. There is a need for a study of the nature of voluntary organisations and the location of centres of waste generation, and subsequently of the best organisation of both for maximised waste collection.

8. Set up cost of intermediate storage

Any organisation of waste collection needs effective intermediate storage. Individuals can be expected to isolate specific waste but not to take such waste any distance for bulking. Voluntary organisations are prepared to take waste some distance if it is convenient. The requirement is for a number of intermediate depots accepting waste at a set price by weight, collating such waste and selling it as bulk to processors at an increased price. Intermediate depots may be set up by processors or by entrepreneurs or by both together. It is important to avoid overlapping and confusion by making it clear who is doing what in which area of collection. The economics of collection do not allow for money to be wasted in competitive collection, which confuses the originators of waste and either payments for waste (so that collectors lose interest) or increases the final costs of wastes (so that processors lose interest). The establishment of an optimum structure of values for waste at each stage of collection is important to encourage general interest.

9. Sorting and disposal of waste at depot

Intermediate depots are useful locations for the sorting of waste. Whilst such depots must be prepared to reject obviously useless materials they must, to survive, accept waste 'as is' and to carry out waste selection. Damaged bottles need to be isolated, bringing a need for depots to handle cullet as well as sound bottles. Plastics film needs to be isolated from waste paper, bringing a need for depots to handle secondary waste arising from the waste they collect. For maximum efficiency the depots need to establish outlets for useless waste, as for example in land infill or incineration. It is consequently important that the civic authorities work closely with intermediate depots.

10. Sorting and distribution of waste in plants

Waste may be divided into the groups of:

a) In-house waste

b) Waste within a circuit controlled by one organisation

c) Concentrated distributed waste

d) Widespread distributed waste

In-house waste may be exampled by paper waste in WIPP mill, baled and pulped for tissue by WIPP. In academic terms this is not waste because it is passed into some useful process and the only consideration is the effective maximisation of processing and marketing. Much in-house waste is not rescued in Jamaica, not only in packaging. Desnoes & Geddes could consider seriously pulp mouldings from worn-out beer cases, probably by taking a financial interest in some joint company ready to buy and use the mouldings. Grace might likewise consider using waste paperboard for fruit interlayers. It is important for all producers to be encouraged to examine their waste and to establish if some in-house activity might use such waste to advantage.

11. Waste within a circuit may be exampled by cullet arising from bottle filling. Bottles arrive at the filling station from collection points and in due course are sent out to the same points as filled bottles. Inevitably the operation results in some damage, leaving the fillers with cullet. This cullet is simple to sort into glass types of specific recipes, ideal for remelting to new bottles for re-entry into the distribution cycle. Filling companies should be encouraged to play an active part in the revitalisation of the glass industry if only to reduce their bottle costs by being partner to the glass remelting.

12. Concentrated distributed waste may be exampled by paper waste at supermarkets. A survey is needed to establish how much waste is generated by individual supermarkets and to discover the best outlets. Possibly the easiest system for supermarkets is to form some arrangement with a voluntary organisation for the collection.

13. Widespread distributed waste is exampled by urban rubbish. This has been dealt with in previous paragraphs. As a division of waste it is the most difficult to collect and is most likely to be in a condition which makes it of low value.