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DEVELOPMENT PROGRAMME FOR PACKAGING IN KENYA.

A Report to the Government of Kenya Ministry of Commerce and Industry

Prepared by
ALLEN JONES

INDUSTRIAL SURVEY AND PROMOTION CENTRE
AUGUST 1974

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August 1974

DEVELOPMENT PROGRAMME FOR PACKAGING

KENYA
DP/KEN/70/521/11-07/E/15(07)

Project findings and recommendations

Terminal report prepared for the Ministry of Commerce and Industry.

by

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United Nations Industrial Development Organisation
acting as executive agency for
United Nations Development Programme

The expert was located in the
Industrial Survey and Promotion Centre
Ministry of Commerce and Industry
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INTRODUCTION

Kenya has promoted industrial development during the past decade. Further industrial development is intended alongside agricultural developments. Packaging has grown rapidly and is likely to grow at an accelerated rate during the next five years. The growth has been related to imported packaging materials which have now become a serious import liability. It has become highly desirable that material growth in packaging is reduced and that domestic materials are favoured in package designs.

GNP in the monetary sector is K£ 581 and there is a development plan for 1974-8. This specifies rural development, diversification and balancing of the economy and export growth. It also implies more association of public capital with private capital. This survey has aimed to follow the pattern of the development plan but education in packaging has been added as a subject for attention.

The project was located in the Industrial Survey and Promotion Centre, which is self-descriptive and contains a team of experts. Packaging had not seriously been examined before, although UNECA had examined paper and woodworking. Hence, although specific proposals have been formulated in this report it is in essence a platform for policy and feasibility-study activity.

The project dates from April 1973 in the Ministry of Commerce and Industry. Candidates were submitted in September 1973 and briefing of the present expert was on 16th April 1974. The objectives as set out in the job description were:

1. assess those local industries which are or could become consumers of packaging media and their present and future requirements in packaging.
2. assess the present and future demands, both domestic and foreign, according to the type and quality of the packaging material.
3. review the present level of development of the packaging industry, considering its present and future trends.
4. analyse the present manufacturing processes and recommend the type and extent of development and improvement needed.
5. prepare a programme for the implementation of proposed developments and rationalisations for those branches of the packaging industry which appear technically and economically justified.
6. recommend the type and extent of further technical assistance required for the implementation of the development programme.
7. complete and discuss the preliminary report with the Government.

This job specification presumed that sections of packaging can be quantified in isolation. In fact, packaging depends on products for its trends and volumes. Any fact or opinion in this report is therefore sensitive to modification by product change, including crop glut or famine from seasonal climatic favour or misfortune.

Also, the world economic situation has dist ed prices and volumes of packaging materials, making any forecast suspect. The project was for four months dated 16th April 1974 to 16th August 1974 and was completed according to the work programme.

Summary of Conclusions

Packaging growth rate is high (13 percent increasing to 20 percent) with most of the materials expensively imported. A paper mill is almost productive but another paper mill is required rated according to available raw materials - probable non-wood and including waste paper. A collection/utilisation system for waste paper is needed, which should include semi-rural small-scale pulp moulding. Development of shrinkwrap is advised to reduce paper demand and assist product developments. The world jute situation could adversely influence Kenya and there is need to discover and develop domestic fibres, at the same time introducing plastics tapes for sacks. To anticipate requirements in 1979/80 a trade association is required and it is advised to institute a research institute in the existing educational system. Packaging in non-urban locations needs to be developed including pallet manufacture. The glass situation is satisfactory but a second can maker might be justified by 1980. Common plastics should be encouraged but specialties discouraged other than very thin film. A development programme needs to comprise a short-term programme to offset current world economic disturbance of raw material supply, with a longer term programme aiming to sophisticate packaging by 1980 with an effective balance of raw materials, processes and distribution of skill. Technical skill and conversion capacity are available from domestic industry but there are problems of investment and cash flow. If the raw material situation can be rationalised the packaging industry will be capable of meeting demands, although future packaging patterns depend on product developments, including w products not yet examined or agreed. Improvements in handling are required and will influence packaging.

Authorities other than the Ministry of Commerce and Industry who would be involved in the proposed programme include:

Kenya Association of Manufacturers
Kenya National Chamber of Commerce and Industry
Kenya Export Promotion Council
Bureau of Standards
Industrial and Commercial Development Corporation
Management Training and Advisory Centre
Kenya Industrial Estates Ltd.

Amongst Ministries the most important attention is required from the Ministry of Agriculture. The references to education concern the Ministry of Education.

Work Programme

The expert was located in the Industrial Survey and Promotion Centre, Ministry of Commerce and Industry, on the 20th April 1974. During the first week a broad plan was outlined with progressive study of major products, study of packaging availabilities, estimation of needs, and delivery of a draft summary of a report for comment by 1st August 1974. Final delivery of a report was estimated r August 7th to give time for any further comment.

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Discussions were held not only with industry but also with retailers, supermarkets, farmers and others including delegates to a Social Welfare Conference in Nairobi at that time. Amongst the many respondents were:

Kenya Meat Commission
Uplands Bacon Factory
BATS
Kenya Co-operative Creameries
Trufood
Nairobi Flour Mills
Kenya Breweries
Bamburi Portland Cement
Uganda Coffee Marketing Board
Metal Box
East African Packaging Industries
Printing and Packaging Corporation
Maize and Produce Board
Tetrapak
Panafric Paper
Metalplastics
Pan Plastics
ACIF
Van Leer
East African Cargo Handling Services
Easy African Paper Bag Manufacturers
EMCO (both the glass and plastic divisions)
Horticultural Crop Development Association
East African Airways
Booth Manufacturing
May and Baker

Several other respondents were contacted but were uncooperative or gave obviously biased and false information.

During July a summary of major issues was discussed with the Director of Industry and a consequent summary was discussed at an inter-Ministry meeting. These summaries have not been included in this report to avoid duplication.

A visit was made to ECA Addis to discuss regional issues. ITC was visited on the way to Nairobi from UNIDO Vienna to discuss with the packaging centre.

Contributory information was supplied by Wolpert and Jones (Studies) Ltd., London.

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Report Sections

1. Product examination
2. Package examination
3. Economic/Social Considerations
4. Development Programme
5. Summaries

Values and statistics used are those supplied by respondents and documents. Many subsequently proved to be false or to be distorted by the disturbed world economic situation. In general the year 1973/74 can not be regarded as typical, particularly where costs are involved. Consequently, this report is mainly concerned with two-stage development - the first stage being measures to overcome unanticipated problems arising from world material situations, the second stage being long term improvement of packaging including education.

Since packaging is a service industry the growth rates follow increases in supply of certain product sectors but there is additional growth in the increase of proportion of packaging in each sector. A growth of about 10 percent is necessary to compensate for population increases and export development. A growth of 25 percent is desirable for welfare improvement including bringing more of the population into the monetary sector. It is not thought likely that the full 35 (10 plus 25) percent growth will be realised. A broad study of the inhibitions and restrictions indicates a probable growth rate of 13 to 20 percent per year. During the short-term period of erratic material prices and unreliable supplies the growth rate will probably be at the lower end of the scale. Long-term development, which is seen to be after 1979, should need to account for the higher growth rate of 20 percent. 1979 is calculated to be a key year in packaging in Kenya, qualified by high rises in sacking fibre prices, reduction in plastics prices, completion of plans to improve agricultural outputs and provision of indicated semi-rural facilities for the rescue of waste paper, plus the introduction of another paper mill.

Since forecasting is almost impossible with the present world material situation it is strongly advised that a further study of packaging, similar to this one but brought up to date, is carried out in 1979. A study of mechanical handling potentials in Kenya is advised as soon as possible.

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Section 1. - PRODUCT EXAMINATION

Products examined are those likely to show packaging problems arising out of recent and future trends in material supply. The future pattern of products is uncertain, making it difficult to forecast future packaging. A few possible new product developments have been included, mainly to indicate that future packaging requirements can not be calculated only from the present product range.

Section subjects

Present demand situation

Future demand situation

Export demands

Beef, pigmeat and poultry

Liquid Milk

Dairy products

Edible oils and non-dairy fats

Processed fruit

Processed vegetables

Fresh fruit/vegetables

Cut flowers and rooted plants

Flours

Feed from maize milling

Tea

Agricultural chemicals

Knock-down wooden products

Native crafts

Textiles

Cement

Charcoal

Projected products - Water
Single Cell Protein Feed
Off-shore developments.

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Present demand situation

In this definition of the packaging picture the product quantities are recorded maxima up to 1973.

Product	Quantity	Units	Packaging Comment
Coffee	71,000	tons	Sacks sensitive to fibre situation. Paper being evaluated.
Tea	57,000	tons	Chest obsolete. Paper being evaluated.
Maize	441	th.tons	Fibre sack sensitive to fibre situation.
Wheat	242	th.tons	Fibre sack sensitive to fibre situation.
Rice	36,000	tons	Sacks sensitive to fibre situation.
Beef	210	th.head	Need for primal jointing and vacuum packs.
Sheepmeat	65,000	head	No comment.
Pigmeat	60,000	head	Packaging development inhibited by shortage of pigs.
Liquid Milk	138	th.litre	Alternative to Tetra needed. Semi-bulk or powder supply needed for Mombasa.
Dairy products			Product development held up by low milk supplies.
Wheat flour	133	th.tons	Sacks sensitive to fibre situation. Paper needs study.
Biscuits	1500	tons	Packaging development required for export.
Sugar	149	th.tons	Fibre sacks need change to paper sacks.
Beer	139	m.litre	Cans and pouches need study for throwaway market.
Minerals (waters)	38,000	litre	PVC bottles need study.
Cigarettes	3000	million	Polypropylene film needs study.
Fabrics	27	m.sq.m	Shrinkwrap needs study.
Soap	27,000	tons	Impermeable plastics film needed.
Cement	790	th.tons	Bulking needed to reduce paper.

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Future demand situation

Packaging demand follows product development. Future demands are partly those from increases in listed products, and partly those involving new products. Agricultural saturation for Kenya is of the order of ten times present output and could be reached in 30 years time. A significant increase is anticipated in the years following 1979 and this needs to be supported by output from unconventional production methods for protein foods, and by introduction of unfamiliar crops. A few potential product developments have been examined in this report as illustration of future packaging demands needing early study. Examples are:

Single-cell proteins

A pilot scheme for protein production from pond algae, marine extraction, fish farming, and carbohydrate fermentation is outlined. This would require 6 to 7 million sacks.

Feed from birds and unfamiliar livestock

Notably this could concern weaver birds and farmed rodents with meat meal as the product. Output could be unlimited but practical production could equate to about 5 million sacks.

Vegetable oils and cake feed

Kenya is suited to oil-bearing vegetation, notably sunflower. Output depends on planting but would require plastics bottles for retail units of oil and sacks for the feed.

Vegetable extracts

A vast range of extracts can be developed, including distillation products from barks. The packaging pattern is complex and can not yet be quantified.

Many more products could be outlined. It is possible that new products developed could require packaging to a value of Kf 50m per year in due course. Most of the product developments require a five-year running-in period and this new demand sector could apply in the 1979 to 1980 period. The packaging development requires a technical institute as outlined in the report. Until this institute is established it is advisable for packaging development to be by joint activity with the potential export customers and with foreign companies now developing similar products. Increased demand for sacks is indicated, possibly to 20 million/year extra sacks. Product development could be inhibited by a sack famine if domestic fibres and stretched tape are not introduced.

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Export Demands

Domestic packaging demands can use inferior qualities from semi-rural production introduced to provide benefit in non-urban societies. Export packaging requires a high level of quality which is best provided in mass production units. A packaging terminal has been proposed in this report, the intention being to concentrate packaging technology and economic production. This terminal would be mainly concerned with exports.

The following list is of products exported to values greater than 1 million shs per year.

Product	Comment
Coffee	Sack supply suspect. Paper and bulking need study. Retail packs could develop to replace semi-bulk exports.
Tea	Chest obsolete. Paper is being examined but future packaging is indefinate. Retail packs with domestic blending could develop.
Meat	Primal jointing in vacuum packaging needs development. Canned meat needs shrinkwrap.
Extracts	Plastics drums could develop for exports but there is potential in broken-bulk compounded extracts.
Cement	Bulking needs encouragement.
Tinned fruit	Cartons need replacement by shrinkwrap.
Dried pulses	Bulking needs encouragement.
Feeds	Market accepts and frequently demands tape sacks. Bulking not advisable.
Fresh vegetables	Interlayers need development using moulded pulp. Shrinkwrap needs development for air freight.
Cashew nuts	Processing needs development into tear-off cans with shrinkwrap.
Dried vegetables	Plastics film inside large (to 1 cu.m.) cartons could be developed.
Fish	Canning needs development. See Feeds for fishmeal.
Flours	Need insect-proof tape sacks.
Woodworks	Shrinkwrap needs development.
Seeds	Need close-weave tape sacks.

Other products could be mentioned but many products have their packaging dictated by export customers. The general trend should be to up-grade product values by processing, the higher product values paying for sophisticated packaging - mainly as dictated by export customers. Significant import substitution of packaging used for exports is not likely.

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Beef

Beef intake by KMC is about 22 percent high quality, 28 percent medium grade and 50 percent low grade only suitable for canning. If more high quality can be made available it is advisable to develop vacuum packaging of primal joints using techniques known to KMC. Cartons used for canned beef could be profitably improved by accurate calculation of necessary board weight and by elimination of excess paper in flaps. More benefit could come from the development of shrinkwrap instead of cartons, giving a one-third cut in packaging cost. This would require a pulp-moulded tray which could be derived from semi-rural manufacture based on Athi or could be part output from a larger pulp moulding factory using Nairobi sorted waste paper. Foreign experience, as a guide to possible economy, is that conversion from fibreboard cartons to shrinkwrap for 2.5 million cases of 24 x Al cans saved UK£ 21,500 in UK.

On a basis of 10,000 tons/year shrinkwrapped at 15,000 cans per hour the cost should be of the order of 0.7 Kenya cents for the film and 1.0 Kenya cents for the tray providing both are by domestic manufacture. Shrinkwrapped units can be stacked five-high on pallets with further shrinkwrap over the pallets for export. (See section on shrinkwrap for finer details).

Pigmeat

Pig killings at Uplands are 50 to 100 tons/week but the market could take 150 tons/week. Half the weight is frozen. The broad pattern of disposal is:

20 to 25 percent smoked and salted
35 to 40 percent fresh meat
35 to 40 percent processed.

In general terms the packaging of pigmeat is satisfactory and does not need detailing here. If more pigs can be provided there will be a need for primal jointing and vacuum packaging. The development of canning is not needed for present supplies.

Poultry

Total bird killings can not be estimated because most are local killings of laying birds. Commercial production is about 60,000 birds per year, mostly boilers. It is doubted that Kenya could compete in world markets for young (under 2-kg, selected breed) birds for export but poultry developments could bring domestic benefit. There are several small-scale producers of up to 1000/week using unsatisfactory freezing. There is also a BAT/Block Estates development for private hotel use, now rated at 6/8000 per week leading to 25/30,000 per week. No packaging development is possible outside the BAT/Block Estates project where polyethylene film in cartons is satisfactory.

Liquid milk

KCC buy in about 280,000 tons/year of which 97 percent is suitable for packaged liquid milk distribution. Kenya has migratory cattle producing 250,000 tons/year and non-migratory cattle producing 320,000 tons/year (taken from the Milk Packaging study by this expert in 1972).

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Broadly, KCC take half of total available milk and package half of their total intake for drinking milk. There could be development of liquid milk sales using UHT processing and alternative packaging to the present Tetrapak.

Nairobi has obsolescent handling facilities intended for 15,000 gals/day but running at 50/60,000 gals/day. A new creamery is needed and, to diversify, this should include sachet and plastics bottles packaging alongside Tetrapak. A new creamery is also needed in the Mombasa area rated at 60,000 gals/day including UHT milk and a mixture of packaging types. At present milk is shipped Nairobi-Mombasa in Tetrapak, and this should be replaced either by bag-in-box or by dried milk for reconstitution with blending in local milk. A general re-organisation is needed along the lines of:

1. Increase Tetrapak facilities according to local and export demands (Uganda) in the cattle areas. Possibly three new units are required.
2. Install a new creamery at Nairobi rated at least to 60,000 gals/day, with facilities for packaging in Tetrapak, sachets and bottles (plastics). In this the market for one-litre units should be sounded for the eventual distribution of half-litre in Tetrapak, one litre in sachets and UHT in plastics bottles.
3. Ship milk from Nairobi to Mombasa in bag-in-box or as powder for reconstitution, relating the cartons used to a repulping facility in Mombasa.
4. Develop a new creamery in Mombasa rated at 60,000 gals/day using UHT and one-litre units in sachets and plastics bottles, half-litre in Tetrapak. A market study of milk out of Mombasa is required to include local supply, ship trade and export. Export trade in plastics bottles could develop similar to that of Spain to North Africa.

Bag-in-box and plastics bottles are detailed under their own section-headings.

Dairy Products

At present there is a shortage of milk arising from killings after the drought. Manufacturing milk is now only 40 to 45 percent of intake but it could be increased. Notably, the excellent cheeses could find export markets and there should be development of more milk powder. Present packaging for powder is cans and polyethylene film. There are many small-scale bulk-breakers in the market and this brings a risk of contamination. It is advised that powder packers should be licenced and exclusively provided with approved identified film bags, uncertified filling being illegal to prevent infection and contamination.

Edible oils and non-dairy fats

Almost all liquid table oil is sold in large tinplate cans. Neither the local consumption habits nor the available purchase patterns encourage small retail packs. There is no doubt that Kenya could develop oil-bearing vegetation for import substitution and for export.

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Sunflower development is vital and it could be the origin of exported oil and local feed. For exported oil it is advised that plastics bottles are used to conform to established retailing patterns, but the economics of such a development depend on cropping plans. Blowing units are rated at 600 to 2000 bottles per hour with considerable variation of final per-bottle cost. Location should be in the seed-crushing area and be allied to a feed development for the non-oil fraction.
(See section on blown plastics bottles).

Solid fats are by tradition in tin cans, which are suitable for delayed distribution. In due course a rapid distribution system will develop and this should be anticipated by a study of wrapping systems for solid fats. More important, part of the development of vegetable oils should be of semi-solid margarines using thermoformed plastics tubs. Whilst large-scale thermoforming of tubs is feasible the market in the early stages needs semi-scale production. The best system is top-forming, a combination of injection and forming developed for this type of market. Top-forming is detailed under its own section-heading.

Processed fruit

The quality of fruit in Kenya is lower than it should be and there is need for product development specific to processing and packaging. Del Monte found it necessary to cultivate their own pineapple and there is justified opinion that future fruit developments must be through integrated cropping/canning complexes.

It is advisable that alternatives to canning are developed, partly to diversify offerings to world markets but also to reduce tin-can imports. A study is needed of dehydration, low temperature, and chemical preservation including fermentation and sugar addition. The packaging requirements for such non-canning systems change constantly and no comment is justified here because it would be out of date by the time systems developed. Exports of existing wet processed fruit need cans and they need to be accepted as essential imports.

Processed vegetables

Processed vegetables also need cans. Dehydration and the allied compounding of soup powders could develop, which would demand sachet packaging using sophisticated plastics laminates, the most profitable market being retail packs originating near the dehydration facilities. The technology is known in Kenya and such packaging will follow product development.

Fresh fruit/vegetables

The value of agriculture in Kenya rose 20 percent in 1973 and again in 1973. Analysis shows, however, that much of the increase was due to rises in coffee and sisal prices. General agriculture showd comparatively little improvement of weight or value. Improvement could come from product development and better attention to packaging, both inhibited by lack of development capital arising from the market. Only about 10 percent of the domestic market can afford to pay higher prices for products, whilst export markets face stiff competition from West African and Mediterranean suppliers.

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Even when Suez Canal opens Kenya will have a distance-disadvantage where deep-water sea travel is involved. Air freighting of exotic and out-of-season vegetation should develop with fresh fruit and vegetables but benefit from common crops would appear to depend on processing.

The indicated developments required are pulp-moulded inter-layers for boxed products and shrinkwrap associated with pulp-moulded trays for air freight. More wood could be used instead of paper for a few hard-skinned products such as avocado. In general, however, improved packaging will not bring significant benefit until the quality of production is satisfactory, and even then will not solve the marketing problems.

Cut flowers and rooted plants

There is marked growth potential in flowers and living plants shipped as air freight. Tough flowers travel well as layers in cartons but Kenya would be well advised to concentrate on exotic blooms which would not find competition in glass-house cultivation in temperate climates. The packaging of such exotic blooms is being developed and the present emphasis is on inflated plastics bags, including inflation with special atmospheres. This needs discussion with potential customers.

Perhaps more profitable, there is a large market for young plants now reared under glass in temeperate climates - notably tomato, cucumber and peppers. This is March-May seasonal trade and there may be complications relative to disease transfer. Shipment is mainly as washed soil-less seedlings direct to nurseries for planting out for sale. Polyethylene bags in paperboard cartons appear to satisfy requirements but this market needs discussion with customers.

Flours

Comment below refers to maize flour or sifted meal but the remarks apply to other flours. Maize is supplied for milling in jute sacks priced at 4.50 shs with a recovery value of 2.10 shs. It is held for probably 10 to 15 days. Handling is geared to sacks and bulking would require the provision of silos. Conversion to paper sacks would be expensive with a 60 to 70 percent increase in direct handling cost. Since paper sacks have no re-use value, paper sacks would cost 2 shs per 20 kg. unit instead of 2.4 (4.5 less 2.1) shs per 90 kg. for fibre sacks. Conversion from fibre sacks to paper sacks would add about 7 Kenya cents per KG. to the selling price of flour.

The breakdown of maize millings is into 1st. grade into 2 Kg. paper bags, 2nd. grade into second-hand jute sacks, 3rd. grade into either second-hand jute sacks or 20 Kg. paper bags. Milling costs through 1973 and 1974 to July have risen:

Maize costs	-	15 percent
Energy costs	-	30 percent
Labour costs	-	20 percent
Paper packaging costs	-	100 percent

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Meanwhile selling prices for end-product have risen only 18 percent. There has been inevitable effort by millers to use more second-hand jute, less paper. Direct study of user-conditions shows that the 2 Kg. paper bag is ideal for the market. Paper from Broderick Falls is not likely to meet strength requirements other than by the introduction of reinforcing fibres (polypropylene filaments) in their inextensible kraft. The use of imported bag kraft seems inevitable and it also seems unavoidable to subsidise this special section of the bag market, resulting in effective 1973 prices of 60 cents for 20 Kg. bags and 6 cents for 2 Kg. bags. Meanwhile, Broderick Falls should be encouraged to develop reinforced versions of their inextensible kraft. The Broderick Falls mill is discussed under its own section-heading.

Feed from maize milling

Extraction rates are with 18 percent of original maize becoming feed. Selling is direct and is in second-hand jute sacks, probably essential for the manual handling involved. Prices are flexible and there would be advantage in the introduction of tape sacks. An insect-proof close-weave tape sack would reduce biological losses and extend storage periods. A tape sack using 14 x 14 inch count with 2.5 mm. tapes is advised, costing probably 2.5 shs each with some re-use value to be determined.

Tea

Conventional tea packaging is in ply chests which require careful selection of the wood to prevent odour contamination. The standard cubic chest is not satisfactory for stacking or handling and it is expensive. The probable lowest cost of chests in Kenya is 14 shs each with very little recovery value. The tea trades accept transit of lower-grade teas in lined hessian but most of their efforts towards economy have concerned palletisation. Previous trials have shown that lined tape sacks will carry tea with very little damage and sisal sacks have been shown to not produce odour contamination.

If chests need to be retained to satisfy convention it should be possible to devise low-cost board. Notably, waste tea fibre is of interest with sial reinforcement, using shrinkwrap on pallet-loads to compensate for the low strength of such boards. Paper packaging and jute may contaminate by odour development particularly in damp storage which may encourage fungi. If sack packaging is accepted, jute needs to be avoided but sisal may be applied to large 100-200 kg. units. Common polyethylene film bags and Valeron film would be suitable but the breathing rate would have to be adjusted without allowing penetration of moisture. This is comparatively simple by providing punctures according to the intended storage and conditioning period. If paper is used it will be necessary to use a liner of 100 or 250 g., although this will not prevent odour contamination from glues, printing inks and wet-strength agents in the paper. It is safer to concentrate on synthetic sacks using selected odour-free polyethylenes, either as simple film in cage pallets or as woven stretched film or Valeron if fairly brutal handling is expected or pallets are in poor condition.

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The woven stretched tape film would need to be either common weave (11.5 x 11.5 inch ends) with a thin liner for controlled permeability or a tightly-woven fabric at more than 14 x 14 inch ends. There would be advantage in studying macro-sack packaging for tea if the tea is to be blended in the export market.

There would be economic advantage in blending and bulk-breaking tea in Kenya. Despite claims by tea retailers, most consumers are not concerned with broken-leaf proportions or fine differentiations of flavour - and a large fraction of the market is in catering tea where any preferences by the consumer are mainly ignored. It would be preferable for Kenya to develop estate-branded blends after due investigations of the market requirements. In effect, this would create a demand for more high-quality paper and would therefore be against one major intention in this report. On the other hand it would transfer activity from foreign markets to Kenya labour and could be labour-intensive rural industry. To simplify marketing and to avoid the extra demand for high-quality paper it is proposed that Kenya examine for the time being only catering tea, in one kilogramme units using odour-free polyethylene film from local supply. The marketing can be either through existing tea traders or direct to larger retailing organisations in export countries, and through the developing cash-and-carry outlets in Europe.

Agricultural Chemicals

About 11 percent of total land area is cultivated, about half as large farm units and half as small farm units. 12 percent of total land is listed as high-potential, 5 percent as land which could be improved using present technology. Primary production of fertiliser is very low, the 150,000 tons demand being met by blending imported primaries. Imported fertiliser is mainly in tape sacks which handle well and offer no problems in stacking. Subsequent compounds are mainly in polyethylene lined hessian serving four potential market sectors:

1. Sophisticated farms which could use film sacks and may adopt silo handling.
2. Concentrated farming communities which could use second-hand tape sacks from central depots.
3. Semi-concentrated farming communities which could use reduced-size tape sacks.
4. Isolated farms which would ill-use fertiliser and where a soil-improvement service is needed, not direct supply of fertiliser.

The fertiliser supply is roughly 40 percent seeking nitrogen, 40 percent seeking phosphorus, little seeking potassium. It should be possible to develop marine sources of nitrogen and phosphorus for land improvement but the extent of such import substitution needs to be evaluated. Weed clearance from static waters could also provide nitrogen and also help in reducing bilharzia snails. Urban waste and sewage is another source worthy of examination. It should be possible to develop domestic organic fertiliser sources to at least take care of growth including the heavy demand likely if hybrid maize is further developed. Urea manufacture is possible for fertiliser use and for cattle feed addition.

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Schemes for domestic organic fertiliser could take three years to become effective, by which time the demand would have reached about 200,000 tons/year. During this period fertiliser use should have spread evenly amongst the farm types but about one-third of the land needs water before fertiliser can be effective. Water supply could take three years to materialise and this land area can be regarded as a potential target for fertiliser after 1977. Hence the probable packaging (1977) demand is about 1.5 million conventional 800 g. polyethylene film sacks, 1.5 million second-hand tape sacks taken from compounders and 3.0 million 25 kg. tape sacks made for the application. The tape sacks would require 250 g. polyethylene film liners. There is also a demand for re-use plastics bucket type containers for small lots of fertiliser but this outlet would be better served by a mobile unit applying fertiliser as required from semi-bulk stocks. Meanwhile the market is best served by re-using tape sacks from the compounders with film liners. After 1977, or when the various mentioned developments have influence, there should be domestic supply of organic fertiliser but there should also be extra demand from land then provided with water. In theory, these should compensate to result in a steady demand for 200,000 tons of blended synthetics with the potential of reduction as more organic fertiliser develops.

Fertiliser supply should be integrated with the supply of other agricultural chemicals, many of which are toxins. The packaging requirement is mixed and sophisticated, calling for a detailed study in association with suppliers. Amongst the many package types needed are:

1. Water soluble films or papers for individual dose quantities.
2. Non-refillable plastics containers such as squeeze bottles for liquids.

In general, such packages can be developed by suppliers but there is a social problem to be overcome. It is vital that substances are correctly applied, which means the provision of a service in which application is by a visiting expert, not the farmer, or the provision of clear instructions which emphasis on the danger of disobedience. This is a problem of education and language which must be solved to prevent personal damage and damage to the environment. Progressive replacement of synthetics by organic fertilizers must be encouraged, and efforts must be made to reduce the weight of toxins fed into the agricultural sector. It is common for at least 25 per cent of applied chemicals to reach waterways as pollution.

Organic fertilizers are either wet or dry. The wet versions can be provided with preservatives for travel but are mainly of value for instant application using drums or tankers within easy reach of the supply. Dry versions require dehydration at a probable cost of of about 200 shs. per ton and can then be packaged as for synthetics.

Urea is a special chemical in that it is a combined fertilizer and feed for ruminants. The packaging required would be new lined tape sacks. It would not be difficult to find outlets for urea to take a full tape sack line of 5 million tape sacks if domestic and export demands for urea are analysed.

.../16...

Knock-down wooden products

The timber situation of Kenya has been well investigated and is seen not to use wood to full advantage. (see - Survey of Secondary Woodworking Industries in Kenya, UNECFA March 1974).

There is available large volumes of timber and cut wood which is outside the dime ranges of markets, but qhich could be applied to local industries fabricating knock-down products - notably furniture, toys and pallet members. These would only be fully economic if fabrication was in the wood-cutting areas, quality wood being passed into existing trade, off-sized quality wood being converted into knock-down products, lower-quality wood being used for crating, lowest-quality wood being used for fuel, chips and sawdust being used for board or fermentation for feed or alcohol. The greater part of tree volume is suited to local carpentry but local fabrication involves high freight cost and high transit damage. Hence there is a need for local production of knock-down structural members, collation into reasonable shapes of packages, assembly elsewhere (including in export countries). The size of available wood determines the type of knock-down product - pallet members and crate sides from the largest, furniture members from medium sizes, toys from small offcuts and plank trimmings. In this report on packaging the main interest is in the pallet and crate side members.

Pallet members need seasoning to suit the range of anticipated climates. Timber needs to be softwood capable of holding screws - any design of pallet should avoid nailing because most damage in transit on undamaged pallets is from nail heads, making it important to use sunken screw heads preferably with round-head screws. The final analysis of pallet cost depends not on initial pallet price but on length of life and on the potential damage inflicted on goods. Hence Kenya should aim for a very high quality of apallet at a higher price but with a higher quality than that now accepted in trades.

Crate sides can use lower quality wood but it should be appreciated that after-use of crate wood in Kenya benefits the national economy. It is therefore worthwhile up-grading crate wood by efficient selection and seasoning where destinations are local. There is a need for wood recovery so that crates can be broken down for re-use in toy knock-down products.

It will be appreciated that in any effort to fully-utilise available timber there will be more small units than large units. Hence the pattern of output of knock-down products should emphasis toys, followed by furniture and then pallets and crate sides. The common development for knock-down products is shrinkwrap and there would be advantage in collective packaging so that equipment and energy would be better employed. Shrinkwrap is detailed in this report but it can be added that a collective shrinkwrap centre would need to handle about 100 units per hour to be economic. On the basis that it may take a semi-skilled worker a full hour to produce a unit it is doubted if shrinkwrap would be justified for this industry alone. It is better to regard carpentry as one rural industry sharing shrinkwrap facilites.

.../17...

Native crafts

It is impossible to calculate the value of native crafts. Recorded wood carvings are valued at about half a million Kenya pounds from about 500 recorded suppliers. Skin products and other products would probably double this value and there is to be added some significant tourist direct trade and unrecorded traffic. The industry is probably worth about Kf1.5 million but a much higher figure is possible. One exporter claimed Kf 700,000 turnover all for export and the estimate of total business could well be nearer Kf 3 million.

The sector presents a difficult problem because the items vary and there is a need for visual inspection per item for sale. There is no benefit to be gained in sophistication of original packaging but the economics of storage and export need attention. Common export packaging is corrugated paperboard cartons, large at 495 x 445 x 317 mm and twice as many small with varied dimensions. Outer packaging is wooden crates and the comments in this report concerning Wood are to be noted. Crate production in the wood-carving areas could comprise rural development.

The heavy cartons are supplied made-up and there is a six month limit to the stock which can be held waiting for filling. There is reported delay in export shipment because (it is claimed) suppliers of cartons gave preference to larger orders for cartons during a (claimed) paperboard shortage. Carton prices listed rose 25 percent in October 1973 and 51 percent in April 1974. A typical small carton rose from 2.50 shs to 3.50 shs to 5.25 shs according to purchasing records, which is 40 percent followed by 50 percent increase. Large cartons rose from 4.50 shs to 5.15 shs to 7.73 shs according to purchasing records, which is 12 percent followed by 50.4 percent increase. There appears to be clerical error or mispricing.

Broadly, the extra carton cost puts slightly more than 10 percent on selling prices and there is already reported price rejection in some export markets. On the other hand export countries are showing rejection of luxury goods regardless of the price and a subsidy on exported native crafts would not by necessity recover the market. Foreign quotations for similar cartons can be exampled by one comparison of:

shs	FOB Europe	Kenya supply
	2.82	4.72
	0.99	1.82
	1.12	1.69
	2.01	3.84

Allowing for CIF conversion of the FOB prices there could be a saving of 50 percent on carton costs by importing. In national terms this represents a 10 percent levy on exported goods fed into local carton manufacture which exporters regard as unjustified support of one industry by another - at present to be identified as support of an import-based industry by an industry using domestic raw material.

The cartons become soft in storage before shipment and second packaging is needed. Customers use the export cartons for their own storage and demand only heavy board. Export rebate is only on the second cartons, which exporters also regard as unjustified.

.../18..

It appears necessary to introduce one-package storage and shipment. Reference to the section of this report on Paper indicates that it is desirable to eliminate or reduce the paper content. It is doubted that reduction of packaging cost is essential for marketing (10 percent inflation of selling prices is notunusual in the present inflationary world situation) but a reduction of packaging material and labour would be of benefit.

Shrinkwrap would not provide satisfactory mechanical protection but it could be used to reduce moisture absorption of paperboard. Alternatively, waxed or otherwise waterproofed board could be used for the cartons. The problem is that items may need inspection and re-grouping before shipment and one-package storage and shipment may not fit into handling techniques. The obvious answcr to the storage deterioration problem is for exporters to use open-bin rigid storage and only package against orders. Open-bin storage is said to increase damage to items with damage levels worth more than the extra cost of storage in packages.

This sector appears to offer a market for air-bubble cushioning sheets as described in the report section on Cushioning. This would reduce mechanical damage and also reduce surface damage from abrasion - and would reduce the export package size (or get more items in a crate). With such a mixed cargo it is not possible to relate the cost of introduction of sophisticated cushioning to the value of damage-reduction and volume-reduction. Using the cushioning as interlayers the demand could be of the order of 1 square metre per carton - possibly 20,000 total square metres per year of air-bubble sheet.

Textiles

It is doubted that Kenya can compete in world markets with textile fibre, yarn or fabric but there is profit to be gained in made-up textiles. The packaging in this market is dictated by retailers with current emphasis on high-gloss plastics films plus rigidboard stiffening. Made-up goods for open display and hanging in shops are mainly supplied in simple polyethylene film dust covers. To anticipate made-up textile developments there should be production of high-gloss polypropylene film, a material also of interest to the cigarette trade and in general luxury over-wrapping.

Cement

Output is of the order of 400,000 tons of which 100,000 tons are supplied bulked. Bulking is into leased 20-ton silos and more paper could be saved by the introduction of 5-ton silos. Bagged cement is in multiply paper, 3 million paper sacks of 3-ply and 3 million of 4-ply. Study of user quantities indicated that the proportion of bulked delivery could increase to 60 to 75 percent over the next five years. By then, output of cement could have reached 900,000 tons, calling for 12 million paper sacks. Increasing the proportion bulked from 25 to 60 percent would save 4.2 million paper sacks.

.../19..

If Broderick Falls mill supplies only inextensible kraft it will be necessary to add an extra layer to the multi-wall paper sacks, adding about 25 percent to the demanded weight of paper. Non-wood paper from the proposed new mill would also make an extra layer necessary. Since there will not be unsold paper from domestic production, and since the introduction of low-strength paper into cement bags would complicate the situation, it is advised to use imported extensible kraft for cement and develop bulking by price adjustment and possible subsidy on silo costs.

Charcoal

Charcoal sakcs are an essential component of Kenya society and must be fabric or tape. Roadside retailers sell the sack at 3 shs and city retailers sell the sack at 2 shs or 3 shs. There are some 10 million multiple-hand sacks in circulation and a famine of multiple-hand sacks can be expected by 1979 (selling prices are already double the correct value of 1.5 shs). A tape sack plant is justified to provide 5 million new sacks for charcoal at an estimated 3 shs each in 1979 with possible introduction of sacks from domestic fibre after about 1980, when the tape sack line can be applied to other demands such as agricultural chemicals.

Water

The packaging of water could become a major consideration for Kenya. By the year 2000 Kenya will probably have reached the limit of agricultural growth within the restrictions of productive land. Controlled water supplies will be essential for the three major sectors of agriculture, industry and personal consumption. By far the greatest drain on supplies will be industry including energy production. It will be essential to programme water through industrial use to personal use and then to agriculture. Industry will become partly a source of goods and partly a means of processing water for human use, in which it will become fouled and can be fed into agriculture - this movement being divided into slightly-fouled for stock watering and fouled for irrigation. This control of water requires transport including packaging. Exported water may become significant from Lake Victoria, which is understood to replenish supplied from underground sources, but the main consideration is domestic demand. Packaging requirements are bulk tankers instead of pipes and packages for personal water. The trends involved are progressive and there is no virtue in Kenya waiting for a situation to develop as has developed in some developed countries. (Norwegian bottled water is bought in Holland at prices higher than those of milk).

Presuming that Industry accepts responsibility for water purification there will be two main types of personal water required. Sanitation water can be fed into existing piped supplies but there is little virtue in using sweet pure water for toilets and washing. There is advantage in using piped domestic water as an instrument of distribution of bactericides and fungicides, particularly if the after-use is agricultural. Selected social groups may benefit from personal piped drinking water but the emphasis needs to be on packaged water using semi-bulk and individual doses.

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The subject is being given intensive study world-wide, present concentration being on blown plastics, bag-in-box, returnable tapped drum delivery and the design of special demountable tankers.

It is not possible to detail the specific Kenya requirement without study of the distribution of population. In this respect there are forecasts that the drought line will continue to move southwards and Kenya may be required to take urgent action long before the mentioned critical year 2000.

Single-Cell Protein Feed

The packaging of feed is a potential development needing special mention. Single-Cell protein is concentrate which can replace conventional feed components and can therefore be a factor in agricultural development where animal production is likely to be inhibited by low crop production. In Kenya, crop production is limited by lack of water and there is potential benefit to be gained in protein production outside the common agricultural environments. Notably, there is a problem in the northern areas where much of the available water is seasonal and brackish. To provide some idea of the potential packaging requirement the following hypothetical pattern of production is proposed.

SCP can be from hydrocarbons, carbohydrates, or other carbon sources, using yeasts, bacteria, fungi or algae. Production in Kenya would be economic using sugar-cane waste, cassava or other agricultural carbohydrate, or carbon dioxide enrichment of brackish water. At first sight a project could be carbohydrate fermentation, algae production and sea-fish farming in the Tana/Lemu area, and algae production with fresh-fish farming in the Lake Rudolf area - both with simple fish-meal production. In theory, this should encourage migration out of the arid regions but a long-term project could be seasonal algae production in the Isiolo area with a view to water purification through algae and fish.

UNIDO document ID/WG 164/13 indicates Kenya meat availability at 55 g/caput. Subject to water availability there should be increase of about 50 g/caput, which on a projected population of 15 million gives a meat target of about 0.5 million tons. Using a high conversion ratio because not all Kenya cattle could be converted to feed-lot rearing, the total feed compound requirement might be 5 million tons including a high proportion of non-concentrates. Of this, 20 percent or 1 million tons could be SCP but much of this could be made un-necessary if sunflower meal or similar develop. On the other hand, if part of the SCP was used for fish farming to fish meal, the balance would be restored and 1 million tons/year is not unreasonable. Accepting that development might be only 10 percent of the ideal, the SCP packaging requirement is for 100,000 tons. Taking a more optimistic view of 15 percent development the requirement is for 150,000 tons but this is doubted. For the purpose of this examination three projects are imaged - one at 30,000 on carbohydrate fermentation and two algae projects rated at 40,000 each leading to fishmeal from seawater and freshwater farms.

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If the carbohydrate fermentation is in the Tana/Lemu area it can manufacture not fully converted SCP protein but upgraded carbohydrate to 15 percent protein, giving a packaging problem for about 200,000 tons of feed to encourage dairy developments or beef in the eastern areas. Movement of the carbohydrate for fermentation would not require packaging because it would be urgently-used cassava pulp or sugar-cane waste. On a basis that about half the algae production would be for direct feeding of fish farms, the packaging requirement for the algae would total two lots of 20,000 tons - 40,000 tons to be carried into the arid regions.

The up-graded carbohydrate could be dried down but the climate would re-moisten within hours and it would be economic to use the feed rapidly, calling for fairly-open weave sacks. The algae produced in the Tana/Lemy area would need drying down but sun-drying could be used for the Lake Rudolf algae. Final dehydration would be in the arid areas by natural conditioning, calling for a breathing sack which would exclude insects and rodents in long storage. Hence, the sack requirement would be 4 million at 50 kg. of close-weave tape. Fibre would not be suitable for delivery of algae feed. Alternatively, the algae feed might be compounded in the production areas, in which case the sack requirement relative to algae protein would be about 2.5 million close-weave sacks.

Overall, this potential feed development could justify 6 to 7 million more sacks. The hypothetical plan described above would obviously need modification but is outlined to arrive at a possible pattern of quantities.

The long-term possibility is algae and farmed fish in the Isiolo area where the problem is said to be over-availability of seasonal brackish water. Such water can be converted into stock-watering water by algae and fish production. Protein productivity of algae is some 300 times that of beef cattle, about 20 tons/ha./year or perhaps half this in seasonal production. An economical project would combine algae protein for human diet, algae protein for cattle feed, cleaned water for cattle watering, pool fish farming for human diet and for primitive fishmeal feed. Such a complex would need concentration and the packaging requirement would be almost nil. Almost all movement could be in semi-bulk vehicles.

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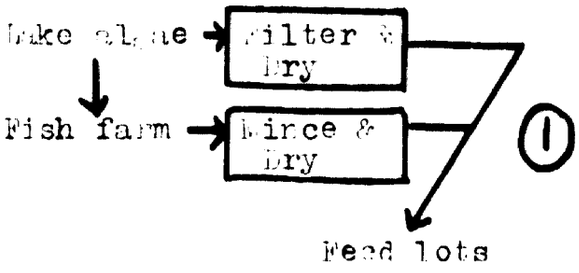
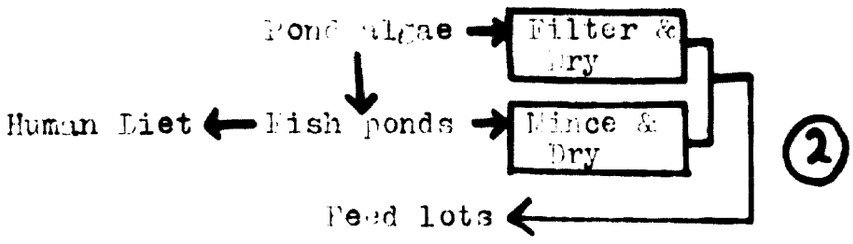
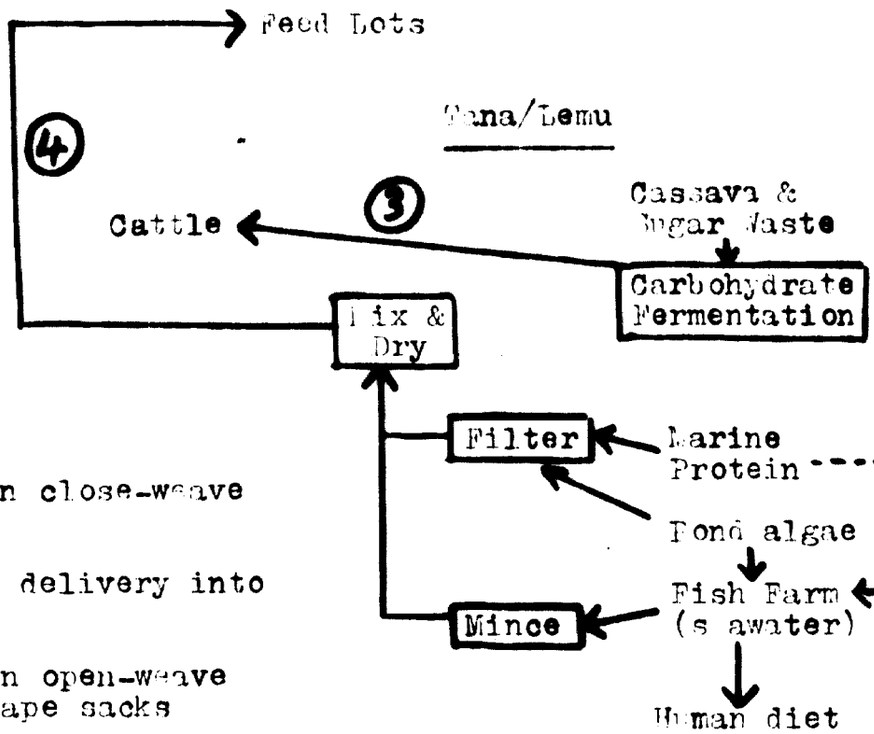
Lake Rudolph



Isiolo





Packaging

1. 0.4 million close-weave tape sacks
2. Unpackaged delivery into complex
3. 4.0 million open-weave fibre or tape sacks
4. 0.4 million close-weave tape sacks

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Off-shore developments

Presuming that a 200-mile limit will later be agreed for national rights, the off-shore waters of Kenya have probably 8 to 10 times the bilogical potential of land in Kenya. It is inevitable that international finance will become interested in development, bringing new packaging demands to be anticipated. Part development is within the resources of the Kenya economy and should be anticipated as nuclei for later high-capital development.

Conventional fish

At present much of the fish harvest is taken by foreign ships for packaging overseas. It has been mentioned in the report that a canning development on the coast for fish would be of benefit. It is further possible to fish-farm inshore waters using algae feed encouragement as mentioned in the section on single cell proteins. 10,000 tons of algae feed was mentioned for marine fish-farming for fish-meal, which is the easiest because all the fish reared can be used. Fisheries Department may have the opinion that fish for human diet should be reared, in which case the harvest from 10,000 tons of algae feed would be about 500 tons/year of table fish and 500 tons/year of waste and small-fry for meal. The sack requirement for fishmeal has been accounted. It is doubted that the domestic market could rapidly absord an extra 500 tons of table fish and this is presumably to be added to the canning demand already accounted.

Unconventional fish

Research abroad has shown waters to contain unconventional fish in quantity at least equal to that of conventional fish. Market development would be difficult for the landed fish and the only sensible outlet is in processing. According to the bone content and flavour, a proportion can be minced for fish flour for human diet. At this stage, since the movement of Peruvian anchovy has resulted in a shortage of fishmeal, it is advisable to place the total unconventional fish catch in meal for stock feeding with a total proteins-for-humans yield of about 10 percent. Coastal estimates of probable yield are remarkably vague but it should be possible to take at least 1000 tons/year out without disturbing the ecological balance.

Shell-fish

Estimates of available shell-fish are extremely vague. It would probably be advisable for Kenya to develop shell-fish farming using proven towed-rope techniques. It would not be difficult to establish systems of yield 1000 tons/year. Shell-fish require early consumption or preservation and this development would add another 1000 tons to the canning potential.

Plankton

Plankton is the most reproductive fraction of marine life and is being studied in detail in many waters. Availabilities can be encouraged by provision of organic waste which breaks down slowly. Extraction can be heavy because reproduction is rapid. Total availability needs to be studied by the Fisheries Department. Processing is by drying and then sacks for use in feed.

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Section 2. - PACKAGE EXAMINATION

Examination has been mainly of industrial packaging materials which are expensive imports. Emphasis is on reduction of growth of demand. A further study would be justified aimed at growth-promotion of domestic natural packaging materials, notably for domestic distribution where imported materials need to be reduced.

Section subjects

Packaging materials

Paper

Non-wood paper fibres

Pulp Mouldings

Non-wood paper investment

Fibres and sacks

Domestic fibres

Tape alternative

Tape production economics

Sisal

Cotton

Tape sack trials

Paper sack trials

Shrinkwrap

Plastics films

Tinplate

Wood

Cushioning

Large semi-bulk

Whole tree utilisation

.../25..

Packaging Materials

Total packaging value in Kenya is probably of the order of K£ 40 million with a material content of K£ 8 million to K£ 10 million. It is necessary to reduce the imported proportion of this material content and also to balance the pattern of materials used. The 1972 patterns in West Germany and UK, as representatives of developed packaging countries, are:

Percent of total material value

	UK	WG
Paper	40	45
Plastics	12	22.5
Metal	18	21
Glass	8.3	10
Wood	2.3	?
Unspecified	17.4	1.5

These patterns are dictated by the market and Kenya will in due course require much the same order of pattern for the sophisticated fraction of the market. Meanwhile, particularly whilst erratic prices disturb value patterns, it is advisable to concentrate on weight patterns.

Paper demand is of of the order of 70,000 tons with indication that domestic production will not satisfy technical or volume requirements. Plastics demand is ill-defined but is probably only about 4000 tons in packaging. Tinplate is about 18,000 tons and packaging glass is about 28,000 tons. Fibre demand is of the order of 10,000 tons including sisal. There are no records of wood in packaging and calculation would be impossible without study of the allied cane packaging. Of these only glass is presently covered by domestic production where the statistics apply. By late 1974 there will be part substitution of paper imports for packaging to about 25,000 tons. Wood developments are unlikely to influence the pattern but wood can develop for pallets.

Although a world recession might reduce the rates, there should be a general growth in packaging materials of 13 percent rising to 20 percent over the next five years. By 1979 it is probable that the above weights will roughly double if steps are not taken to conserve material by recycle systems and by the application of advanced packaging technology - which means mainly the introduction of advanced packaging education. Of imported materials, possibly 25,000 tons of low-strength paper could be added from a new mill, and there is a possibility of domestic fibre development to replace jute. Metal and plastics are unavoidable imports and comparatively little transfer of packaging into glass is possible. Most of the recommendations in this report require a running-in period and are concerned with eventual reduction of national packaging cost after five years, which could with inflation and growth reach a disturbing K£40 million for materials only if steps are not taken early.

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It is to be appreciated that the non-materials fraction of total packaging cost might increase to Kf 60 million during the same period. This can be reduced by selective elimination of unit packaging, as in bulking cement or granular inert products. More palletisation would also reduce the handling cost and also generate a new demand for woodworking industries. There could also be economy from encouraged investment in new plant and bought technology to reduce conversion costs, calling for amalgamation of small production units into combinations and the provision of government loans with assurance of long-term benefits.

Conversely, the recommendations in this report require investment which can be expected to compensate for the non-material packaging economies mentioned in the above paragraph.

The individual materials have their own report sections. Up to 35,000 tons can be taken out of paper import requirements by repulping and shrinkwrap and a new mill could probably provide 25,000 tons of import substitution. In effect, this would result in a paper-import situation in 1979 roughly equal to that at present, economies and domestic production taking care of the growth. There could be a four-fold increase in plastics imports in five years, including that needed for shrinkwrapping. If jute shows the anticipated price increase and a natural fibre is not developed in Kenya there could also be an extra 3000 tons of plastics for tape. Tinplate growth will be related to agricultural developments with a dramatic rise after about 1980 when projects have influence. The growth of glass over the next five years has been stated as 50 percent but this is considered conservative.

The fibre situation confuses the pattern of growth. At present jute is at a low price and there would be advantage in overbuying for stock against future inflation, meanwhile developing a diversified pattern of fibres on the looms.

Much of the present value of materials is absorbed in the mechanics of obtaining. There could be significant economy in national bulk buying of materials with subsequent re-sale to converters through a domestic agency.

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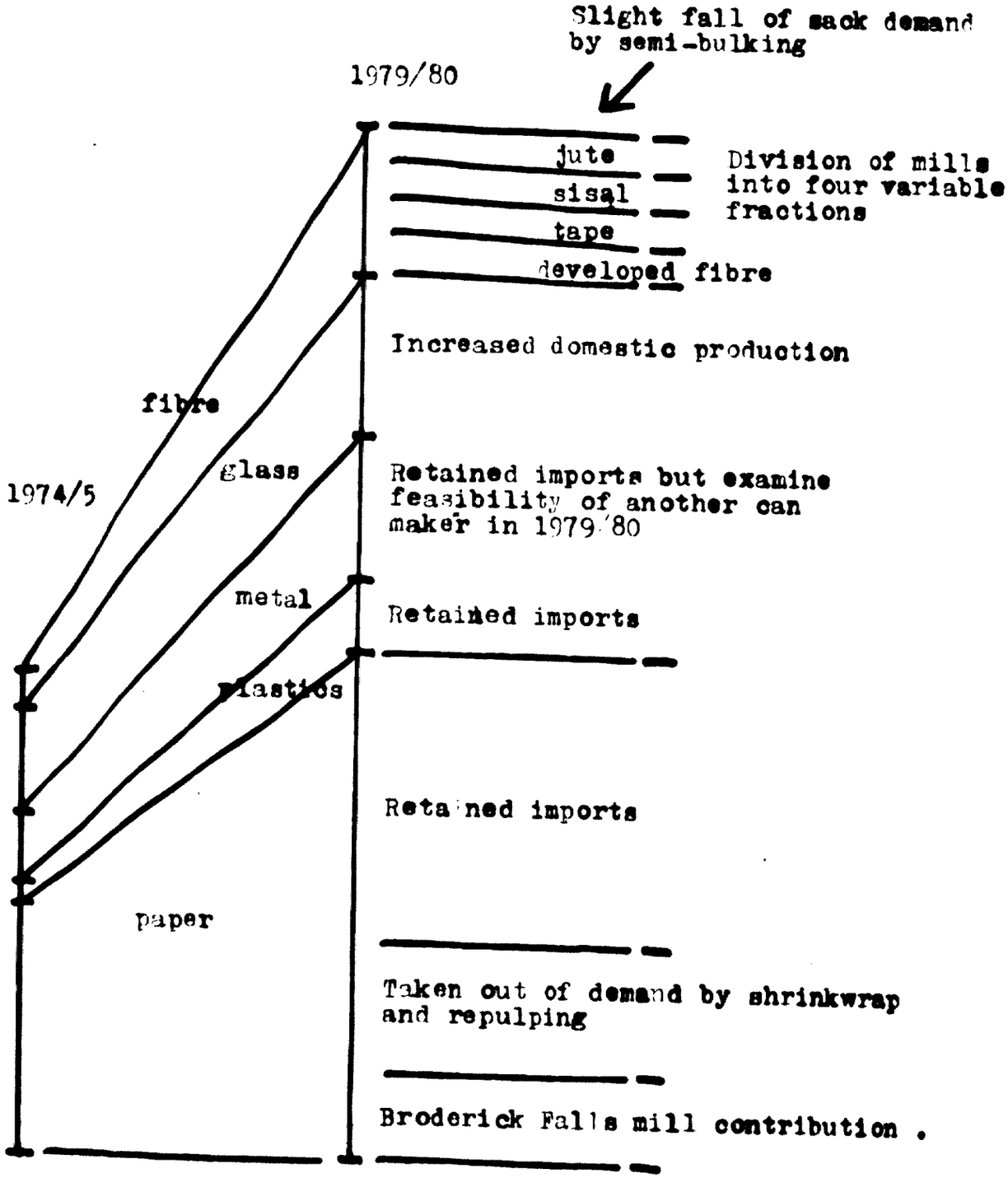
Packaging Growth and proposed modification



Paper

Total paper conversion and printing has a value of the order of 5 percent of total industrial output and represents a demand for 100,000 tons in 1974. The packaging demand is probably about 70,000 tons, much of which is specified material and must be imported. The Broderick Falls mill should be operative late 1974 and is designed for 25,000 tons each of inextensible kraft and bleached quality paper. The quality paper will not satisfy demand and the inextensible kraft could all be taken by EAPI for inner liner work. Broderick Falls output will not influence the sack and bag market and it could fail to meet requirements for weaker papers. ECA have advised extension of the capacity by 50,000 tons but there could be insufficient pine for such extension. Limited investigation within the available time indicates that another new mill should be based on non-wood fibre and that a capacity of 25,000 tons would coincide with raw material availabilities. The available pine should be left for quality papers and for increase in woodworking. It is further advised that a board mill should be instituted to use the weak fibres from non-wood pulping and non-pine woods. Up to 70 percent of imported sack kraft is exported and is frequently specified as Scandinavian extensible kraft. It should be regarded as an essential import, leaving domestic production to substitute for weaker papers and board.

In due course, after about three years of consolidation, Broderick Falls or the proposed extra mill could introduce reinforcement of weak fibres by synthetic filaments, to take care of domestic needs for stronger papers. At present it is not feasible to introduce weak fibres into the Broderick Falls mill other than some dilution of pine by eucalyptus and factory rework to about 10 percent.

Recirculation of paper is very low, being mainly through Thika mill with capacity rated at 4000 tons but output nearer 2500 tons. It is vital to recirculate more paper by repulping waste. In theory, an efficient waste collection system could rescue 40,000 tons in 1974 and 80,000 tons in 1979, which would justify expansion of Thika mills 20-fold by 1979. In fact, much of the waste is used as fuel and much is contaminated in after-use. It is possible that a collection system for waste could provide raw material as clean regular supplies to a third paper mill rated at 25,000 tons, in addition to the second mill running on developed natural fibres. Alternatively, a 50,000 ton mill could be studied to run on mixed waste paper and developed non-wood fibres. Since both sources of raw material depend on development it is presently advised that one new mill be studied, rated at 25,000 tons with possible 50,000 tons of raw material. If, by 1979, both sources of raw material develop it would not be difficult to extend with another digester and paper line.

An efficient waste collection system would also provide semi-clean distributed waste which could be applied to pulp moulding but would not be satisfactory or economic for recycled paper. This would probably be by small-boy collection at a few cents per kilo although 50 cents per kilo would be economic and justified for its financial benefit to rural communities.

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Non-wood paper fibres

Direct investment cost for a 25,000 tons non-wood paper mill is likely to be high and feasibility depends mainly on ability to find very low cost fibres. The fibres will be short and resultant paper will have a low comparative value as import-substitution. It may prove necessary in due course to up-grade the paper values by addition of reinforcement filaments fibres.

The fibre groups of interest are:

Bagasse
Reeds and grasses
Cereal straws
Waste paper

By-product from agriculture such as pineapple leaf fibre.
Natural fibres examined for sacks but rejected as weak.
Reject industrial fibres such as short-length sisal or cotton.
Reclaim fibres from disintegrated textiles.

In effect, any cellulosic fibre could be used if supplies were reasonably regular but preference is for fibres with no profitable alternative use. A full study requires more time than is available to this expert but the following comments apply.

Bagasse

Bagasse is a valuable fuel and has potential for fermentation to feed. Replacement of bagasse fuel in sugar mills needs one-seventh the equivalent weight of oil, which could be alogical reason for not releasing bagasse for paper manufacture. With 2 to 3 percent retianed sugar, bagasse is a useful starting point for fermented feed. As a rule bagasse paper is inferior to reed or grass paper.

Reeds and grasses

Grasses show about 40 percent conversion to paper and a 25,000 ton mill would need about 65,000 tons/year of dry-weight reed or grass. Local comment alongside Lake Victoria is that reed grows as tall as a man in four weeks. Yields are of the order of 2 to 3 kg. per square metre but there is little information on recovery growth after cutting.

Cereal straws

Straws make excellent paper and PIRA in UK have a study of the economics available. The problem is that straw is seasonal and is expensive to store. On the other hand supplies can be forecast with accuracy.

Waste paper

Waste paper is already used by Thika mill to manufacture excellent kraft replacement.

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By-product from Agriculture

Pineapple leaf fibre is mentioned as an obvious fibre for examination but the list is extensive.

Other fibres

Many fibres rejected for textiles can be used mainly as additives with very short fibres in paper. Such fibres from industrial sources may become expensive if they have to be cleaned free from oils.

From the present unsatisfactory study of available fibres it seems evident that a non-wood paper mill in Kenya would have to mix fibres, resulting in semi-seasonal manufacture for stock until one of the mentioned fibre groups became developed as regular supply. There would consequently be advantage in an early development of waste paper collection to provide a basic fibre supply into which the other groups could be introduced.

The most serious consideration for such a mill would be water. The mill would need perhaps half a million tons/year of water which it would pollute with 12,500 tons of contamination. Broderick Falls mill uses sedimentation and aeration to clean water but any study of another mill should refer to biological processes leading to protein from the pollution. Various processes now exist of which the most likely uses direct enzyme treatment to break cellulose followed by filamentary fungi growth which can be simply skimmed off for high-protein feed.

It is not possible to estimate the value of paper from such a mill. Even Broderick Falls mill can not now give final paper prices because chemicals prices are uncertain. In the case of this non-wood paper mill there is the further variable of uncertain raw material cost.

In 1973 the Thika mill, rated at 4000 tons/year of paper from waste, had a capital value of Kf 0.5 with labour cost Kf 60,000/y. Inputs were 220 gals/mt. water, 4000 lbs/h steam and 30 gallons oil per ton of paper. Of the labour about two thirds of the 135 total were lower-paid. At about twelve times the capacity rating, Broderick Falls wood-based mill has a capital value of Kf 17 m and a probable labour cost of Kf 150,000 with a completely different labour structure. Pulping and moulding on ITDG plant involves a machinery cost of about Kf 60,000 and the water is recycled to a level of about 10 gallons/mt. input from standard mains. This water is, however, lost in drying and does not result in pollution. The indication is that waste paper, as a raw material, is better applied to semi-rural moulding than to the small-scale paper production as at Thika although the technology at Thika could be used as a platform for increased-scale paper production from clean waste.

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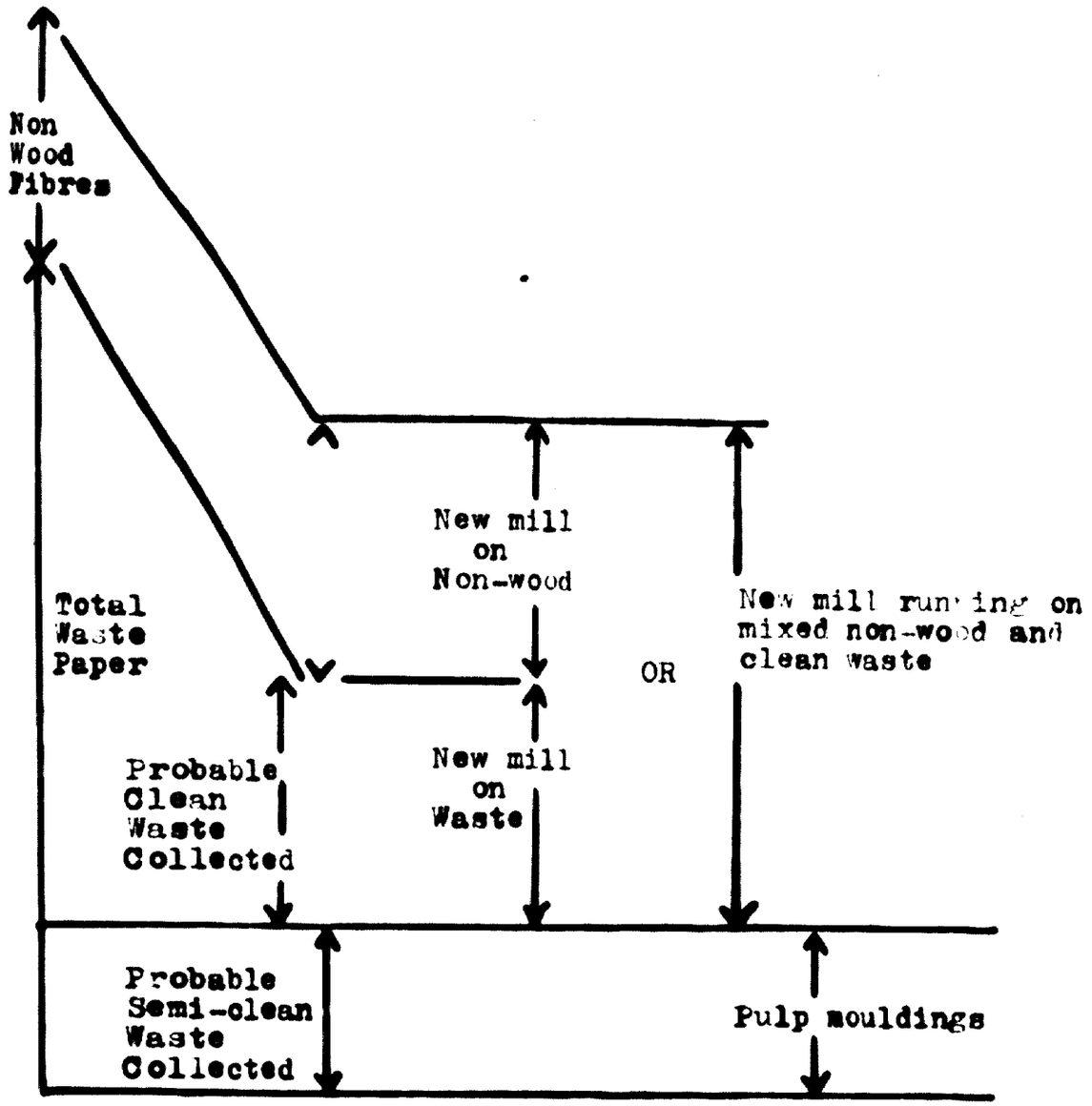
Non-wood and waste paper recovery development
1979 projection



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Pulp Mouldings

The three main outlets for pulp mouldings are eggtrays, interlayers in fruit packaging and shrinkwrap trays. Other items such as textile cones could develop.

Egg production is said to be 100 million calling for 3 million/year of 30x trays at 50 gms. each. Allowing for overweight trays and production losses it is safe to estimate waste paper requirement at 300 tons/year. The ITDG small moulding machine is known to Kenya and is rated at 120 cycles/hour, costing about Kf 10,500 landed. On a basis of three-shift operation 4 machines would be needed. The costing needs discussion with ITDG but could be along the lines of:

4 ITDG machines	Kf 42,000
300 tons waste paper at Kf 25/ton	Kf 7,500
Non-machine conversion costs, say	Kf 15,000
Direct costs	Kf 64,500
Visible cost per tray about 43 cents	
Replacement value of the rescued waste paper divided by half to allow for the 50 percent recovery	Kf 30,000
Actual national cost	Kf 34,000
National cost per tray about 23 cents	

Interlayers are roughly the same size and shape as eggtrays and much the same costing would apply. Requirements are ill-defined with many sizes of fruit involved. It would be wise for interlayer moulding to develop out of eggtray moulding.

Shrinkwrap trays are dealt with in more detail under the heading of Shrinkwrap. Moulding in 4's with a 120/hr. cycle the possible cost would be about 11 cents each direct visible cost, which is less than half the present quoted costs for rigidboard and PVC trays. Full national benefit would, however, come from association of tray moulding with semi-rural shrinkwrapping.

Since the economics are conducive to small-scale pulp moulding there does not appear to be justification for large-scale pulp moulding. Such large-scale operation would need regular supplies of waste which could find outlet in the proposed board mill or in recycled paper manufacture.

Non-wood paper investment

Krauss Maffei estimates for non-wood paper are appended. They can be analysed without further comment in this report. Any feasibility study should also make reference to study reference 28848 by Dr. Julius Grant, January 1970, which expertly examines collection costs.

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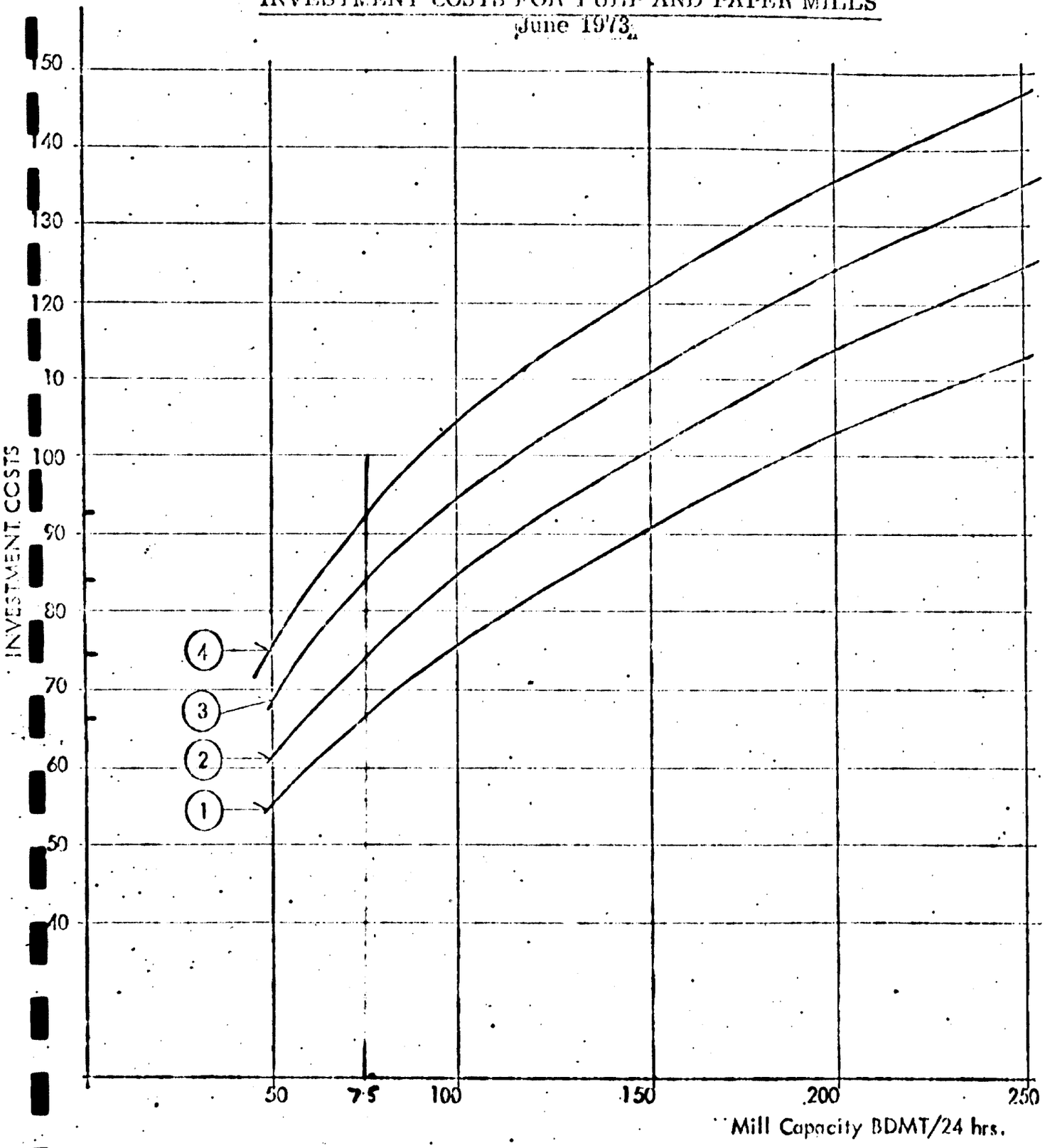
Krauss-Maffei

FIGURE I

INVESTMENT COSTS FOR PULP AND PAPER MILLS
June 1973



Raw Material Basis: Non-wood plant fibres

1 - Pulp Mill for unbleached market pulp
2 - Pulp Mill for bleached market pulp
3 - Pulp and Paper Mill for unbleached paper grades
4 - Pulp and Paper Mill for bleached paper grades

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FIGURE II

INVESTMENT COSTS PER DAILY TON IN RELATION TO MILL CAPACITY

June 1973

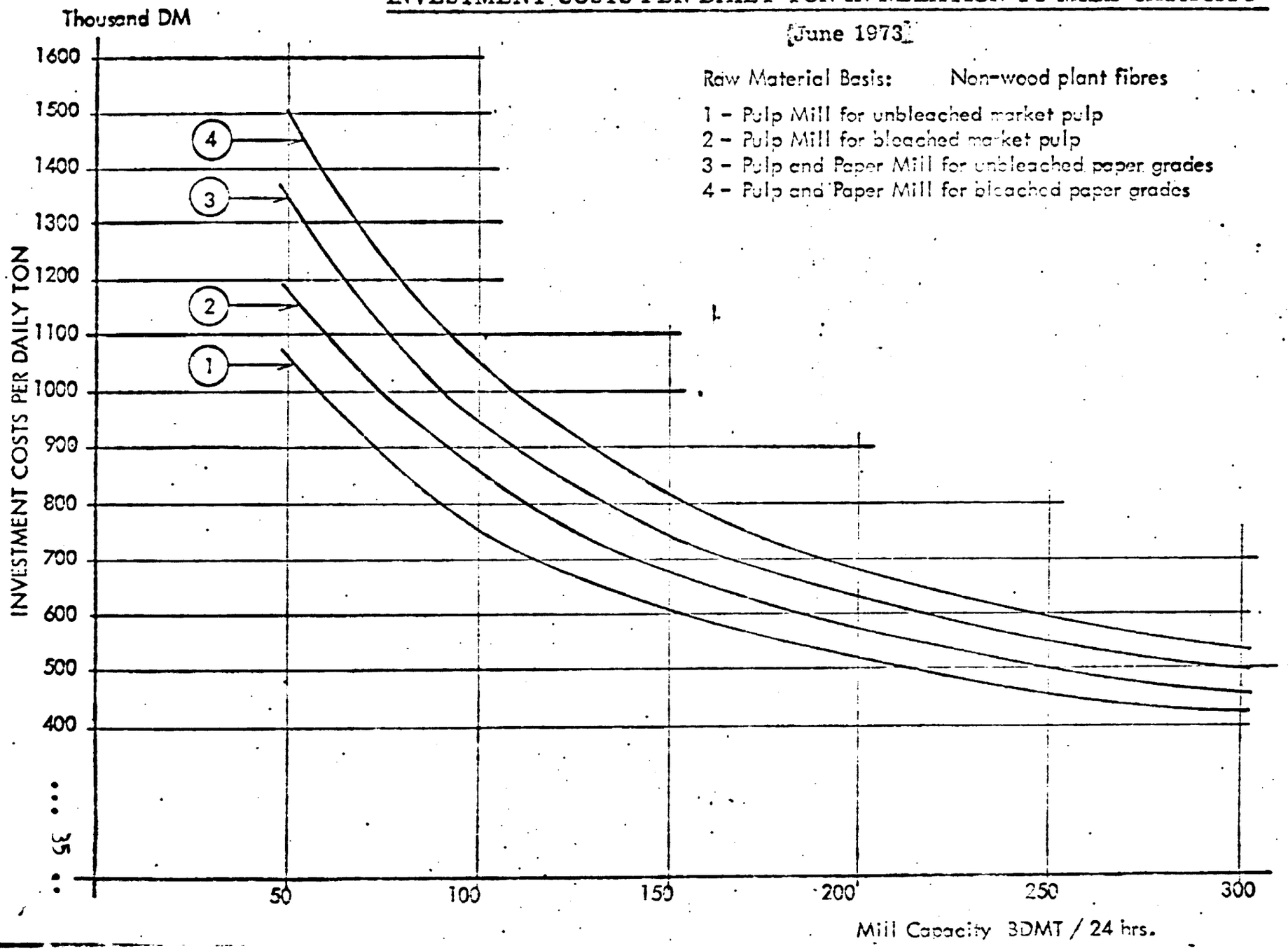


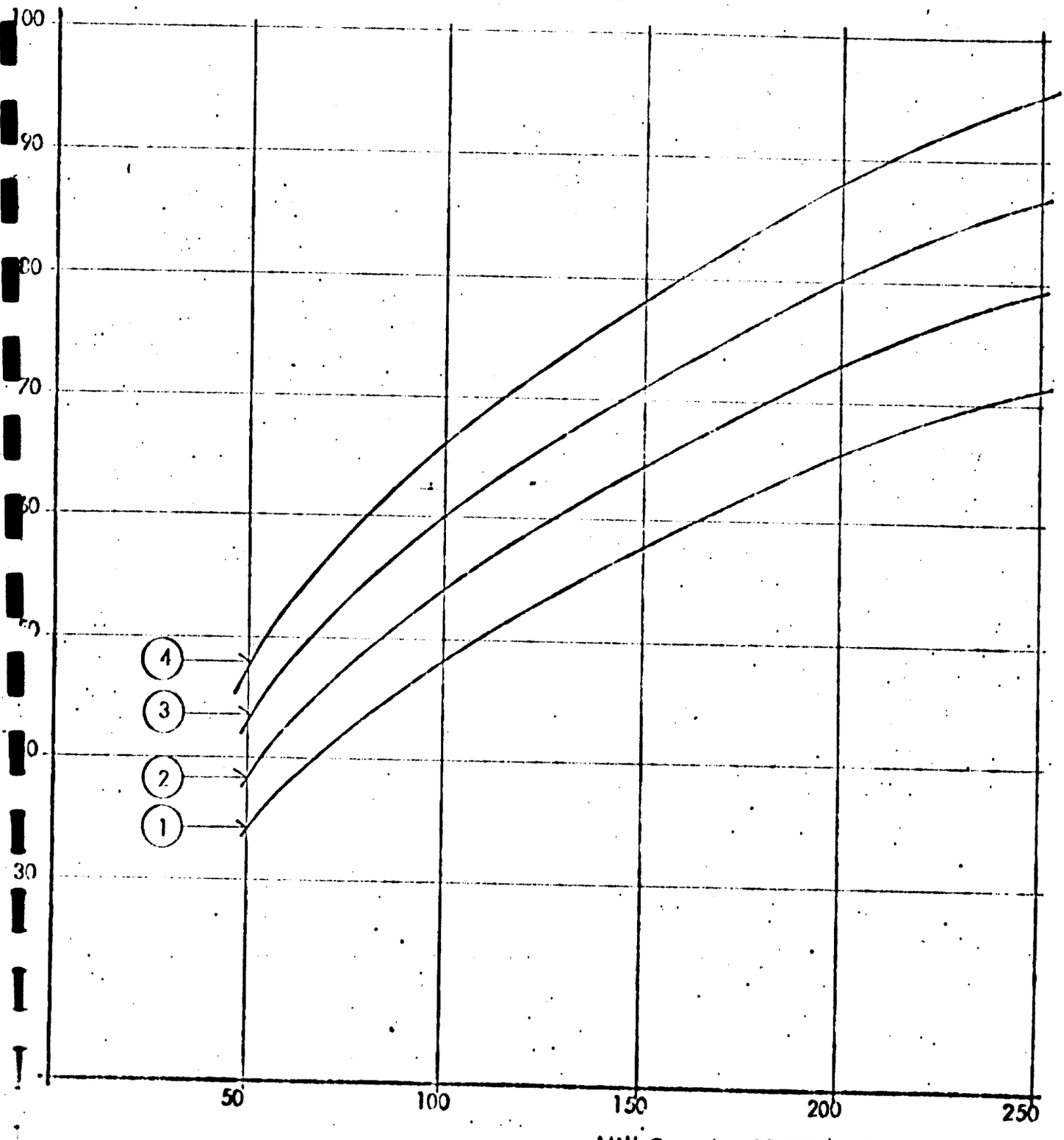
FIGURE III

FOB-EQUIPMENT COSTS FOR PULP AND PAPER MILLS

June 1973

Raw Material Basis: Non-wood plant fibres

1 - Pulp Mill for unbleached market pulp
2 - Pulp Mill for bleached market pulp
3 - Pulp and Paper Mill for unbleached paper grades
4 - Pulp and Paper Mill for bleached paper grades



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Fibres and Sacks

Sacks are manufactured from fibres according to fibre strengths, friction coefficients and flexibilities. Stiff fibres such as sisal are suitable for sacks holding more than 100 kg. whilst softer fibres such as jute or kenaf can be used in the 25 to 100 kg. range, which is the popular range. Flax and cotton have value particularly up to 50 kg. above which they are expensive packaging. Stretched tape, the only satisfactory replacement for natural fibre, is best up to 100 kg. but has been used for large sacks. Woven fibre or tape is essential for sacks meeting manual handling. Multi-wall paper can be used with mechanical handling to a unit weight of up to 50 kg. and plastics film sacks are also satisfactory up to 50 kg. with mechanical handling. Kenya has a need to eliminate jute imports and the following possibilities are available:

1. Conversion to higher unit weights using sisal. Such conversion would increase handling costs and the present high prices for sisal fibre discourage its use in sacks.
2. Development of an alternative domestic fibre, which should be given encouragement but will take ten years to provide satisfactory quantities.
3. Development of mechanical handling and palletisation with associated reduction of unit weight. Whilst mechanical handling should be encouraged for its general benefit there would be comparatively little change of packaging material cost - jute being replaced by imported paper and film.
4. Development of bulking systems to avoid sack usage. This would be effective economy in terms of fibre elimination.
5. Introduction of stretched plastics tape for sacks. This would reduce import costs and also allow the production of superior sacks including insect-proof sacks.

Sack usage in Kenya is about 30 million of which 10 to 14 million are new sacks introduced each year. Over the next five years crop developments could increase the new sack demand. If paper prices continue to rise there could be 2 to 3 million new sacks required to replace paper. It would not be impossible for the 1979 new sack demand to be equivalent to 20,000 tons/year of imported jute, or 25,000 tons of developed domestic fibre on the basis that such a fibre would probably be weaker than jute, or 6000 tons of plastics tape on the basis that tape sacks weigh only one-third the weight of fibre sacks. The proposal in this report is that by 1979 the looms in Kenya should be capable of handling any of the raw materials, the output pattern being changed according to prevailing availabilities and prices. Total sack usage in Kenya by 1979, including new and re-used, should have reached at least 60 million and may reach 100 million. The facilities for re-use depend largely on the pattern of fibres used and potential changes in handling methods which can not be forecast.

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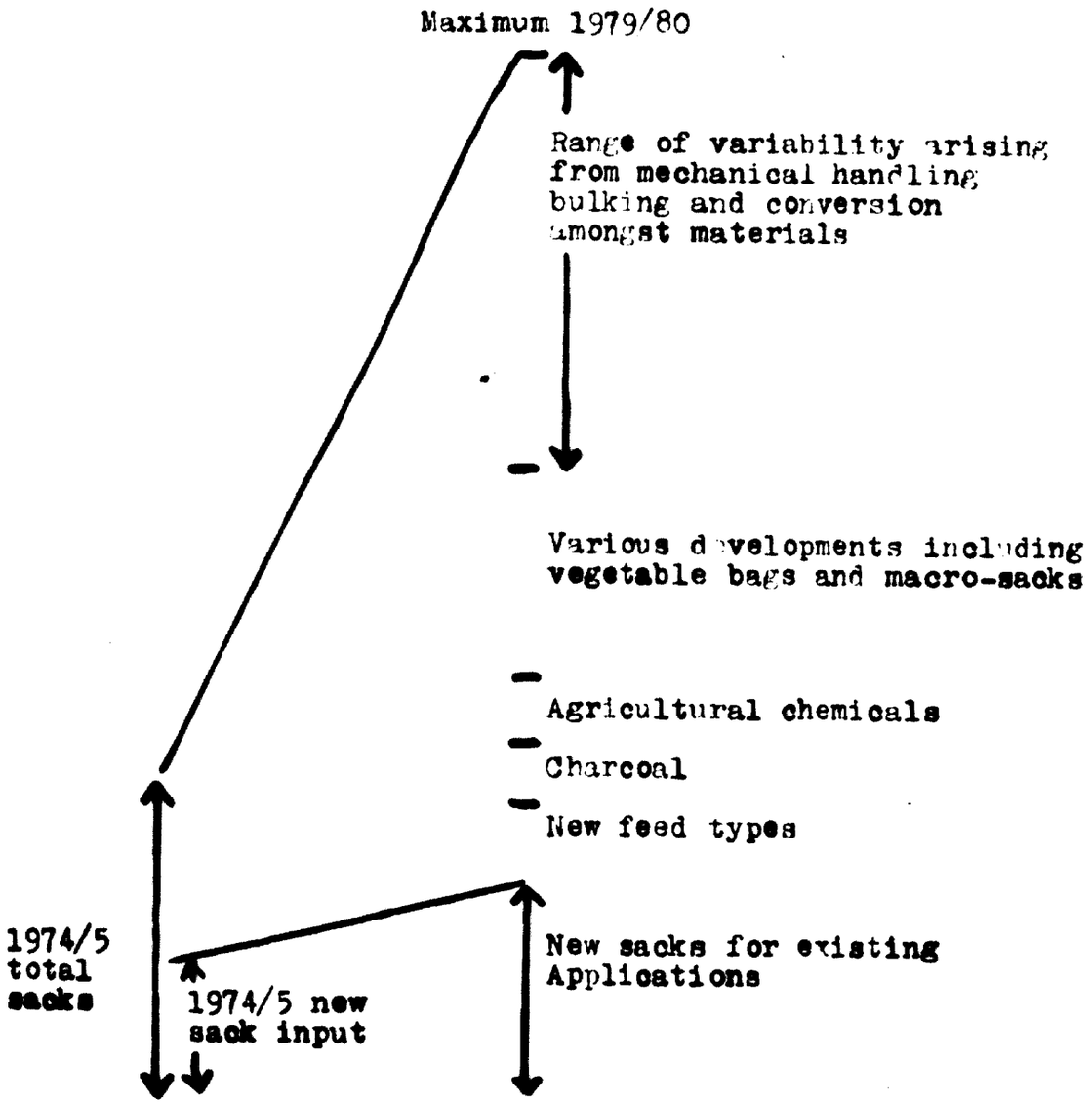
Sack Development
1979/80 projection



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Domestic Fibres

Domestic fibres are required to replace jute but also for the proposed extra paper mill based on non-wood. There are some 300 fibres listed for textiles and almost any cellulose fibre has application in paper. Estate farming for jute replacement would reuqire at least 25,000 acres and the selection of fibre is difficult for the Kenya climate. Most fibre crops need a 14 hour daylight season and 70 inches of rainfall. It could be more economic for Kenya to use the mentioned 25,000 acres for 10,000 tons of rice and to negotiate the import of fibre from some wetter African country, offering in return woven sacks manufactured in the drier, more suitable for weaving, climate of Kenya. On the other hand, limited investigation reveals that flax has been grown to 26,000 acres over the 1921/1955 period in Kenya, Triumfetta grows wild in Nyanza, Furcraea should thrive in Kenya and Abroma is retted for fibre in Uganda. It should not be too difficult to find a domestic fibre and any discovered wild fibre need not wait for estate farming. Small-boy local industries in sisal production are evidently capable of supplying one kilogramme per capita per evening after school at a cost of 2 shs per kilogramme, and would be delighted to draw other fibres for sale.

The domestic fibres for paper are discussed elsewhere in this report. A full analysis of the fibre potential in Kenya needs the attention of a suitable botanist.

Tape alternative

Woven stretched polyolefine tape, either polypropylene or polyethylene, is the only suitable synthetic alternative. The economics are discussed in detail in this report but broadly - Tape sacks are equal in strength to jute sacks at one-third the weight and down to half the cost. Handling characteristics can be studied by reference to importers of fertiliser for compounding but there could be a problem of insufficient breathing if jute is replaced by tape. It is probably important to carry out a stacking trial using 30,000 imported sacks in a 30 x 30 x 30 formation with grain to establish if there are breathing problems and to indicate how any such revealed problems can be overcome by ventilation.

Subject to specific investigation it is advised that production facilities for tape sacks are divided so that a factory produces only tape for supply partly to existing sack weaving and partly to new textile facilities, including Leno weave for nets and knitting on small machines for vegetable sacks. Some of the tape could also be used to supply filaments to paper mills for reinforcement of weak fibres.

A specific sack to be investigated is a 14 x 14 inch count weave using 2.5 mm. tapes, this being suitable for fumigation but subsequently being insect proof.

Tape production economics

A 1972 analysis of the tape/jute situation using Indian references gave the following comparison for lightweight fabric:

	Material	Conversion	Final cost/metre[2]
100% jute	0.72 shs	1.71 shs	2.43 shs
100% tape	0.57 shs	0.71 shs	1.28 shs

Heavyweight fabrics made up to sacks would probably have shown 40 to 50 percent more, relating to the 3.50 shs being paid for jute sack in Kenya in 1972. Since 1972 conversion costs have probably risen 1.00 shs per sack and whilst jute prices have been fairly stable plastics prices have risen 45 percent. 1974 prices are probably 4.50 shs for jute and 3.00 shs for tape although the demand for tape has allowed higher actual selling prices. Polyolefine prices should stabilise through 1974/5 and the 3 shs per sack for tape can be accepted as a projected probability. Jute prices should rise from 1975/6 onwards and a projected price of 9 shs per jute sack in 1979 has been forecast.

Plant

A complete sack line granule-to-tape-to-sack is economic at 5 million sack output with a 1972 investment cost of about 10 million shs. In the first year material cost was 3.3 million shs, repayment on plant was 2.0 million shs and another 2.0 million shs was required for labour and overheads. On a five-year repayment period the annual cost was 7.3 million shs for an output valued at 6.4 million shs in 1972 rising by inflation to 8.0 million shs by 1974 in terms of tape prices, or 15.0 million shs by 1974 in terms of tape prices using 1974 polyolefine prices less about 1.5 million shs to pay for the more-expensive polyolefine. Very roughly, a 1972 plant should now be delivering a 10 million shs per year output using tape prices, for an input of about 9 million shs per year with 4 million shs still owing for plant. If the output value is measured in terms of jute sack replacement, not tape sack prices, the output in 1974 would be worth 22.5 million shs for the same input and debt.

A feasibility study is needed to bring the costing up to date but a 1974 plant might show 50 percent higher investment cost (15 million shs instead of 10 million shs) whilst projected jute prices might show a 100 percent increase after five years. Output in 1979/80 in terms of jute equivalence would then be 45 million shs value, which would also apply to sisal equivalence if sisal holds its 1974 prices.

Tape-only plant

About two-thirds of the mentioned capital cost is textile processing. A granule-to-tape plant would cost about one-third and could deliver tape for existing looms, new weaving facilities and knitting. Diversified existing looms running on a mixture of fibres and tape could probably take 25 percent of tape production from one unit and reduced scale weaving and knitting would be required for 75 percent. A fully detailed analysis of small-scale sack and knitting production is needed, preferably carried out on behalf of Kenya but located near the machinery suppliers, with the economics calculated more in terms of national benefit than of calculated cash profit.

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The technology of tape production is well known in Kenya by Pan Plastics, Metal Box and others. It is advisable for at least one tape line to be operative before 1979 to anticipate jute shortages or high prices, and that another line be seriously considered as insurance against failure to develop a domestic natural soft fibre. It is also advisable that conversion (small looms and knitting) be introduced to the extent of 15 million sack equivalent by 1979, emphasis being on small-scale down to individual hand-knitting. Preferably, small-scale weaving should be in crop areas needing the woven sacks and knitting for vegetable bags should be widespread. At the same time, existing weavers should introduce net weaving for fishing nets, hail nets for the tea industry, fruit collection nets and net bags to support the knitted versions. If Broderick Falls paper mill or the proposed new non-wood mill favour reinforcement by 5/7 percent addition of polypropylene filaments, then a stretching unit for fibrils from tape would be needed (a Bruckner laboratory roll stretcher would probably suffice).

Sisal

Sisal was introduced into Kenya sacks when it had a price of about K£80 per ton and was justifiable dilution for jute at twice the price. Now that sisal can find prices double those of jute there appears to be little justification for its use in sacks although it is now the only insurance against a jute famine in Kenya. This insurance needs to be maintained by ability in the mills to weave sisal but there are other markets to be developed. Notably, a sisal core in synthetic fibre or in an extruded layer of PVC results in a unique cord. Sisal also has profitable application in paper fibre blends.

Cotton

Cotton has high flexibility, which allows small sacks to be economic, fine fibre to allow production of sift-free sacks, and purity which makes cotton sacks suitable for food sensitive to odour. There is also a high re-use value in low-income societies. Kenya should seriously examine the application of any available cotton fibres to bags of meal and feed, using decorative fabric which can be used by the housewife or farmer.

Tape sack trials

There are certain basic differences between fibre sacks and tape sacks, making trials necessary. Tape sack reduce ventilation in stacks and it is necessary for full-stack trials to determine if heating and mould growth is encouraged by using sacks made from tape. To be satisfactory a trial needs to be of a full stack 30 sacks cubic, calling for 30,000 tape sacks. Preferably the sacks should be filled by the farmer, shipped to the store and left as a stack for the period found necessary to reach stable internal temperatures - using thermal probes in the test stack and a control stack using jute. If the stack of tape sacks reaches an abnormal steady temperature reference to standard tables will indicate if unwelcome mould growth is likely and core sacks can be tested for such growth.

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The sack should then be broken for delivery to the millers for handling comment with the tape sacks observed as second-hand sacks through other commodities to charcoal.

It is also necessary to study the special close-weave sack for insect exclusion. Standard laboratory tests have already shown the sacks to be efficient but a field trial is necessary. The Ministry of Agriculture can advise on worst pests and most-sensitive products, and should be directly concerned in a small-store sealed infested stack of jute sacks, tape sacks with fumigation and tape sacks without fumigation.

A further trial is necessary to establish fire risk. Preferably, this should concern a 2 sack times 5 high stack with overdried reject grain, fired one side on a dry day with gently applied fanning, and on the other side on a dry day without air movement.

The Maize and Produce Board is fully aware of the potential problems of tape sacks and may add to the above trial specification.

Paper sack trials

Although imported sack kraft is likely to be maintained for multi-wall paper sacks it is of value to carry out trials using sacks based on Thika mill paper. This is roughly similar to paper which would arise from non-wood fibres or waste paper. Trials would give at least some idea how far domestic paper might substitute for imported kraft. The most important test is the 2-metre drop test and it is important to use several commodities, each of which has its own compressibility and flow factors. In foreign trials dry coffee beans have shown high potential for bursting bags (being dense and furnished with a flat side to prevent flow) and sunflower seed has shown high penetration (being furnished with points and cutting edges). Tests with small-granule products including salt and flour should be included.

Shrinkwrap

Shrinkwrap is a system using plastics film which contracts on heating. Product is enclosed in the film, which is then heated so that is contracts to hold the product firmly. If a number of items are thus collated it is common to use a tray base from plastics or pulp moulding. The advantages are:

1. Low material usage
2. Simple technique
3. Visibility through the package wall
4. Inhibition of pilferage

All four advantages can benefit Kenya. The low material usage reduces imports and cuts freight cost. The simple technique allows semi-rural development. The visibility through the package is demanded by export customers for easy stock control. The introduction of shrinkwrap could replace cartons with a one-third reduction of packaging cost and a saving of perhaps 10,000 tons of paper.

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At 20 microns thickness one ton of shrinkwrap film covers 57,000 square metres. Based on 10,000 tons of carton board replaced:

Present value of imported board		Kf 2.26 m
Import cost of polymer for shrinkwrap		Kf 0.25 m
Value of retained imported board		Kf 1.16 m
Revised import costs		Kf 1.41 m
Deduct national benefit from polymer conversion to shrinkfilm	Kf 0.30 m	
Deduct probable value of waste paper recovery in moulded trays	Kf 1.00 m	
Total deductions		Kf 1.30 m
Possible final national cost not including shrinkwrap plant		Kf 0.11 m

Such an anlysis can be no more than indicative of the costing. Plant requirements can be partly met by domestic engineering (simple oven heating systems) for semi-rural development. Plant for the pulp moulded trays might reach Kf 0.3 m. A full analysis of requirement is needed after a market study, not possible during the present period. National benefit would be maintained by investment of Kf 1.0 m per year rising to Kf 2.0 m in 1979. The following cost comparisons are of interest: (1972).

1. Bundles of paper in UK.
   65 micron film 1.7 Kc or 50 micron film 1.2 Kc
   Replaced kraft plus glue 1.8 Kc or gummed kraft 2.1 Kc.
2. Unidentified product USA. Full pallet shrinkwrapping.
   Film cost 7.85 shs
   Replaced corrugated board plus straps 17.85 shs.
3. Cans as 24's in UK.
   Film 0.4 Kc plus tray 1.0 Kc
   Corrugated cartons 30 percent more expensive.
4. Cans in UK
   Saving of 0.8 Kc per unit.
5. Canned peas in UK at 15,000 cans/hour.
   Simple film sleeve wrap 0.6 Kc. Using tray - 0.7 Kc for film and 1 Kc for tray.

At common carton sizes the economy is of the order of 30 percent. For large objects including pallets and furniture a 1972 comparison showed total annual cost for board as:

	Using board	Using shrinkwrap
Material	Kf 205,000	Kf 113,000
Labour	Kf 27,000	Kf 10,000
Energy		Kf 3,000
Machine service		Kf 6,000

Overall saving by using shrinkwrap was about 40 percent.

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The market for shrinkwrap is widespread and impossible to quantify. There are two main divisions of mass-production rated in multiples of 2000/h, and small-scale erratic production on simple plant (home-made) rated according to product availability. The broad requirement in Kenya is general encouragement of shrinkwrap at all levels to reduce paperboard demands in large-scale operations and to up-grade products in small-scale operations.

Plastics films

With the avilable market there is little obvious benefit in the production of sophisticated films or laminates but polyolefines as films need encouragement. There could be profitable development of stretched polypropylene film and very thin (10 micron) polyethylene film. The 10 micron film will be needed for wrapping of wet products (meat and fish at retail level for example) and in fruit packaging, as lower-cost substitution for greaseproof, parchment and tissue. The development of thin-film bags for retail use would considerably reduce imports of polyethylene for common film and needs encouragement.

One special film of interest is Valeron by Van Leer. This is a strong laminate capable of replacing multi-wall paper or fabric sacks. EAPI could run Valeron on existing paper lines and its introduction could take perhaps 5000 tons out of paper demand. This substitution would not, however, save import costs and it is advised that Van Leer are contacted with a view to domestic manufacture of the film, using Kenya as a regional export centre.

The main potential development for films is as liners in sacks or boxes, probably calling for an extra 15 million sq.m. per year by 1979 including sack growth and new liner requirements. At this level it could be economic for polyethylene coated paper to be introduced to reduce polymer demands by using low-strength domestic paper for much of the weight. Such a coating project would up-grade paper or board from waste or non-wood fibres.

Tinplate

Tinplate imports are an unavoidable component of export trade. Growth can be expected in food processing for canning but the rate of growth depends on how quickly Kenya can develop agriculture. There is considerable scope for crop development in Kenya and for the provision of a number of new processing/canning industries. 90 percent of present canning is of food and significant expansion is forecast in about three years. Fish should be canned in Kenya to replace canning of Kenya fish abroad. Fruit juices need development, as do semi-bulked vegetable oils intended. Pet foods offer an attractive market.

The only technical development of interest is tear-off lids, which could be introduced into existing canning lines in small lots without difficulty. Some tinplate could be saved by more development of larger units.

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The present market is too small to tolerate a tinning line and can supplies are presently economic through single supplier. Introduction of competition would bring extra cost by market-division but future markets could possibly allow the introduction of another supplier. A full analysis of can application and areas of growth is needed before the feasibility of another can supplier can be stated. Growth from 18,000 tons to near 40,000 tons is possible by 1979, with possibly more as domestic markets become sophisticated and wealthier, but the structure of such higher demand might be too diversified for long-run production in two companies.

There could be reduction of tinplate costs by participation in a joint venture outside Kenya, with Kenya supplying processed food in bulk or semi-bulk to some non-agricultural country for canning.

Replacement of tinplate by plastics is not likely to influence the situation. So called plastics cans have limited shelf life and could only be applied to the domestic market, and would not save money in import substitution because most of the plastics would be sophisticated laminates. One exception to this general comment is engine oil, which could save perhaps 30 percent of distribution costs for oil. A form-fill-seal unit for oil-in-plastics is rated at 25 to 30 per minute whereas canning needs 500 per minute. The cost saving by shipping oil in bulk to local filling depots is about 50 percent. USA costing is 3 US cents for a plastics pouch and 5 US cents for a can.

Wood

Wooden packaging is dealt with extensively in the product section of Knock-down wood products, the packaging component being part of the whole-tree concept. There are over a hundred common woods available for study but this subject is better left to forestry experts. Podo has historic use in food packaging and could develop.

On the other hand, timber is not unlimited and, apart from pallets, packaging applications have a lower benefit-value than other uses for wood.

Pallets are required for domestic handling developments and for a growing export demand. Whilst a market exists for short-life low-cost pallets the main demand is for excellent quality specified-and-stamped pallets. These need a Kenya specification and organisation of woodworking units on the whole-tree concept. A study of the timber availabilities is required before the development can be quantified.

Woven cane is excellent packaging offering protection against crushing and could be developed as rural industry. Sizes and shapes need relationship to market demands. There is potential import substitution in the replacement of cartons in local domestic distribution.

Crates are in general likely to be replaced by shrinkwrap and heavy pallets for heavy machinery. The market indicated is the movement of valuables. Quality in Kenya is average and could be improved to allow more after-use of the wood.

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Thin-wood packaging based on woven slats needs development as a side-issue of plywood. There could be significant growth in fruit and vegetable export and in general carton replacement for exports.

Plywood is expensive and should be reduced in packaging. Other markets bring more profit. The replacement of plywood tea chests is important. Although domestic ply is being examined for tea chests instead of swedish ply this is not likely to be economic. Low-grade ply is needed for the development of precast concrete and in-site concrete casting.

Reconstituted Board has application in pallets and boxes but there is more profit in other applications. The production of reconstituted board is advisable but not mainly for packaging.

Whole-tree concept

At present much value is lost in woodworking by burning so-called waste. The whole-tree concept relies on:

Wide trimmed thick planks for structures and export.

Off-size planks for pallets and crates.

Cut planks for knock-down furniture and other structures.

Off-cuts for toys

Chips and dust for reconstituted board. Later for fermentation.

Bark for distillation for chemicals.

Leaf and new growth for extractions.

The packaging element is seen to be low. In an organised whole-tree complex there is sufficient contaminated waste for fuel needs without using valuable wood. In due course, fermentation will become a major issue in woodworking. 25,000 tons of chips and dust can ferment to about 10,000 tons of protein feed. Alternatively combined hydrolysis and fermentation can produce alcohol to about 50 percent of original dry wood weight.

Upgrading labour in woodworking

In 1972 the wage levels in woodworking were about half those in paper conversion and need to be improved. This can only be by upgrading products including higher qualities for pallets and direction of all wood into best applications.

Whole tree utilisation

Pallet and crate production in rural woodworking areas needs study in terms of whole tree utilisation to discover the most economic size of unit. Bark can be solvent extracted to give per 1000 tons of bark:

35 to 40 tons wax

650 to 850 tons plywood extender

100 to 300 tons phenol substitute.

The wax may be important in carton waterproofing, the extender in plywood and the phenol substitute in disinfectants. An alternative system of breakdown could result in cork, bast fibres of interest in papermaking, and tannins.

Alternatively, the bark can be distilled to yield low-sulphur oil with a heat content of about 10,000 Btu/lb. suitable for boilers. This is important in the efforts to reduce oil imports and might be employed in the mentioned home-made shrink tunnels. The pitch residue from the paper mill might also be a source of fuel at about 140 Btu/cubic foot of gas made by oxidation of the pitch.

Present woodworking systems use only about 40 percent of trees and it is common for much of the trimming and bark to be wasted because there is a limited demand for domestic heating. It is therefore important to study the chemical and heat potential of the non-used fraction - particularly in the design of equipment for rural development. Notably, burning of waste can produce hot gas for shrinkwrap and it is not beyond possibility that a hot-gas device will also provide condensed volatiles for local fuel-oil needs. In theory, a rural complex of shrinkwrap and repulping waste paper could run on local waste from woodworking.

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Cushioning

Cushioning reduces material contents of packages but it needs advanced technology as might be provided by the proposed research institue. Cushioning relies either on elasticity in a material, as with woven cane, or on trapped air. Corrugated paper has some cushioning value when dry. Stiff fibres such as sisal or coir (coconut) fibre can be used with coatings, as layers or shaped blocks. Many animal and vegetable fibres could develop, including rubberised hair. If thermoplastic coatings are used it is possible to use simple fly-presses for cushioning shapes. Since Kenya has supplies of stiff fibres there is no need to develop expanded polymer cushioning although expanded plastics are needed for marine and insulation applications - notably to replace imported cork.

Trapped air cushioning should be developed. The two main types are dunnage bags and layers of trapped bubbles in polyethylene film. Dunnage bags are inflated bags mainly used in large packages but small balloons are of growing interest in smaller packages. The main cost is inflation equipment, materials being polyethylene film for small bags and strong webs such as butyl rubber, Valeron or coated PVC for large bags. Layers of bubbles in polyethylene film are required to protect against abrasion, vibration and impact. They protect fruit surfaces and have growing use to prevent abrasion of polished surfaces as on records or glossy metal or wood. Development is regarded as essential for exports.

Large Semi-bulk

Semi-bulk reduces sack demand and is developed elsewhere for agricultural dry products. Various systems should be developed including:

Lined cages - which are mainly 2" weld-mesh with kraft, film or butyl rubber liners, used for return journeys. Cost by manufacture in Kenya could be of the order of 300 shs each for 50 journeys before serious damage. Allowing 20 shs per liner the journey cost would then be 26 shs against a claimed cost of sacks on pallets of 51 shs.

Large flexible bags - with top lifting for fork-lift trucks and top-filling with bottom discharge. These are used by Tate and Lyle for sugar for silo filling but they can be used for any dry product needing protection against moisture and infestation. Empty bags drop to one-eighth their filled bulk and the economic size is about 1.5 m diameter and 2.0 m high. Probable cost by Kenya manufacture would be 400 shs for the bag and 200 shs for the lifting ring. Life could be three years and a regular return-journey run could give 150 journeys before serious damage. On a basis of 100 runs the per-journey cost would be about 5 shs but this would only apply for rapid turnround. The bags could be used for storage pending movement.

Bag-in-box - which is a film bag in a carton or returnable plastics crate. If cartons are used there will be a need to relate a pulp moulding outlet for the paper. If plastics crates are used a return-journey run is essential. Bag-in-box is of value mainly in liquid movement and could replace churnsor tetrapak for milk.

Section 3. - ECONOMIC/SOCIAL CONSIDERATIONS

Packaging is a service industry in which isolated direct economic study has little value. Emphasis is therefore on packaging contributions to product industries and to social welfare, at least-direct-cost and with minimal inconvenience.

Section subjects

General economic problem

Investment

Cash Flow

Investment requirements

Value analysis

Production capacity

Know-how

Programme labour analysis

Incentive and controls

Decentralisation

Concentration

Raw material rescue

Desophistication

Packaging in agriculture

Packaging Association

Packaging Institute

Packaging Terminal

Development framework

Five-year co-operatives

Air Freight

Development proposals

Further UN involvement

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General Economic Problem

Packaging, as an economic sector, has a value of about K£ 40 million and is largely based on imported materials. Domestic material is the glass component and rural crafts, with up to 50,000 tons/y to be added in paper 1974/5. Exports are dominated by coffee, tea and sisal with probably only 8 percent of exports containing a high proportion of packaging. The reduction of packaging in exports other than of tea, would not have significant influence and it could damage trade. Imports have a high packaging content including about K£ 4 millions of primary packaging materials, although up to 70 percent of this primary material is calculated to be re-exported. There would be benefit in diversification and up-grading of exports with consequent higher packaging content, as for example in producing retail packs of coffee and tea and in general food processing. The packaging content of imports could be reduced by domestic processing and overall industrial development, and by meeting some of domestic needs through semi-rural development. Broadly, the answers to the problem are:

1. Reduce packaging demand
2. Conserve materials in the demand
3. Maximise the use of domestic materials.

There are complications. Packaging is a service industry and reduction could damage product markets or inhibit welfare improvements. Conservation of packing materials could increase product losses and it is unwise to use restriction as an instrument of conservation. Hence, a development programme needs to extend out of the narrow confines of packaging technology, into such subjects as potential agricultural fibres and rural development, and to relate to all other development intentions. Such a programme, including education in packaging throughout the entire economy, would be expensive. It is therefore essential to transfer as much cost as possible into the private sector whilst still gaining universal benefit. It is essential to determine priorities and also to time-scale developments for maximum ultimate benefit.

Kenya has in effect two development requirements. A short-term programme is needed to lose part of present import liability and to offset recent material price increases A longer term programme is needed to develop balance in packaging and to infuse packaging technology into the economy.

Investment

Intended development investment is K£ 150 million over the next five years and part of this concerns packaging. It does not include certain developments outlined in this report, notably another paper mill, speculative investment in raw materials, or semi-rural packaging development. Nor does it include public money invested in private industry to encourage packaging efficiency and economy, or investment in education for long-term benefit.

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A pattern of priorities for investment is difficult to define in terms of national benefit. The most urgent need is to invest for reduction of material costs to industry, which mainly means national bulk buying and subsequent allocation with minimal confusion or delay. Allied to this is investment in new packaging plant for smaller companies, whereby productivity can be high in new structures involving co-operating small companies under holding companies including government participation. Of similar urgency is a new paper mill which could be the largest single investment subject. Less urgent are rual developments and education, in both of which investment costs are impossible to quantify. Rural developments include whole-tree woodworking, shrinkwrap and small-scale pulp moulding. Education includes a research institute and a trade association. Both these long-term targets are social requirements with national benefit more important than capital appreciation. Investment in rural development can be reduced by domestic manufacture of the machinery including pulp moulding machinery under licence from ITDG. The cost of an institute can be reduced by fitting it into the existing educational network. Much of the cost of an association should be carried by industry.

Cash Flow

There is a problem of cash flow. Materials have to be obtained well in advance of cost-recovery. Previously, 180 days credit was possible but this is now mainly reduced to 30 days credit and frequently cash is demanded. This means that converters carry the cost of materials through storage and production. In many examples, future prices are unknown, an example being Broderick Falls where inability to forecast chemical prices prevents the determination of final paper prices. Hence, more cash is needed in reserve against future high prices and this is withdrawn from production and development.

The government should request forecasts of raw material requirements from industry, bulk buy in advance and then resell to industry. After initial import the distribution would in effect be of a domestic material and companies should be able to draw their stated rations against demand without complication preferably through a holding company. The government should also infuse cash intc machinery purchase, aiming for more efficiency and profitability through participation using holding companies including groups of small firms. This would also maximise the use of investment through organised market division within groups - each small firm having its own sales responsibility.

Investment requirement

The value cf packaging in an economy varies from 6 to 10 percent of GNP. This would give packaging in Kenya a value of K£ 42m to K£ 71m but this requires adjustment for K£ 143m of GNP outside the influence of packaging. A more probable value for Kenya packaging would be K£ 35m to K£ 57m, which is equivalent to about one third of national farm revenue. Estimated growth rate is 13 to 20 percent on a rising scale through the next five years. This growth rate is partly by increase of GNP and partly by increase of the proportion of packaging in GNP.

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The present value is probably about K£ 40m and could without difficulty reach K£ 100m by 1979. Investment is needed to conserve materials, re-use materials, and convert to domestic materials from imports where practical. On a 20 percent basis the implied investment would be:

Year	1975	1976	1977	1978	1979
K£m	8.0	9.7	11.5	13.8	16.4

In other words, about K£ 60m investment over five years might be justified. This would not be promotional investment aimed at producing growth but would be anti-growth investment designed to reduce the overall cost of packaging in terms of material cost, handling and conversion plus filling.

Unfortunately, it is not possible to analyse each of the report recommendations in simple terms of money. The benefit to be gained from investment is partly financial but the main aim is social benefit which can rarely be translated into cash values. For example, another new paper mill is proposed using non-wood fibres. This could represent 25,000 tons/year of import substitution with a known cash value but the more important aspect is that it would employ a large number of workers and would put to use fibres which would be otherwise neglected. A similar new mill based on pine fibres would employ fewer workers and could rob Broderick Falls paper mill or woodworking industries of raw materials. Where possible, such a development should seek to employ new fractions of labour and commercialise new domestic raw materials.

Likewise, in the rescue of waste paper it is necessary to consider three types of waste:

1. Regular clean waste as suited to large-scale repulping.
2. Small-lot clean waste for small-scale repulping.
3. Distributed suspect waste suited only for small-scale semi-rural pulp mouldings, not recycled paper.

With regard to 3. the direct economics might be criticised but investment would result in higher semi-rural incomes and rescue of about 15,000 tons/year of paper which would otherwise be lost. Similar comment applies to the development of wood-working on a whole-tree basis. It is important to appreciate that a study of packaging differs from studies of other industries in that the target is not growth but economy (reduction of material) and that benefit is not direct but is to associated industries which profit from economy in packaging.

Value Analysis

Value analysis is a new factor in economic studies, of particular importance in packaging. In terms of national benefit from a package the monetary cost may be of relatively low significance. For example, a little extra money spent on export packaging can develop and confirm an export market. Likewise, development of rural production of a seemingly expensive package brings benefit by labour-employment and utilisation of otherwise-wasted local skills.

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Packaging is frequently the starting point for improvement or initiation of new industry, as would be the case if Kenya wood-workers built pallets for home and export use, instead of shipping wood for foreign woodworkers to profit.

In general, a package has a value according to how it influence the market and distribution. For example, sacks are vital in all stages of Kenya handling down to the handling of charcoal - which is a social factor without which Kenya would suffer. The sacks have added value if they use labour in Kenya for fibre production and making up. On the other hand, tapes would have value in that they would allow full working of looms despite situations concerning natural fibres. Domestic paper production has direct value in import replacement but there is added value in its ability to develop new packaging. Demand estimates in this report are excessive, partly because paper growth rates are inevitable but because overproduction using ignored raw material (reeds and grass) results in an export commodity with a fairly safe market. A notable substance requring value-analysis is sisal, in which previous value was calculated in terms of jute-substitution and is now lost because jute is less expensive than sisal, to be replaced by a new value for sisal in direct export. The value pattern of any package constantly changes and it is important for the proposed packaging institute to maintain a watch on value patterns.

Conventional cost-and-profit estimations have not been applied to the recommendations in this report. They have been examined mainly in terms of value to the national society, not to individual companies. Kenya could benefit from the employment of a Kenya technical economist with the sole function of using value-analysis on packages. He should ask himself:

1. Who benefits from the production of the raw material.
2. Who benefits from the conversion of the material.
3. Who benefits from the use of the package.
4. Who benefits from the disposal of the package.

If Kenya is shown to benefit he should then ask:

1. How will the value pattern of the package change.
2. Can use of the package be extended to increase the benefit.

One important component of value of a package is the influence on distribution and shipping, notably in terms of size, weight and shape. Distribution and shipping patterns differ considerably, giving rise to many packages for a product. For example, maize flour for the Kenya market requires a different packaging approach to that for cornflour in exports. In this report the emphasis has been on packaging for the domestic market, where packaging is now a contributor to inflation. The report will need revision in due course to accept new value patterns arising from exports and from higher levels of welfare in the Kenya market.

Production Capacity

Existing conversion capacity is sufficient for demand for common packages and is under-used during the present period of raw material shortage and high cost. Capacity for uncommon packages exists but lacks an obvious market at the prices which would apply with expensive imported raw materials. There is a need to expand the range of available package types, the urgent requirements being:

Shrinkwrap

Stretched tape for sacks

Pulp Mouldings

Very thin polyolefine films

The market would not support sophisticated plastics laminates other than for oil. It might support coated paper for small cartons to be used for retailed liquids but this requires market research. From first impressions a 2500 tons/y coated paper and board unit would find a market. Capacity for expanded plastics would benefit marine and insulation markets but is not justified by the packaging market alone. Capacity for thermoforming plastics would find a market but this market could be satisfied partly by pulp moulding and it would need more expensive plastics imports.

Rather than introduce new package product it is important to rationalise and occupy existing capacities by a narrowing of ranges from individual companies and supply of sufficient raw material at reasonable prices. It is also necessary to encourage long-term planning by providing security of profits.

Know-how

There is no shortage of know-how in the country but most of it is held by large foreign companies. Transfer to smaller companies is farily free but would be improved if an association were to be formed. There is a need for package design skill, which could save about 10 percent of materials used. In the face of material shortages the major companies are concentrating on design improvement and no action is required until an institute can study the subject. The only obvious area where know-how needs to be obtained is in small-scale shrinkwrap and pulp moulding. Shrinkwrap know-how can be obtained directly from polymer suppliers as printed literature and development could be through existing extruders and domestic engineers working from supplied data. Small-scale pulp moulding technology can be obtained directly from ITDG. Otherwise the private sector has access to know-how and the only problem is making smaller companies aware of packaging developments abroad. This would be covered by an information broadsheet or journal from the proposed association.

Programme labour analysis

After the Kenya authorities have defined orders of priority and established a consequent programme the problem will be recruitment of initial economic and technical skill for implementation. For the full programme about 350 reasonably-specialist persons are required, with training needed for perhaps 3000 others.

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The ultimate benefit, which is mainly to product sectors, could have a value of half a million man-years by 1980, which is an attractive reduction of unemployment.

On the other hand, persons in Kenya who could satisfy requirements for the initial 350 are already employed in beneficial activity. Even if money is made available for intensive training it would be difficult to provide packaging-oriented Kenyans in sufficient number and external skill will have to be bought. Primarily, the feasibility of any of the mentioned proposals depends on ability to divert skill away from some other development, dilute productivity in some other development by adding packaging projects to non-packaging work-loads, losing responsibility for development into specific private companies, or bringing in skill on contract or in package deals. It is proposed that the first action after completion of this report is analysis in terms of labour availability, dividing the list into probables to be subjected to feasibility studies and possibles to be held back until initial labour can be found. Whilst the probables are being evaluated there should be a crash programme to improve the packaging technology of the hard core of initial labour, partly to co-ordinate their effort and to ensure that they become up-to-date. Persons thus educated but made unemployed by probables which fail in feasibility studies can then be redirected into a training programme for operatives or into the long list of study programmes.

By 1980 perhaps another 1000 perons spread out in industry and agriculture will need a reasonable level of packaging education - at least sufficient to develop packaging within a narrow economic sector. These can best be discovered and recruited through a competitive offer of certificates of competence, or diplomas, in return for study-papers on specified subjects. This not only provides the labour but also provides considerable technical information at very low cost. It also allows students to add an extra qualification, with the result that future executives will have more packaging skill when they deal with products.

The essential requirement is the short-term crash course for the initial skilled labour. With an intensive programme and careful selection of instructors this could be a one-month course covering basic technology and economics, their application to Kenya situations, plus detailed accounts of the key processes and equipment. United Nations should be requested to assist.

Incentives and Controls

High material prices and shortages are providing their own controls. Restrictive legislation can do no more than increase production problems, reduce productivity and encourage inflation. In general, import restrictions should be relaxed or lifted unless evidence can be found that they are essential. Output from Broderick Falls mill and another mill has a ready market and can not directly substitute for quality imported paper. When Broderick Falls can calculate their selling prices it may prove of value to subsidise this material to prevent inflation but the most obvious national benefit concerning paper is in waste recovery.

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Until a waste collection system can develop it is advisable for the government to set an example by providing a collection unit for its own waste, using the idle capacity at Thika as an outlet trials on ITDG equipment.

Standardisation will ultimately save money in handling but at present the main advantage would be in giving longer runs in production. For example a standard non-alcoholic drink bottle is justified. Longer production runs provide their own incentives in the form of lower prices but some subsidy-levy system may prove necessary. Until a full range of Kenya standards is defined such a subsidy-levy system can not be quantified. On the other hand financial support for unitised handling would encourage standardisation. The easiest support is supply of pallets on a sale-or-return basis and free handling of the pallet weight and volume - by law and regardless of the route. At the same time, major handling depots such as ports, air terminals and railheads should give a significant reduction (30 percent) for units collated or designed to fit into calculated handling volumes, with subsequent relationship of individual calculated volumes through standard dimensions. Handling dimensions need study in detail, comprehensive organisation giving a possible benefit of 40 percent of handling costs, plus benefit in revenue if Kenya dimensions fit those in export markets.

With sufficient awareness and education about packaging, companies would not require incentives or controls to increase their profits by material economy. There is a need for incentives to develop awareness and education, and to provide packaging technologists in 1979. It is proposed that a Kenya packaging diploma be instituted to be granted in return for a study-document on approved subjects. A list of study subjects is appended.

Since present prices are unreal and beyond reasonable prediction it is not possible in this report to advise specific fiscal incentives and controls. The situation is providing its own variable controls, which change too rapidly for legislation to have effective influence. Perhaps the most effective incentive would be governmental bulk-buying of raw materials on behalf of industry, thus removing domestic costs of small-lot buying, delivery delay and wasted time in getting raw materials.

Study Subjects

The report contains a large number of recommendations of study projects. The major study projects are included in the recommendations to Government or industry. Other study projects could profitably be used as research subjects for employed economists or technologists, or for University students needing research projects. In due course such projects would be delegated to the Institute or Association but it is necessary for research manpower to be found and employed on the projects now. Contracted foreign researchers, not being familiar with the peculiarities of Kenya, would not be outstandingly effective.

1. Time-scaled projected demands for packaging by product and materials.
2. Packaging proportion of value of exported items by product.

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3. Domestic meat distribution in terms of losses, infection, quality, advisable packaging.
4. Processed meat products in terms of market, distribution and required packaging.
5. Poultry in terms of market, distribution, freezing facilities and packaging needs.
6. Liquid milk market potential using UHT milk in revised packaging terms.
7. Packaging requirements for a developed edible oil and feed complex arising from new crops.
8. Packaging requirements for an improved fresh fruit and vegetables distribution system.
9. Market study of potential processing systems for crops and subsequent identification of packaging requirements.
10. Economic study of bulking methods of distribution of flours and similar granular products, including advised sizes and constructions of silos and containers.
11. Analysis of present and future requirements for packaging in feed supply.
12. Investigation of domestic blending of tea (and perhaps coffee) for retail-pack export.
13. Flowers and living plants as export items, including identification of high-profit sectors and packaging to suit the marketing environment.
14. Toxicity incidence and possibility in distribution of agricultural chemicals, with advised packaging to suit the market and reduce danger levels.
15. Study of woodworking to establish combinations of workers into economic units for effective packaging.
16. Analyse the water situation to identify packaging requirements for domestic and export volumes in five, ten and thirty years.
17. Analyse the economics of tin-can application in terms of domestic canning and of semi-bulk supply of product to an external canner.
18. Use value-analysis to construct a system of small-scale packaging developments in rural areas.
19. List domestic fibre-potential plants and identify their relative value as developed crops. Include potential paper fibres.
20. Cost and value analysis of papers used in the various outlets.
21. Design and prototype a shrinkwrap tunnel suitable for rural use and using self-contained energy supply.
22. Economics and feasibility in Kenya of recovery systems including detinning steel, pulping paper, remelting glass and finding outlets for scrap plastics.
23. Improvement in design and application of packaging based on traditional crafts.

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24. Bulking and semi-bulking loss factors in terms of biodeterioration and other decay. (This relates to 10 but is mainly biological study whilst 10 is more economic/mechanical).

25. Analyse machine-efficiency levels in packaging and identify locations where national benefit would be gained by replacement.

26. Packaging processes in terms of size of operation for maximum benefit and the relationship of such sizes to existing and adjusted social conditions in Kenya.

27. Waste paper as a raw material for repulping, in terms of size of production unit in mouldings and the pattern of end-products possible from moulding.

28. Energy content of materials, conversions systems and applications of packages.

29. Methods of weight reduction of packages.

30. Pilferage in transit, in terms of motivation, levels of loss, favoured products, systems of theft and packaging designs which reduce pilferage.

Decentralisation

Many factors influence the location of packaging. They include:

1. Pattern of availability of product.
2. Transit cost and life of product before packaging.
3. Benefit value of labour input.
4. Energy and material supplies.
5. Disposal pattern of packaged product.

Decentralisation, including rural development, in Kenya mainly concerns two areas of operation. The first is agricultural product which can be improved by shrinkwrap packaging. The second concerns pulp moulding to rescue waste paper which is too widely spread for collection into large recycle or moulding units.

Shrinkwrap at semi-rural level concerns products which are supplied in small lots, including crops and rural craft products, particularly for domestic sale. The location of units can be defined by a study of rural activity. Labour in the areas benefits from the infusion of technology and income. Imported plastics would be offset by economy in paper usage. Plant could be home-made from original designs using low energy input. This shrinkwrap development is not to be confused with centralised mass production, in which higher efficiency can be expected. The number of units depends on the results of a feasibility study which further depends on a study of rural activity.

Pulp moulding at semi-rural level has been costed. The intention is to rescue considerable weights of waste paper. Most semi-rural areas could provide sufficient raw material from small-boy collection. Labour in the area would benefit from the infusion of income but the main benefit would be rescue of paper which would save imports.

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Further decentralisation concerns product up-grading by local processing, including retail packs for tea and coffee. This concerns intermediate-scale packaging units and a full study is required of possible product upgrading before this can be quantified.

There is also a requirement arising out of the proposed tape introduction. It is possible for small looms and knitting machines to convert tape at semi-rural level for local sacks, vegetable bags and nets. Another rural development would concern quality pallet manufacture in woodworking complexes.

Concentration

Most of the mass-production products have centralised packaging in the private sector. A study is needed of semi-scale product availabilities to determine where central packaging units could be of benefit. This study needs to relate availabilities to markets and could include packaging facilities near transport terminals such as Mombasa port, railheads and airports - notably Mombasa airport.

Raw Material Rescue

In development societies the discard of waste is valued at about 20 percent of per capita material consumption, with packaging responsible for 3 to 5 percent of waste. Waste recovery and re-use needs a comprehensive approach including rescue of the heat content, chemical components and mechanical contributions - and including conversion techniques including fermentation for protein. Up to 50 percent of paper could be rescued for use in new paper and in pulp moulding. Glass is already rescued for remelting and requires no comment. Plastics consumption is not sufficient to justify recycle or pyrolysis systems. Tinplate could justify a detinning plant in due course, probably in 1979, but this requires costing.

The only present paper repulping is at Thika, rated at 4000 t/y drawing supplies from EAPI. There would be advantage for paper converters to include repulping of their waste as produced, either as mouldings for sale or as blanks for feeding a new paper mill. The raw value of this waste would be about 650 shs per ton. Non-factory clean waste would require collection and sorting and its disposal depends on requirements of a new paper mill, waste paper being one fibre of interest. To pay for the collection raw value would be reduced accordingly. Distributed semi-clean waste paper would have value only in pulp moulding and most of it would require semi-rural location.

The glass situation requires economic analysis. Bottle glass uses roughly 40 megajoules per kilogramme new glass but only one third this energy for remelting. During the energy crisis it would be worth while to calculate the energy balance of producing new glass for export.

Detinning of tinplate requires specialist analysis. First impression is that detinning is not yet justified but a four-fold increase in tin cans might warrant a plant.

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Desophistication

World packaging costs are likely to rise sharply because techniques and equipment have been designed to the 1950-1970 economic environment. This was based on the use of fossil energy instead of human labour and on mass-production with standardisation. Energy has become expensive and it has been realised that about 90 percent of market requirements can be best served by semi-scale projects which direct income into primary product production areas. The overall trend is away from high-investment low-running-cost plant to low-investment high-running-cost plant with the realisation that economy is not directly proportional to size. This means a complete revision of attitudes in planning and equipment specification which should benefit developing countries with thin markets and idle labour. In Kenya about 80 percent of labour is outside the reach of fossil energy and part of the intended Kf 15 million investment in metal and engineering should be directed into machine design for Kenya conditions. In particular low-energy shrinkwrap machinery needs definition and the ITDG pulp moulding machine needs revision to reduce energy demands.

At the same time there is a need to encourage rural materials instead of sophisticated materials. Cane and sisal weaving need subsidised encouragement including the application of advanced packaging technology to sizes and shapes. The rules which apply to cartons can be applied to other materials and should be used.

Packaging in Agriculture

The ultimate potential of conventional agriculture in Kenya has been calculated at about ten-fold present production involving 14 million people which could not be absorbed into industry or services - including 5 million along the coastal region. Conventional cropping can be expected to follow the familiar division into crops for fresh consumption, crops for processing and crops for extraction including fibre retting. There appears to be very little long-term planning although it is appreciated that diversification is essential to prevent national disaster if coffee, tea and sisal prices fall together. The greatest potential is in crops for processing including oil-bearing plants but mainly fruit and vegetables for canning.

Subject to the provision of better qualities there is growth potential in fresh fruit/vegetables, for which air freight needs development. Probable increases in handling costs and freight rates will favour southern Europe and West Africa for fresh vegetation supplies for Europe and other markets are not outstandingly probable. For the growth which will develop there is a market for pulp moulded interlayers and for cane baskets.

Crops for processing including oil-bearing vegetation will require mainly more cans. There could be a four-fold increase of can demand by 1979, which may justify a second can maker. Most of the potential developments need new varieties or new crops and serious development of vegetation for processing will take at least three years.

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It is probable that non-conventional agriculture and alternatives to agricultural systems will develop quickly, calling for packaging which can not now be defined. Most of the developments will concern sacks with emphasis on special designs. In particular a need is seen to develop insect-proof fumigatable sacks from tape using 14 x 14 inch weave with 2.5 mm. tapes.

Crops for extraction, mainly of juices, will require semi-bulk packaging, such as bag-in-box, and blown plastics bottles. The extracted bulk would be applied to feed markets, calling mainly for sacks.

At present it is impossible to forecast packaging requirements because future crop patterns are ill-defined. The subject requires a special study after the Ministry of Agriculture have outlined longer term plans. Such plans are urgently needed because although crops can develop quickly the development of satisfactory packaging could take several years.

Packaging Association

An Association is required to provide a forum for discussion between companies and government. It could originate as a splinter group from the Kenya Association of Manufacturers or as a governmental body with present packaging companies represented and other industrial sectors co-opted as required. The function would be defined as:

1. To seek, collate and process packaging information, and to distribute such information where needed.
2. To organise exhibitions and conferences on packaging.
3. To provide consultancy services, or to act as a purchasing agency for such services, on packaging.
4. To assist government in the formulation of legislation and control of packaging.
5. To provide detailed information on Kenya packaging facilities and requirements to foreign respondents.

The actual work-load would depend on the staff obtained. In general the association would be directly concerned with technical and economic matters of immediate interest. Preferably 8 persons would be employed:

Information Officer who knows sufficient about packaging to answer telephone inquiries.

Inquiry Processing Officer responsible for dealing with written questions which need information search or processing.

Two Assistant information Processing Officers to collate and process information.

Libratian to store and deliver background information.

Editor to formulate and produce an information sheet for circulation.

Liason Officer to forge and maintain links between companies and government.

Public Relations Officer also responsible for exhibitions and conferences.

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It should be possible for such an association to be self-financed from the sale of information and consultancy services.

Packaging Institute

An institute is required to deal with long-term economic and scientific aspects of packaging for Kenya. To avoid overhead costs and to accelerate activity it is advised that this is located within the education structure, maybe as a chair of packaging at a university. As a rule, the work-load would be as specific research projects and there would be facility for qualification in levels such as City & Guilds and Membership of the UK Packaging Institute using existing study patterns. In due course the institute could include pilot plant for product development, and facilities for package evaluation.

Staffing would depend on the location of the institute in the education structure. Finance would be governmental plus subsidy from industry for specified research projects.

Packaging Terminal

It is considered essential that the Kenya Government promote a packaging terminal with the following intentions:

1. To concentrate packaging technology where it can be most effective in terms of tonnages packaged and quality of packaging.
2. To take strain out of Mombasa harbour by displacing handling out of the harbour area to some convenient local site.
3. To service developments at Mombasa airport in anticipation of an early 500 tons/month air freight and much more later.
4. To assist agricultural development in coastal regions by providing an outlet for fragmented production.
5. To provide warehouse volume near railways so that present disruptions arising from missing wagons would be avoided.
6. To provide handling facilities for up to 100 per month ISO containers landed by ship equipment at Mombasa. Also to provide handling facilities for LASH developments (lighter aboard ship).
7. To collate small shipments as units or pallet loads outside Mombasa harbour but within reach without delay when ships arrive.
8. To enable quality control and specification to be used effectively on many small quantities.
9. To provide a negotiating centre for contact with export customers relative to purchase, quality, delivery and required packaging.
10. To reduce packaging cost by bulk buying of material, the use of machinery at maximum efficiency, and by collation of mixed orders in common packaging.

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It would appear desirable that the terminal should be sited in the area of Miritini, where land is available for development. This is sufficiently distant from Mombasa island for it to take the strain out of the harbour area. It is convenient for a new rail terminal and for LASH lighters to unload in the Mipirani area. It is also convenient for Mombasa airport and for associated new cold stores to hold cargo against demand from the airport and Mombasa harbour.

The indication is that such a terminal should be capable of dealing with at least 1500 tons/month and should comprise straight-through loading bays with mechanical handling through to dry stores and cold stores. For efficient operation it would be essential that the storage volume should be divided into unbonded and bonded warehouses, with self-contained facilities for documentation and release. This would require sealed vehicles from the harbour and from the lighter unloading point. The urgent facilities would be palletisation and shrinkwrap, including shrinkwrap of complete pallet loads.

In effect, the terminal would provide facilities for packaging development using production plant for trials and economic study, hence saving the cost of special development plant and eliminating problems of using plant in private companies. Congestion in Mombasa is said to cost exporters 15 percent through delays and ship-waiting times have increased three-fold during the past 15 years. It is important to establish processing facilities outside the harbour area and avoid any activity other than loading or unloading on the island. This includes port packaging and collation which the cargo handling services now avoid because they have insufficient space or labour. Experience at Nairobi indicates that Mombasa airport will need special packaging facilities nearby for shrinkwrap and IATA container development. It is fairly certain that coastal marine and agricultural developments will need packaging facilities associated with storage, with ability to supply filled packages or collations urgently ready for direct loading onto ships or into aircraft. Part of the extra forecast handling at Mombasa can be handled by a few ISO containers and lighters by the LASH system. This extra handling needs free space not available on the island and goods from containers or lighters need packaging for distribution. Exports will need specialised collation at short notice according to whether there is volume in ships demanding pallets, containers or freight lighters needing minimised packaging, or aircraft needing lightweight packaging.

When goods are shipped at a stated quality it is economic to inspect and pass-or-reject at a point of maximum concentration which is preferably alongside the vehicle. To avoid legal complications, certification needs to be dated to the shipping date and not to some previous date when the goods were packaged before domestic travel which could provide journey hazards.

Differentiation is needed between goods which are best prepackaged and require only handling at the terminal, and goods which require packaging development as part of terminal handling.

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Coffee is due for development of semi-bulking and part conversion to paper. Part of exports can be filled into 5 kg. cash-and-carry units in film bags, which is best done just prior to shipment to reduce volatiles loss. This also applies to Tea although the packaged shelf life of tea is longer than that of roasted coffee.
Meat mainly requires last-minute shipment inspection before vacuum packaging. Likewise fresh vegetation needs final inspection before shrinkwrapping and loading.

A full analysis of the required facilities is impossible without a forecast of the probable import/export pattern in 1979 when a terminal could be built. Preferably the terminal should start as a bonded warehouse with appended bulk-breaking and collation, bringing in packaging facilities as indicated by problems experienced in handling and by constant study of products as they pass through or develop and call for handling.

Development framework

It is stressed that packaging is a service industry, influenced by and having influence on all human activities. The main problem in packaging development is identification of economic sectors which can be used for primary concentrated development. In most countries there is much expensive duplication of effort, which could be reduced if responsibilities for specific developments are clearly defined and publicised: The resonsibility for a specific packaging development should be with the body responsible for the main product finding benefit from the development. This body can find early return for the effort and capital involved and other products to benefit will profit in due course. For general packaging development each project needs to be identified with an existing component of the economic structure. The allocation of projects is outside the terms of reference of the present study but the following comments may assit ISPC or such other body that may be instructed to fit packaging development into the existing economic framework.

Kenya Association of Manufacturers should be concerned with the report comments on profitability and investment. Whilst it can assist by co-operation in the solution of short-term problems the main responsibility of KAM should be long-term development of association and education, and with schemes for the improvement of profitability in production.

Kenya National Chamber of Commerce and Industry should be more concerned with the report sections dealing with the supply of packaging raw materials and the eventual use of packages for products. The main responsibility should be making certain that packaging in Kenya has sufficient raw material at the most acceptable and reliable price level and that products are packaged using the highest levels of package design.

Industrial Survey and Promotion Centre obviously needs to co-ordinate the technological developments of KAM and the supply developments of KNCCI. Notably at present this concerns restructuring packaging to reduce paper consumption and to take precautions against a world jute decline. Another major requirement of ISPC is the introduction but not development of new technology into the economic sectors where it does most good for the general economy. In packaging the major considerations at present are waste paper recovery systems and shrinkwrap.

Kenya Export Promotion Council should be concerned with packaging as an aid to selling goods. Its main responsibility should be to define the packaging requirements for minimum transit cost and maximum sales impact - in effect providing KAM and individuals with specifications to be met. The other responsibility should be to seek export markets for packaging products which might originate in Kenya. Notably in this respect the potential markets for Kenya-made shrinkwrap film, stretched polyolefine tape and very thin plastics film are worth investigating now.

Bureau of Standards should have the responsibility of reducing package costs by enforced standardisation which will allow longer runs in package production. For example, soft drinks bottles should be standardised to allow longer production runs. The allied responsibility should be to promote package design for minimum material usage and maximum protection of products. Hence, a direct link is needed with the proposed Institute.

Industrial and Commercial Development Corporation should be responsible for the development of packaging projects outside existing packaging production. Notably this concerns rural developments such as small-scale waste paper pulping and small-scale shrinkwrap tied to local agricultural output. The responsibility should also extend to the proposed packaging terminal at Mombasa, insofar that one major benefit from this terminal would be development of eastern rural agriculture and trading.

Management Training and Advisory Centre should be deeply concerned with the remarks in this report on packaging education. The educational requirement can be divided into the advanced education needed for package design, and a wider education needed in using packaging to advantage. There is no benefit in developing highly technical packaging outside central points where it can be used by the majority of Kenya firms. On the other hand, there is no benefit in excellent package design if the packages are ill-used in filling and shipment. The main task of the MTAC should be to improve handling and at the same time to furnish KAM with 'statements of handling conditions' for packages to be accordingly designed or modified. Hence a link is needed with the Bureau of Standards to reduce handling losses in the domestic market by improving packaging.

Kenya Industrial Estates Ltd should regard packaging as a major consideration in rural industrial development, particularly as an off-season activity and spare-time activity using casual labour. Unsophisticated packaging such as traditional baskets should not be ignored as subjects for development. Kenya Industrial Estates should also ensure that rural development centres include packaging firms. Another responsibility which can be placed with KIEL is import-substitution of paper. An urgent requirement is the discovery of a location providing reed and grass and also water for a feasibility study for another paper mill. A process based on reed or grass would be labour intensive and would manufacture inexpensive paper with a ready market.

These comments are based on observations by the expert looking at the economic structure in the light of experience elsewhere. Personnel within the Kenya economic structure are obviously more qualified to dictate responsibility and the purpose of these comments is to stress the importance of defined responsibility in packaging development.

Five-year co-operatives

The investment situation in Kenya resembles that in other countries where industry is fragmented and facing a small receptive market. The demand for specific items (packaging or otherwise) is not sufficient for many small producers and some form of co-operation or operation-delegation is necessary - but without creating monopoly situations which are inflationary. It is proposed that the Kenya Government introduce five-year co-operative ventures to avoid multiple costing in many uneconomic small ventures. The basic structure of such a co-operative would involve:

1. Pre-estimation and then direct supply of raw materials to the co-operative central purchasing office, not to small individual companies. This would allow long runs in production, would eliminate existing excess profit in small-order satisfaction, and would ensure supplies to machine with the prices fixed at an early stage so that efficient cost-estimation would be practical.
2. Small companies operating under a holding board elected from the directors of the small companies, with some measure of allocation of production so that each small company can specialise.
3. Government purchase of machines for supply to the co-operative with a five-year recovery of machine cost.
4. Five-year contracts for management and engineers to ensure that personnel remain in Kenya working on the specific machine and project during the period when the machine can be expected to be profitable.
5. Insurance that the machinery and skill would not be made uneconomic through the introduction of restrictions.

The provision of such a promoted co-operative would carry the following advantages:

1. Raw materials would be made less expensive partly because production runs would be longer but also because production would be at early costs and would therefore avoid inflation costs.
2. Middleman profit would be avoided in the supply of small quantities of raw materials. There is some evidence that middlemen profits of more than 300 percent have existed.
3. As an enlarged unit a co-operative would be able to find more investment capital and loans, and would be more reliable in the payment of machine costs owed to the government.
4. There would be more confidence in investment if national money was tied in machinery, it being presumed that the government would not damage the industrial structure of any organisation which needed five years of efficient operation to repay loans on machinery.
5. The enthusiasm and effectivity of personnel would be increased if each responsible person had an assured 5-year contract.
6. Small companies would not longer be seeking unprofitable diversification, being assured by the co-operative that specialised activity would be profitable.
7. Export business could be built up through specialisation and by negotiation through centralised sales.

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Air Freight

Air freight out of Nairobi is a seasonal 1000 tons/ month with probability that 30 percent more could be shipped with better services and more reliable aircraft schedules. A standardised carton is being developed and palletisation is appreciated. European customers demand shrinkwrap, which could make any such carton obsolete and could increase product shipment by 50 tons per month.

More payload could come from development of Mombasa for air freight, using 747 and 707 aircraft with an extra 8 tons per aircraft lift in the lower altitude. On the other hand, the Mombasa climate is hot/wet and a rapid movement of cargo will be needed. Present Nairobi-Mombasa transport costs are 30 cents per kg. and it will be necessary to plan the freight pattern out of Mombasa with care. Very little can be said of packaging for Mombasa air freight until the extended runway has provided some experience for cargo analysis.

Development proposals and further UN involvement

Proposals have been listed to provide the Kenya authorities with a platform for determination of priorities, which depend mainly on ability to find skill to initiate projects and carry out studies. Availability of skill does not by necessity justify initiation since the found skill may be of more value elsewhere applied.

Further UN involvement concerns mainly the developments of products which enable packaging to develop. A number of job specifications have been listed but it is understood that domestic skill may undertake some of the tasks indicated, or may be already engaged in the tasks. With regard to packaging as an isolated subject, it is advisable for UN to assist in the improvement of mechanical handling in the near future, and to assist in another study of the packaging situation in 1979/80.

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Development proposals

These proposals are not in order of priority.

1. Evaluate paper for coffee bean packaging and also study domestic roasting for retail packs, including 5 kg. film bags for direct cash-and-cary markets and catering markets.
2. Evaluate paper and lined sacks for tea and also study the market for domestic blending for retail packs. Encourage the elimination of plywood tea chests.
3. Evaluate semi-bulk handling of whole grains and possibly develop flexible big bags for combined storage and transit for silo or hold bulking.
4. Provide new creamery facilities for milk, including alternatives to Tetrapak and one-litre units. Cost-study the Nairobi-Mombasa milk run and introduce either powder or bag-in-box.
5. Provide certificated film bags for milk poweder and restrict filling to licenced operators.
6. Fill sugar into multi-wall paper sacks.
7. Research beer in cans as a possible development about 1979.
8. Standardise non-alcoholic drink bottles and study plastics bottles for drinks as a secondary outlet for edible oil bottles.
9. Evaluate shrinkwrap for textiles.
10. Evaluate plastics laminate and expanded polystyrene film for soap.
11. Cost-study the overwrap film over cigarettes with a view to using polypropylene. Discuss future use of recycle board for the packets.
12. Encourage bulking of cement by the introduction of 5-ton silos, possibly by rental from demestic manufacture.
13. Anticipate new feed developments by evaluation of insect proof tape sacks based on 14 x 14 inch count 2.5 mm. tape.
14. Market study exported vegetable oils to determine feasibility and volume of future blown bottles.
15. Shrinkwrap canned products after discussion with export customers.
16. Mould interlayers for fresh fruit/vegetables from pulp.
17. Process nuts and introduce tear-off can lids.
18. Install a pilot large-size shrinkwrap machine for wood products and full pallet loads.

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19. Install canning line for fish and developed marine products near Mombasa.

20. Evaluate insect-proof tape sacks for seeds for export.

21. Introduce moulded pulp trays plus shrinkwrap for more of distributed fresh food.

22. Subsidise bags for broken cereals at 1973 levels.

23. Evaluate synthetic filament and other reinforcement in domestic intended paper.

24. Use tape sacks for fertiliser and urea.

25. Design, certificate and develop the manufacture of high-quality pallets.

26. Develop moisture-proof export cartons which can be used for long storage then export.

27. Introduce sheet air-bubble cushioning based on layers of bubbles trapped in film.

28. Provide low-cost tape sacks for charcoal.

29. Discover and develop a soft domestic fibre to replace jute.

30. Introduce stretched plastics tape manufacture related to existing looms, new looms and knitting as intermediate scale development.

31. Modify sack weaving capacity to accept jute, sisal, tape and any other fibre.

32. Study the economics of overbuying jute whilst prices are low.

33. Evaluate large sacks using sisal, including pallet-sized rectangular sacks, related to pallet handling.

34. Subsidise improved mechanical handling which eliminates sacks or otherwise reduces packaging material demand.

35. Evaluate cotton as a bag for flour, including the use of decorative fabrics which could be re-used by the buyer.

36. Use half the Broderick Falls mill output for quality non-packaging paper, the other half for inextensible liner paper of one grade as required by EAPI.

37. Build a new mill for paper based on waste and non-wood fibres, to 25,000 tons or more as indicated by a study of the raw material situation.

38. Maintain imports of sack kraft but develop reinforced papers for some later substitution for sack kraft in the home market.

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39. Develop waste paper collection, starting with a unit to rescue waste in government offices.

40. Introduce semi-rural pulp moulding using small machines and local collection. Manufacture interlayers, eggtrays and shrinkwrap trays.

41. Analyse Thika mill economics of waste paper recycling and determine if it should be closed or expanded.

42. Carry out a major study of shrinkwrap application and introduce it in all places where economy is indicated and/or where significant reduction of paper demand would be evident.

43. Develop polypropylene film and very thin polyolefine films for the wrapping markets.

44. Discuss engine oil distribution with oil companies with a view to acceptance of non-can packaging.

45. Discuss possible Valeron film production with Van Leer.

46. Study the coated paper market in anticipation of plant alongside domestic paper production.

47. Add a potential board mill to the development programme for paper and carry out market research to determine its size.

48. Analyse the probable can requirements for 1979 and study means of introducing another can-maker for the increase.

49. Evaluate the economics of a joint venture outside Kenya for canning products supplied ex-Kenya as semi-bulk.

50. Relate woven cane basket manufacture to standard shapes and dimensions with a view to carton replacement.

51 Investigate thin-wood slat weaving for fruit and vegetable boxes.

52. Develop coated stiff fibres (mainly sisal and coir) for block and moulded cushioning.

53. Evaluate lined wire cages for return-journey use.

54. Evaluate and manufacture large PVC-coated fabric bags for storage and return-journey handling.

55. Develop bag-in-box for liquid handling.

56. Use public money to invest in groups of small companies with a five-year surety, through holding companies and with market division.

57. Install a chair of packaging in a university and build a research institute for packaging around it.

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58. Design and manufacture intermediate-scale equipment for shrinkwrap and pulp moulding.

59. Determine forward requirements, bulk buy raw materials and then sell to industry from stock through an agency.

60. Study rural activity to determine packaging needs which can be met by local manufacture, including reduction of factory-made packaging in favour of local crafts.

61. Analyse the relationship of glass manufacture to energy demands.

62. Study the economics of detinning as a possible rescue project concerning waste cans.

63. Institute a general study programme in the engineering sector to determine if Kenya can manufacture low-energy equipment for home and export.

64. Organise a packaging association of industry and government.

65. Discuss woven cane containers with air freight companies.

66. Relax or remove restrictions which can not be proved of national benefit when examined by an independent body.

67. Introduce sale-or-return pallet supply and enforce free rates for the pallet weight or volume

68. Encourage a 30 percent rebate of handling charges for unitised loads with dimensions calculated to the handling depot.

69. Introduce a packaging qualification at two main levels of diploma and equivalent to M.Inst.Pck. UK. Grant the diploma against worthwhile study-papers on specified subjects. Contact the UK Institute of Packaging for the higher qualification.

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Job Specification
Expert in mechanical handling — One month

1. Examine existing handling techniques in terms of cost and social benefit.
2. Advise improvements which would bring benefit without causing unemployment.
3. Identify handling equipment which could be manufactured in Kenya.

Job Specification
Expert on food processing — Three months

1. Examine existing crops as subjects for processing.
2. Advise processing methods which could use existing crops.
3. Advise changes in crops necessary for processing.

Job Specification
Expert in marketing — Three months

1. Examine existing trade in terms of product and packaging related to market requirements.
2. Analyse the economics of production, processing and shipment of major trade items.
3. Advise methods of increasing profitability and social benefit.

Job Specification
Marine biologist — Two months

1. Survey existing utilisation of available marine products.
2. Formulate schemes for development.
3. Advise on possibilities for animal feed production from maine resources.

Job Specification
Forestry specialist — One month

1. Study existing methods of tree utilisation.
2. Formulate schems for whole-tree utilisation.
3. Advise on feed and chemical production from trees.

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Job Specification
Agricultural economist — Six months

1. Examine the existing livestock in terms of social significance and potential growth.
2. Determine a pattern of feed requirements.
3. Outline methods of providing feed at lowest cost and with maximum social benefit.

Job Specification
Agricultural economist — Three months

1. Study farm economics in terms of land potential and efficiency of farm techniques.
2. Outline typical farm requirements in terms of chemicals and the form in which they should be supplied.
3. Estimate agricultural requirements and relate requirements to sources of supply.

Job Specification
Fuel economist — Six months

1. Study the supply and application of energy in the various economic sectors.
2. Advise on economies by technical improvements and changes of energy sources.
3. Assist in the design of equipment using local resources of energy.

Job Specification
Botanist — Three months

1. Identify fibre plants which could be developed for paper manufacture.
2. Identify fibre plants which could be developed for sacks and cordage.
3. Formulate schemes for fibre development.

Job Specification
Paper expert — Two months

1. Identify major requirements for paper and the types of paper required.
2. Advise on small-scale paper manufacture and reclaim methods.

Job Specification — Two months
Economist

1. Study the problems of investment and cash flow in conversion industries.
2. Advise on methods of promoting investment.
3. Advise on methods of promoting cash flow.

Job Specification — Three months
Social economist

1. Study the industrial structure in relation to welfare.
2. Advise on relocation of selected industries.
3. Formulate schemes for rural and semi-rural industrial development.

Job Specification — Two months
Institution organisation expert

1. Advise on the construction of trade association and technical institutes within the existing social structure.
2. Devise and implement systems of data processing through institutions.
3. Advise on methods of financing institutions.

5.8.74.

AL/JAG

Topforming - Extracted from 'Dairy Product Packaging' by Allen Jones, November 1972.

There are three stations to the operation. The first is a plasticising unit feeding soft material into a die where it becomes a flat disc. This disc is then passed to a thermoforming cycle, which is the second stage. Here a combination of plug assist, air pressure and vacuum produce the container. The third stage is ejection, previously by a sweeping arm but now by air jet.

The principle originated with Hoffco in Switzerland and in 1970 Daniels Hamilton developed the TC 18, a more compact and economic unit. The number 18 indicates that the rating of the machine is 1800ml. capacity but there are indications that there is economic advantage in making a bigger machine. Limiting dimensions are 1[illegible]0 mm. high and 120 mm. diameter.

So far, 22 different materials have been fully run on the TC 18, from BASF, Shell, BP, Sterling and Dow. Reground scrap is not worth investigating in dairy product packaging, although it could be of interest in other applications, because the process produces no scrap in its operation. Emphasis is on polystyrenes and with a conventional 6 gms. yoghurt cup the output is of the order of 1,000 per hour. Recently, the plasticising capacity has been stepped up from nearly 9 to 22 kgs./hour, which allows higher out put rate at higher shot weights.

In contrast to injection moulding the tooling cost is low, about £600, and it is possible to have varied short run operation with a total capital outlay of the order of [illegible],000. The future is seen, not as direct competition against high output injection or thermoforming, but in varied or short run production, and in the building up of production from a modest start to high output with a bank of machines. In this respect it follows the policy of Bekum with their small blowing machines.

Mouldings produced have a very fine control over wall thicknesses, including the provision of a strong landing to take a lid under pressure. There is low stress in the mouldings if the combination of plug assist and pressure is well organised, which helps particularly in deep draw. This can be true of conventional thermoforming but the TC 18 starts with a soft disc of calculated thickness and this helps to reduce stress distribution. Excellent production is possible with crystal polystyrenes.

Container costing depends on conditions of operation but there is a basic advantage over conventional thermoforming in the avoidance of pre-manufactured sheet. Primary running cost, ignoring outputs, is approximately:

Top former	£1.2 per hour
Single impression injection moulding	£1.50
4 impression injection moulding	£3.75
Conventional thermoforming	£[illegible].30
Thermoforming with included extrusion	£15.'0

Top former production rate is dictated by the shot weight and is a direct influence on per container cost. At 300 to 400 per hour, which means bigger containers, per container machine cost is [illegible].3 to 0.4 pence using polystyrene. At 500 to 600 per hour the per container machine cost is of the order of 0.2 to 0.3 pence. Above 800 per hour, which is in the yoghurt cup range, the machine cost is between 0.1 and 0.2 pence per container.

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Appendix 1

Material cost is similar to that for injection moulding, both processes starting from powder or granules. For a 6 gms. yoghurt cup the material cost is 0.1 pence, increasing to 0.3 pence approximately at 20 gms. The absence of scrap enables a linear relationship to be used for shot weight and material cost.

Combined machine and material cost for a 6 gms. yoghurt cup by Top former is about £2.5/thousand, roughly 25 pence per thousand more than by injection moulding. It is about equal to that of conventional thermoforming at some ten times the output rate, indicating that Top former can replace conventional thermoforming where a lower output rate is needed without increasing per container cost. The Top former per container cost is at least 50 per cent higher than that of thermoforming with built in extrusion and rated at some 30,000 or higher. Top former is not likely to replace very high output thermoforming with built in extrusion.

If, however, the shot weight is increased there is a different set of comparative costs. With increased shot weight injection moulding becomes progressively more expensive when compared against Top former and above about 2[illegible] gms. there appears to be sufficient advantage for Top former to be preferred. With increased shot weight the per container costs of conventional thermo-forming also rise sharply. Top former shows advantage over conventional thermoforming at all weights if the conventional thermoforming does not include rescue of scrap, and shows advantage at and above about 12 gms. if the thermoforming rescues its scrap. Compared against thermoforming with built in sheet manufacture, Top former shows advantage with shot weights at and above about 16.[illegible] gms.

In other words, if low output of 6 gms. cups is required Top former has general advantage. If high output is required Top former competes only against conventional thermoforming, which suffers by the 60 per cent extra cost of using sheet instead of powder or granules and by the reduced value of material after recovery. At 15 gms. shot weight the comparative costs are similar and other considerations determine the process selection. At about 18 gms. shot weight Top former shows general advantage and could compete against coated paper cartons. This possibility makes Top former very interesting in dairy product packaging.

Dreloe, which is part of the Smith and Nephew Group, are contract thermoformers using polystyrenes and polyethylene produced as sheet within the company. Thicknesses used are from 0.19 to 6.[illegible] mm. and printing has been given special attention to five colours. Top forming has been developed to a high degree.

APPENDIX 2

LIQUID PACKS

Bag-in-Box

Bag-in-box comprises a plastics film bag in either a disposable carton or a returnable moulded plastics crate. General Films Inc. use double-layer polyethylene film bags, at 3, 6 and 12 gallons filling at 1 gal/sec. Their 1972 costs were about 40 Kc for dispenser packs and 20 Kc for pouring packages. Outers were moulded crates with 1000 journeys to loss. In Holland returnable moulded crates are used as outers for 20 litres. There, cost is (1972) about 14 shs. per outer with a life of two years or 160 trips. Material is 4 KC per gallon and full operational cost including washing is 10 KC per gallon. In USA Magipak use ABS containers at 2, 3, and 7 gallons with a cost of about 35 KC per gallon.

Systems using disposable cartons as outers include Pergall by Bowater Organization. At 5 gallons, the bag is two-ply polyethylene. The bag and box at 5 gallon weighs 1.5 lbs. and replaces a milk churn at 17 lbs. Another system is by Forenade Woll AB using bags furnished with push-in or screw caps and taps. The outer is paperboard and volumes are 10, 20 and 25 litres filling at 150 l/mt. Zewathener has a system of eight stages. Film or coated paper is welded to form a bag and is then inserted into a paperboard box. Bottom flaps are sealed and taped, after which the unit is inverted. After filling the bag is welded to seal and the top of the outer closed. Unit weights are about 0.2 kg. per 5 litres of capacity.

The systems are known to the paper and board industry in Kenya.

Blown Plastics Bottles

Kenya will need blended polyethylene bottles for milk and PVC bottles for edible oil. The production costs vary according to the periods of running of machines. 1972 plant costs varied £ 80,000 to £ 200,000 for 6000/hour. U.K. overheads varied 0.07 P. to 0.2 P. per bottle with 14 hour running, or twice this for 7 hour running. Variable U.K. costs were 0.06 to 0.09 P. U.K. material cost per bottle in 1972 for polyethylenes was about 0.3 P. The final costs as calculated in 'Milk Packaging' by Allen Jones were:

Machine price range £	Fixed costs P	Variable costs P
80,000	0.0732	0.0621
120,000	0.1270	0.0850
200,000	0.1984	0.0892

Final per-bottle prices can be determined by adding about 0.3 P to the above for material.

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Machine Price Range £	Package Cost, P/Litre
80,000	0.4478
120,000	0.5269 to 0.5313
130,000	0.5443
200,000	0.6001

An interesting situation arises when the machines are run on pint bottles. Output rates measured as numbers of bottles increase 10 per cent but the weight of polyethylene per bottle reduces by about 25 per cent. The significance of material content in total costing drops from about three-fifths in 1-litre bottles to about a half in 1-pint bottles. Conversely, machine costs assume more importance in pints than in litres on the same machines. Package costs for pints are:

Machine Price £	Fixed and Variable Plant Costs, P	Material Cost, P	Package Cost, P
80,000	0.1218	0.2255	0.3473
120,000	0.1930 to 0.1969	0.2255	0.4185 to 0.4224
130,000	0.2086	0.2255	0.4341
200,000	0.2584	0.2255	0.4839

If the plant is run on pint bottles, but for one 7-hour shift instead of for 14-hours per day, the plant costs double and contributes more to the final cost than does the material cost. According to the machine price the proportion of total cost which is not material cost varies from one-half to five-sevenths approximately. Finished package costs rise accordingly to between 0.47 pence and 0.74 pence.

Cartons

Alternatives to Tetrapak which should be cost-analysed and evaluated for future developments include:

Perga - Bowater Flexible Packaging, Bowater House, London

Purepak - Ex-Cell-O Corpn. Detroit, U.S.A.

Zupack - Habra-Werke Wilhelm Zupack GmbH, Darmstadt, W.G

Blocpak - Jagenberg-Werke AG/Linnich GmbH, Dusseldorf, W.G.

Haskon-Haskon Inc., St. Paul, Minn. 55114 U.S.A.

Jiropak - Jiropak Ltd., Crayford, Kent, U.K.

Sealright - Sealright Co. Inc., Kansas City, Miss. 64112, U.S.A.

Unit price for Perga in U.K. in 1972 was 0.6 P. Bowater supply a small-scale filling and sealing unit for volumes to 1 litre, which is of direct interest. Jiropak is a carton made from high density polyethylene and is of reduced interest.

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Sachets

Sachets are film bags to contain liquids and are known in Kenya for milk. Systems to be cost-analysed include:

Bertopack - Bertoglio Sarl., Lugano, Switzerland.

Finnpack - T Halonen Oy., Toijala, Finland

Milk-pack - Hassia GmbH, Oberhausen, W.G.

Rotapac - Rovema AG, Giessen W.G.

Pitcher-Pak - Prepac, Villejuif, France.

Thimopack - Thimonnier et cie, Lyon, France

Magema - Magema, Dresden, DDR.

Systems use either tubular film or flat film formed into tube or bags on the machines. Material is mainly about 0.1 mm. thick low density polythelene. A semi.scale filling unit at 400 litres/hour is of direct interest, as supplied by Prepac, but most systems aim for about 4000/hour filling at one-litre, which is roughly the filling rates for plastic bottles.

QUOTATIONS FOR PAPER PULP PACKAGING UNIT

Development Techniques Limited offer for sale a plant specifically developed for the small scale production of paper pulp articles. This plant has been designed to meet small scale packaging requirements of developing countries utilising t eir own raw materials, e.g. waste paper, in the production of egg trays and other packaging materials for internal consumption.

THE PLANT consists of a forming station and pulp preparation station including the necessary pulpers, vacuum pumps, mixin tanks, storage and service tanks, etc.

Price inclusive of standard voltage electric motors, one mould, and all plant d·tails but excluding pipework to carry water or any other site requirements, buildings, drying house, etc.	£10,500 ex works
Delivery	6 - 9 months from receipt of firm order.
Terms	Net Cash, against shipping documents and irrevocable letter of credit, confirmed by a bank in the U.K., to be established at the time of placing the order.

Development Techniques Limited would be prepared to send with the plant a fully qualified engineer to assist in setting up the plant and starting production. The additional cost for this would be £1[illegible] per day, plus travel and subsistence expenses.

Technical Details of the Plant are attached.

P.T.O

Appendix 3

Power Requirement

3 phase 400 440V 50 Hz
Total maximum consumption 45KW/hr
Pulp Preparation Unit - 9.5 KW/hr
Dryer (heaters) - 31.5 KW/hr
drive - 4 KW/hr

All motors are standard voltage fan cooled, tropicalised.

The figures quoted for maximum power consumption of the dryer are based on tests carried out at 50 degree F. 70% humidity. Where ambient temperatures are higher, a significant reduction in power consumption can be expected.

Labour Requirements

Three men are required:

1. Operator to prepare pulp
2. Operator to operate forming table
3. Dryer operator

No special skills are required.

Supervisionn

This will vary with local conditions. Basic requirements are the organisation of raw materials and those factors concerned with the distribution of the finished product.

Raw Materials

14 lbs (7 - 8 kgs) per hour
Suitable materials - waste newsprint, printers' waste, general grades of clean waste paper.
It is important that polythene P.V.C. etc. wrappings are not used.

Waste Disposal

Under normal working conditions there is no waste from the plant. Any effluent that occurs during cleaning will consist of water or paper pulp solution.

Gullies or soakaways should be provided to accomodate this.

Water Consumption

The major part of the water used in the process is recycled. Experience has shown that a consumption of 300 litres per hour is normal. Most of this is lost through the dryer.

A gradual build up of fine fibres is to be expected in the recycled water. This will not affect the process materially but depending on local conditions this may necessitate dumping to waste occasionally thus increasing the overall water usage slightly. A water supply of 5 lbs/sq.in. is required (normal mains pressure).

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Appendix 3

Additives

Two additives are required in the process:
1. Water Soluble Wax Emulsion
2. Aluminium Sulphate

The usage of these two items is 50 gms of each per batch of pulp. Assuming two batches of pulp per hour then the weekly requirement (40 hrs) is 400 gms of each. Both materials can be supplied by Developmental Technics on a continuing basis.

In certain conditions of heat and humidity a build up of bacteria can be expected. Water treatments are available to cater for this and advice will be given where necessary.

During cleaning and maintainance a weak solution of sodium hypoclorite (household bleach) mixed with paraffin (kerosene) will inhibit mould and bacterial growth.

Moulds

Moulds to produce a variety of articles can be produced to customers requirements.
Standard moulds are available:

1. 30 egg wholesale tray. This design gives a self supporting stack of filled trays that do not require boxing for transit.

2. 2 x 6 retail egg packs. These packs can be sealed with a conventional office stapling machine. They are designed to be split into two six packs at point of sale if required.

This mould table will accommodate moulds up to 18" x 18" x 6" with a surface area of approximately 220 sq. in.

Site Requirements

A covered area of 20' x 40' is required. This allows working space around the plant and also storage of both raw materials and finished products.

Flooring and Foundations

A substantial smooth concrete floor to a depth of 12" under the main items of plant is required. Floors of lighter construction, 6", may be used over the remaining area.

Services

Power 3ph 400 440V Hz to two positions

Water Mains supply to one position.

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Capacity

The plant is designed to carry out 120 - 150 cycles per hour. With a mould designed to produce single articles this will give a production rate of 120 - 150. per hour.

Depending on the size and design of product multiple moulds may be used which will give a proportionately higher output of finished articles.

Process

Waste paper is pulped and diluted with water to give a working consistency (.5%). Small quantities of water soluble wax and alum are added to the pulp.

The article is formed by applying vacuum to a specially produced mould which is submerged in pulp solution. The formed article, in a semi wet state, is transferred to a dryer for completion on the production process.

Plant.

The plant is self contained and comprises:

1. Pulping and Preparation Unit including:-
   Pulper
   Water and Pulp Storage Tanks
   Vacuum Pump
   Air Compressor and Receiver
   Pulp Delivery pump
   Agitator
   Supporting Structure

2. Forming Unit including:-

   Pulp Holding Tank
   Mould Carrying Table
   Transfer Mould Sliding Platen
   Supporting Structure

3. Dryer
   Tunnel type; ducted air supplied by fan. Chain driven rod type conveyor. Electric motor drive through reduction gearbox. Electric heaters standard. The dryer can be adapted to employ other fuels for heating i.e. gas, steam, oil.

Dimensions and Weights

Pulping and Preparation Unit.

10'6" high, 6'6" wide, 6'6" deep.
Nett weight 1.0 ton. Weight loaded 5.0 tons max.

Forming Unit:

7'0" high, 4'6" wide, 4'0" deep.
Nett weight 0.5 tons. Weight loaded 0.75 tons.

Dryer:

29' 3" long, 6'0" wide, 5'9" high
Weight 1.7 tons.

APPENDIX 4

PRIMAL JOINTED MEAT

Primal joints need to have most of the air excluded from the meat by vacuum packaging in film. The Cryovac method puts the meat into a bag, draws the air out through a nozzle and then shrinks the bag in hot water. Other systems use a vacuum chamber with sealing of bag under vacuum. Experience has shown that the permeability of the film for 10 kg. joints should be less than 100 $cm^3/m^2/day/atm.$ and the popular material is PVdC for the barrier layer. Nylon/polyethylene (20u/70u) is commonly used with or without a PVdC layer. The essential level of vacuum is said to be 98 percent. A common economic level for primal jointing and subsequent use of vacuum chambers is 100 sides (50 beasts) per hour, which is high for the Kenya market. It might be possible for Kenya engineers to design a low-output machine. Capital costs using the Metal Box system in U.K. is 0.5 P per beast. Metal Box (Kenya) are evidently not familiar with the process as used in U.K. but can no doubt get the information. It is probable that a low vacuum system using a chamber would be satisfactory for Kenya. In USA nylon/ionomer bags are used but ionomer costs about 25 percent more than polyethylene - although it seals at a lower temperature and will encourage easier machine design. Allied Meat Company of Denver appear to operate at an economic level of 25 sides into 250 bags per hour, using [illegible] corrugated cartons per side for the outers. KMC have a Swiss machine and are familiar with the technology of primal jointing.

MATERIAL PRICES

This report has been compiled during a period of extreme confusion regarding material prices. This confusion is likely to continue until there are clear indications of the probable investment pattern for profits from oil. Tin metal, which is a major influence in canning, reached a peak of £4000/ton in May 1974 but has since dropped to £3499/ton. At the same time steel has dropped a reported 40 percent in mid-1974. Also, lower food prices in world markets have encouraged canning projects in producer countries. In theory there should now be more canning with cheaper cans but economic theories are no longer to be trusted. One London estimate is that can prices should now drop about 15 percent but conversely the makers of cans claim ability to raise prices 30 percent without damage to the market.

Paper increased in price 40 percent during 1973/4, mainly because paper-makers were seeking more profit to attract investment and to pay for developments. Notable in the necessary development is pollution-control, including protein manufacture from fermented effluent. It is now evident that paper-makers will have to convert effluent to protein, converting a present liability into a profitable process. It is doubted, however, if more efficient use of raw material (full tree conversion instead of 40 percent utilisation) will result in lower paper prices, although it should help to stabilise prices. Packaging paper prices are evidently being held up by demand for the more-profitable non-packaging paper - a demand which can not be met and which draws production away from packaging paper. In theory paper production in Kenya should find good prices and a ready market for many years.

Plastics prices do not, as is frequently claimed, depend on oil prices. They depend on production capacity, which has been strained through 1972/3/4 from undercapacity arising from cuts in investment. A change of oil price a few dollars either way is unlikely to influence polymer prices and recent cuts in oil prices have marginal significance. London reports that polymer capacity in 1975/6 should exceed demand but that new demands could result in another shortage after 1980 when water schemes need pipes and high paper prices encourage conversion to plastics. Much depends on whether the oil countries spend money on petrochemical developments at home or invest their money abroad. Hence, Kenya should take care in promoting plastics developments until the intentions of oil countries are known. Tape manufacture can be excepted because the jute situation will provide a special situation.

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A report from Bangladesh is that jute production is dropping rapidly, one estimate being that there will be a 30 percent drop this coming harvest against a normal harvest. On the other hand, India is increasing output but only for domestic weaving. The estimate considers that at least one million tons of rice will replace jute and that jute will progressively price itself out of the market. In theory this should encourage prices for sisal and other fibres which are not confined in their climatic requirements.

Glass prices must rise in sympathy with energy and handling costs and a decline in demand is expected as other materials show lower handling costs. To compete in general packaging glass needs a ten-fold reduction of unit weight, insensitivity to fracture and more design [illegible]al - all impossible with glass. In Kenya, however, most of the application is in beer bottles which are difficult to replace and in which higher bottle prices can be passed on to retail prices.

In general, therefore, Kenya faces a more attractive packaging material situation than was forecast in early 1974, with the exception of jute which appears to have developed as more of a potential problem. Conversely, Kenya faces an unattractive situation with regard to products requiring packaging. World basic prices in early 1973 were too low and there are signs that 1975 basic prices will be little above 1973 prices (coffee was £425 in 1973, rose to £625 in early 1974 then dropped to a present £490). With less effective profit, the commodity trades will have to cut their packaging costs (or handling costs) back to 1973 levels at most. The higher material prices for packaging materials will be justified only by up-grading products for export. The domestic market will require development of domestic materials including those now classified as rural crafts.

Import Pattern	1972 units/mshs	1973 units/mshs
Aluminium foil	258t/3.6	Nil
Paper bags and boxes	780q/0.9	515q/0.8
Jute bags	2.1m/5.3	22500/0.043
Other bags	198q/0.2	10q/0.012
Made up metal cont.	11,000q/8.0	10763q/11.4
Glass cont.	7500q/2.8	9323q/3.3
Jute fabrics	2277sq.m./0.0087	161000sq.m./0.77
Ramie products	287000sq.m./2.8	266000sq.m./2.8
Raw jute	7193t/15.4	8300t/15.5
Metal closures	/3.0	/3.3
Tinned steel	16,800t/29.7	23,000t/47.5
Kraft paper	300000q/58.7	318000q/70.1
Composite and board	1705q/0.5	5918q/2.2
Corrugated board	1542q/0.4	3237q/1.1
Parchment/greaseproof	3459q/1.3	13000q/6.3
Plastics bags	/0.4	/0.53
Polymer	96000q/32	118000q/45.9

Import Pattern	1972 units/mshs	1973 units/mshs
Pulp and waste	41000q/2.3	52000q/3.3
Hemp yarn	137q/0.5	85q/0.3
Material import cost	K £ 8.4 m	K £ 10.75 m

(t-tons. q-quintals, sq.m.-square metres)

The price rises of importance are those of metal and paper. The packaging content of the plastics is too small to be important. Sacking materials, despite the drift from made-up bags to fabric, dropped in cost from nearly 24 mshs to 19 mshs.

PAPER IMPORTS/DISPOSAL

Based on comments from importers the pattern of demand in 1970 was:

East African Packaging Industries 1[illegible],000 t/y sacks
1[illegible],000 t/y corrugated

Printpak - 2000 t/y board
1200 t/y corrugated
2400 t/y kraft
1700 t/y newsprint

Ideal Packaging 2000 t/y white board.
100 t/y greaseproof

Shamac 200 t/y white board

Paper Bags Ltd [illegible]000 t/y sack kraft
[illegible]600 t/y white board
E.A. Paper Bag Man. 900 t/y bag paper

Kenya Litho 3300 t/y board

Hussein Packaging/Printing 400 t/y board.

The 1974 quantities are evidently likely to be much higher. Board demand is of the order of 11,600 t/y plus the 197[illegible]/74 increase, which justifies a feasibility study of a board mill allied to new paper production. In 1970 the board came in at K£87 per ton but now costs K£200 to K£[illegible]00 according to source and quality. Kraft cost is about K£270, quality writing paper is K£380 and newsprint K£160. Quality paper is likely to show higher inflation in price than lower grades, adding weight to the proposal that Broderick Falls, capable of producing quality paper, should be backed by further capacity capable of producing only lower grades at probably less cost/ton than Broderick Falls.

The 1972 disposal was roughly:

Lineboard fluting	18,400 t	
Sacks/Bags	21,000 t	
Quality Paper	[illegible],000 t	plus already printed
Newsprint	1,700 t	
Box Board	4,000 t	
Other probably	[illegible],000 t	

This indicates about [illegible]0,000 tons in packaging. The non packaging paper has not been investigated for this study but there is opinion that it is 'towards half that of packaging paper'. No doubt Broderick Falls have studied this market.

1972 paper imports were listed as about [illegible]9,000 tons. It seems improbable that non-packaging paper imports were only about 9000 tons when one consi ers the weight of office, education and personal writing and printing in Kenya. A detailed study of sources and disposal appears to be indicated.

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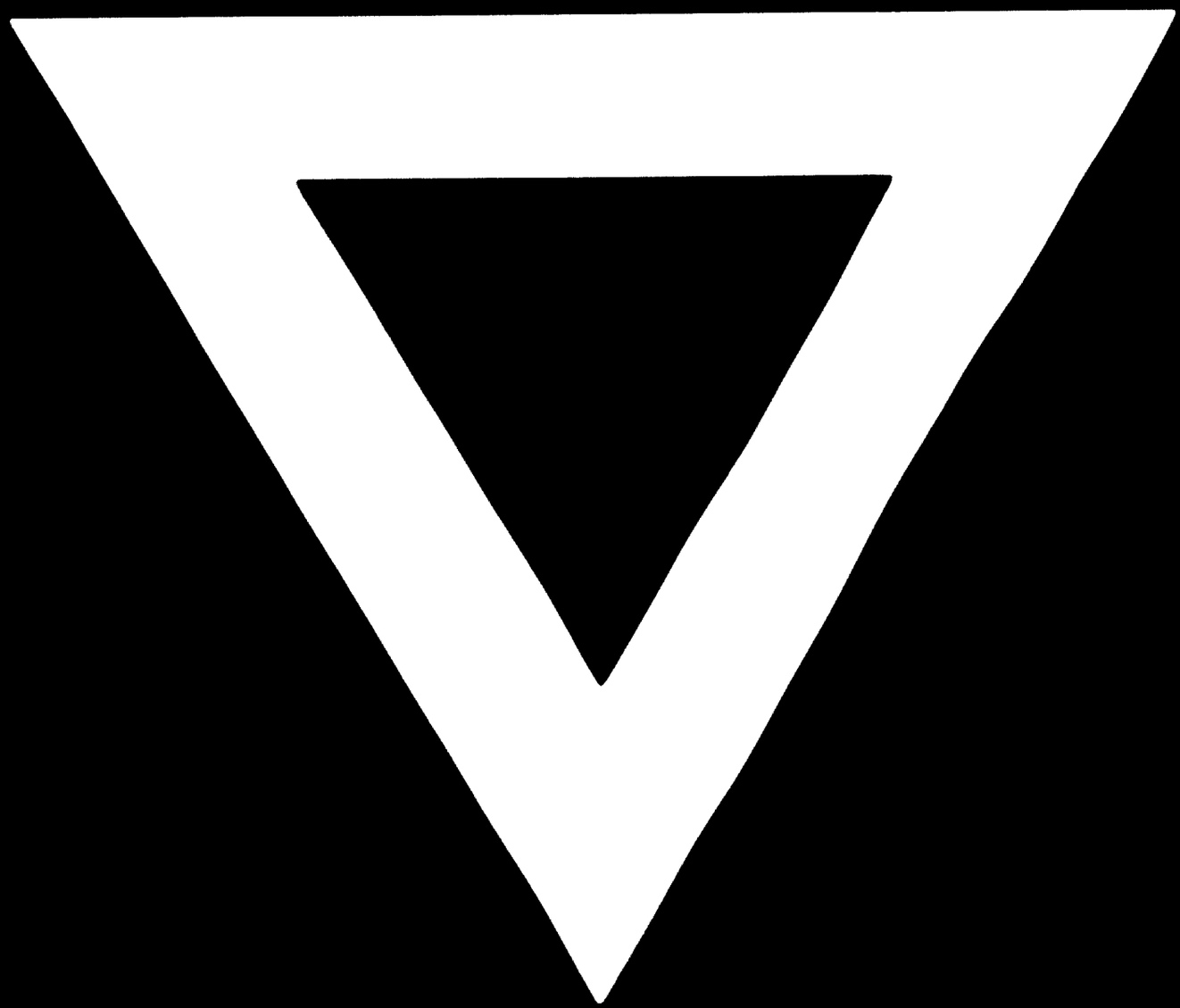

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