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CENTRE FOR INDUSTRIAL DEVELOPMENT AND RESEARCH

DP/LIB/69/512

LIBYAN ARAB REPUBLIC.

Technical Report: PACKAGING

Prepared for the Government of the
Libyan Arab Republic by the
United Nations Industrial Development Organization,
executing agency for the
United Nations Development Programme

United Nations Industrial Development Organization

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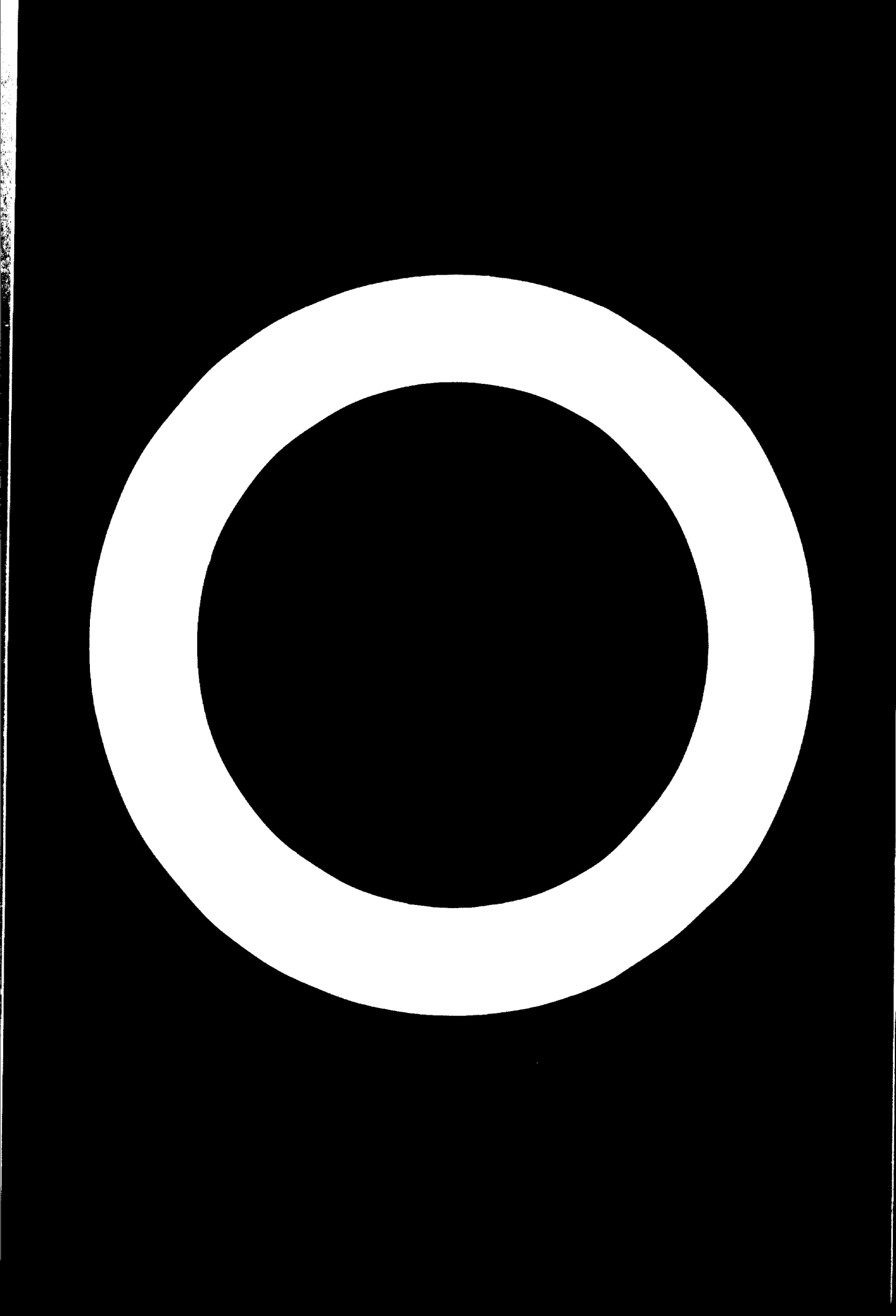

United Nations Development Programme

CENTRE FOR INDUSTRIAL DEVELOPMENT

AND RESEARCH, TRIPOLI

(DP/LIB/69/512)

LIBYAN ARAB REPUBLIC

Technical report: Packaging

Prepared for the Government of the Libyan Arab Republic
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of N.V.R. Iyengar, expert in packaging

United Nations Industrial Development Organization
Vienna

EXPLANATORY NOTES

NASCO is the National Supply Company.

References to "tons" are to metric tons.

Reference to "dollars" ($) are to United States dollars.

References to "dinars" (LD) are to Libyan dinars.

Reference to "pounds" (£) are to pounds sterling.

The following exchange rates are used:

Country	Currency	Exchange rate per US dollar in 1974
Libyan Arab Republic	Libyan dinar	0.29605
United Kingdom	Pound sterling	2.40

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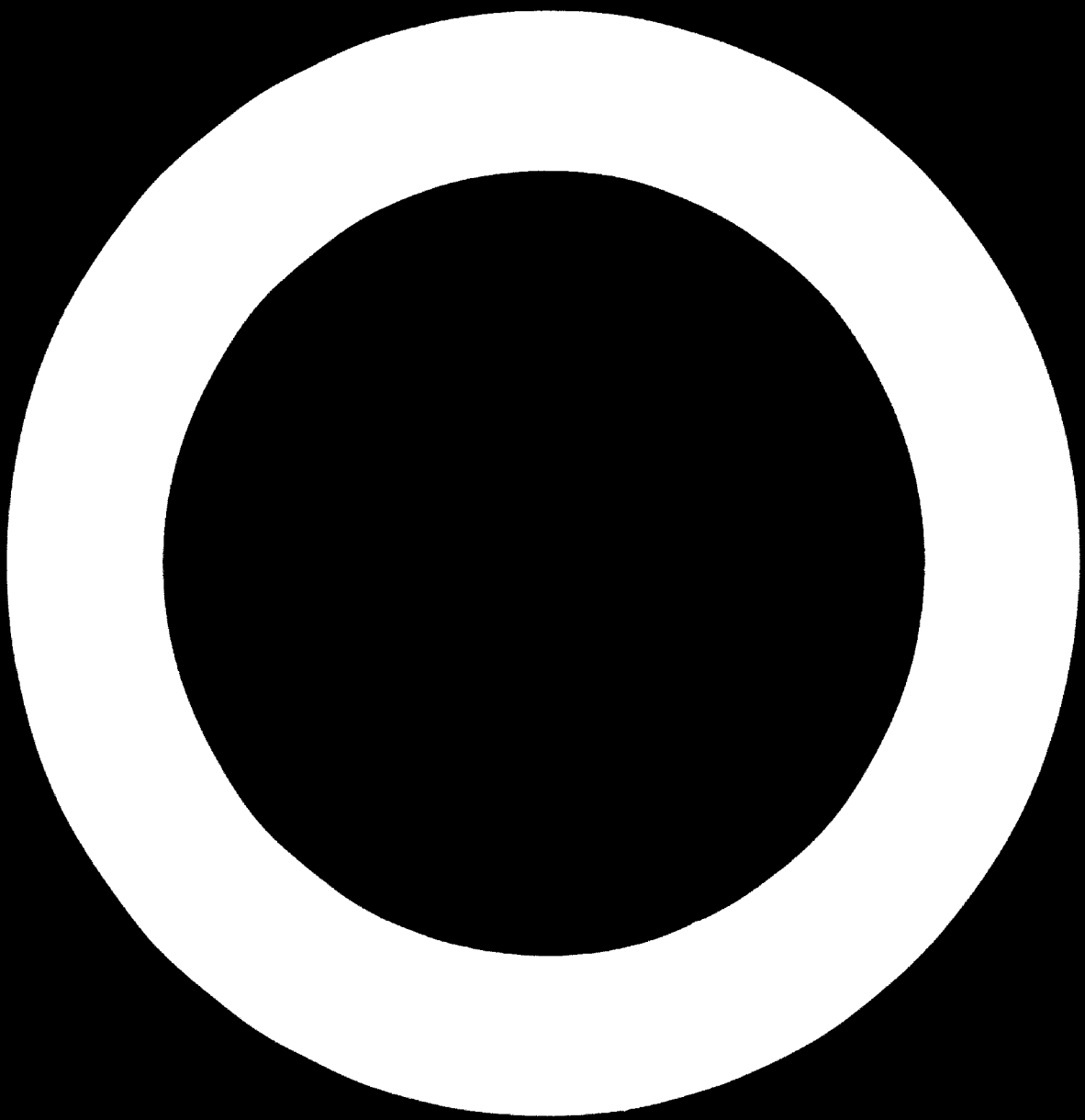

INTRODUCTION

The Libyan Arab Republic is in North Africa, bordering the Mediterranean Sea. It has an area of 679,358 square miles, of which about 90 per cent is desert. A narrow coastal region, backed by mountain plateaux, is quite fertile. The principal crops are barley, wheat, groundnuts, olives, dates and a wide variety of fruits and vegetables. Nevertheless, Libya imports over 75 per cent of its food requirements. In 1972, food and products worth about 106.5 million Libyan dinars (LD) were imported.

The population of Libya was estimated at about 2 million in 1972, with an annual growth rate of about 3.7 per cent. About 95 per cent of its people live in the coastal region, and, as a result of the rapid present rate of industrialization, there is considerable migration from rural to urban areas.

Owing to a long history of European influence and to immigration, the population is adopting modern life styles although many traditional habits and tastes persist. This tendency has necessitated the importing of a wide range of food and non-food consumer products. It is anticipated that, as the country becomes more industrialized, there will be an ever-increasing demand for well-packaged consumer items with built-in convenience features. This demand will be accentuated by the shortage of labour.

Libya is rich in petroleum resources; over 85 per cent of its revenue is provided by oil exports. A large part of this revenue is being used to raise the standards of living of the people in all possible ways.

Large-scale plans are being implemented to increase food output by the adoption of several agrarian measures. The 1972-1975 budget which allocates $US 735 million for agrarian reforms, includes funds for the wide development of agriculture, horticulture, dairying, poultry raising and fish canning, so as to minimize reliance on food imports.

Similarly, projects relating to such basic industries as textiles, cement, fertilizers and steel are in various stages of development; there is now intense industrial activity in all sectors. This young republic is on the verge of rapid development in many fields.

To achieve these objectives, the Government has set up a number of organisations, among them the National General Organization for Industrialization, the Industrial Bank and the Centre for Industrial Development and Research, Tripoli, which work together to promote industrial prosperity.

The Centre for Industrial Development and Research, Tripoli, which is intended to provide the scientific and technological support to various sectors of industrial growth, was established in 1976. It is a rapidly growing technological institution that has become a key factor in industrial development. It has taken active steps to incorporate packaging research and technology into its development scheme and, under the auspices of the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO), secured the services of an expert in this field to survey the status of packaging in Libya and to suggest measures for its improvement.

The present study is based on information and impressions gathered on visits to selected factories producing consumer goods and packaging materials and to department stores, wholesale markets and wayside shops. The factories and organizations visited are listed in annex I. There were also discussions with several authorities concerned with packaging, handling and distribution.

The state of packaging of some important products, with emphasis on food, ways and means of up-grading the packaging pattern in this country, and the requirements of the technological base at the Centre for Industrial Development and Research in terms of staff, their training, equipment and expertise to attain its goals are presented.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The Libyan Arab Republic imports more than 75 per cent of its food requirements. In 1972, food and food products with a value of LD 106.5 million, were imported. About 95 per cent of the population lives in the coastal region. As a result of the present rapid pace of industrialization, there is considerable migration from rural to urban areas. It is anticipated that, as industrialization continues, there will be an ever-increasing demand for consumer items that are well packaged and that have convenience features.

The present study involved visits to selected factories that produce consumer goods and packaging materials and to department stores, wholesale markets and wayside shops. Discussions were also held with several authorities concerned with packaging, handling and distribution. The report is based on the information and impressions gathered from these sources. It indicates the present state of packaging of some important products, with emphasis on food. Ways and means of up-grading the packaging pattern in Libya and of expanding and strengthening the technological base of the Centre for Industrial Development and Research at Tripoli, in terms of staff, their training and requirements of equipment and expertise are presented. The recommendations are summarized below.

A Packaging Advisory Service should be immediately created at the Centre for Industrial Development and Research, Tripoli. This unit should begin by assisting Libyan industries in solving some of their urgent packaging problems and making plans for the packaging of such important products as meat, fish, fruits, vegetables and dates.

The staff of the unit should consist of two graduates trained in packaging and a technician familiar with the handling of delicate instruments. The two graduates should be trained abroad in the basic principles of packaging at an appropriate institution for periods of 6 to 9 months (annex II). Assistance from UNIDO in the form of fellowships should be sought.

Equipment for the evaluation of packaging materials and packages, costing costing about $57,000, should be obtained in a phased manner (annex III).

Space measuring 300 square feet (air conditioned) for the materials testing room and another 300 square feet for package-testing instruments should be provided.

Action should be taken to obtain books and periodicals relating to packaging to augment the resources of the library of the Centre (annex IV).

The services of an experienced packaging technologist should be secured for a period of two years through UNDP to develop appropriate expertise in packaging and to advise and assist industries in improving their packaging patterns (annex V).

Action should be taken to formulate standards for packaging materials and packages.

To promote packaging concepts, action should be taken to prepare circulars and pamphlets and to send them to various industries and concerned organizations. Radio and television programmes could include items relating to the importance of hygenic packaging of food products.

In the field of exports, it seems well worth while to study some potentially important exportable items and to develop appropriate packaging for them.

Action should be initiated to promote the establishment of a 5,000 tons/year corrugated board boxmaking factory. It might also be useful to establish, in the Benghazi area, a 3,000 tons/year factory to produce brown wrapping paper from waste paper and corrugated board. This possibility should be investigated.

The establishment of a plant for the conversion of paper, plastics, viscose film, aluminium foil and their laminates to serve the needs of various food-processing industries in the Tripoli area, is also worthy of investigation.

PACKAGING PRACTICES IN LIBYA

The impressions and information collected during the course of the study are presented in the following pages. Annex VI indicates the packaging pattern generally adopted for various products manufactured in the country.

Factory-produced foods

According to the 1971 census and statistical report, Libya had 71 large food-processing industries; many, among them the poultry, fish, edible oil and mineral water industries, were in the public sector. The public sector industries have expanded since then, and more units are being established in various areas to cater to the needs of the local populations. The private sector industries are also diversifying and expanding their production. Since the policy of the Government is to make the country as self-sufficient as possible as regards its food requirements, it is striving to expand and increase the production of the agricultural, horticultural, dairy, poultry raising and fisheries sectors. However, the volume of raw material used by the food-processing industries accounts for only about 15 to 20 per cent of the total production, the rest being marketed in unpackaged form.

In order to observe the packaging patterns adopted for each type of product, some important factories were visited, as shown in table 1. They are listed in annex I.

The general pattern in all of these industries is that the processing and packaging machines used are imported, and the methods of manufacture are likewise of foreign origin. In practically all cases, imported packaging materials and containers are used. The packaging materials are determined primarily by the type and make of machine that has been adopted. In general, the packagers seem to have made no attempt to utilize newer materials with better and more economical properties for the reason that the machines used are not suited to them. The packagers are thus entirely dependent on foreign suppliers for day-to-day advice.

Table 1. Factories visited

Industries	Units existing	Units visited
Foodstuffs		
Canning and pickling of fruits and vegetables	11	5
Fish canning	1 a/	1
Edible and hydrogenated oils	27 b/	1
Macaroni products	6	3
Bakeries (biscuits)	4	3
Bakeries (bread)	Many c/	1
Confectioneries	7	3
Dairy products	3 d/	2
Carbonated soft drinks and mineral water	8	2
Flour mills	4	1
Non-foods		
Cigarettes	2	2
Shoes (leather)	2	2
Animal feeds	1 e/	1
Cement	4	2
Paints and varnishes	3	2
Dry batteries	1	1
Textile garments	2	1
Safety matches	1	1
Detergents	1	1
Disinfectants	2	1
Lubricating oils	1	1
Packaging materials		
Plastic bags, including shopping bags	3	2
Paper bags and paper conversion	1 f/	1
Multiwalled paper bags	1	1
Tin cans for paints and varnishes	1	1
Tin cans for lubricating oils	1	1

a/ Three more units are being set up.

b/ Including many oil presses.

c/ Many small bakeries produce a wide variety of baked goods.

d/ Two more units are projected.

e/ Three other units are under construction.

f/ This group is said to include many small units.

In the processed fruits and vegetables category, tomato paste, hot-pepper paste, olive pickles, jams, squashes and the like are significant. Fresh produce for processing is obtained from local sources. One or two tomato processing factories have their own can-making lines, using imported lithographed tin plate, while others obtain their cans from abroad. Three-ply corrugated board boxes obtained either along with the cans or separately, are used for bulk movement of filled cans, glass jars and the like. Owing to the rusting of cans and the breakage of glass bottles in quite a few import consignments, the factories experience losses as well as reduced productivity. Practically all the tomato canning factories work only for about four or five months in the year. All of the processed tomato products are taken over by the National Supply Corporation (NASCO) for distribution to the public.

The fish-canning industry, which is being developed by the Government on modern lines, has one unit in operation and three more under construction. The existing one, at Zanzur, has a line for the production of rectangular aluminium cans from imported lacquered aluminium sheets. When in full production, this line is expected to have enough capacity to supply all four factories for the canning of sardines. The corrugated board boxes required for bulk movement are obtained from abroad.

Attractively printed moisture-proof viscose film is the principal material for wrapping macaroni in 1-kg packages. Cloth bags are used for institutional distribution. Macaroni is sometimes marketed in plain paper packages. The requirements of corrugated board and other packaging materials by this industry are imported.

Biscuits produced in the country are packaged in printed moisture-proof viscose film, with an inner liner of grease-proof paper. Aluminium-foil laminates and attractively printed tin containers are used for gift packs. These products are distributed to retailers in corrugated board boxes.

Bread and other baked goods are still generally sold unwrapped, although there appears to be a trend towards the use of polyethylene bags, obtained from local sources.

Sugar confectioneries and hard-boiled sweets are twist wrapped. Toffee is packaged in printed aluminium foil with inner wax-paper wrapping. Sugar-coated nuts are marketed with no individual wrapping. All of these products are sold in printed heat-sealed polyethylene bags containing 250 g, 500 g or 1 kg. As with biscuits, lithographed tin containers, plastic jars and the like are used for gift packs. Here again, the products are delivered to the dealers in corrugated board boxes. All of these packaging materials are imported.

Wax-paper cups, plastic cups and wax-paperboard cartons, printed polyethylene bags (300 gauge), all of which are imported, are the main packaging media for yoghurt, ice creams, pasteurized fluid milk and fermented skim milk. In some cases, pasteurized milk is also sold in glass bottles. Corrugated board boxes are the main bulk-packaging medium for these products.

Soft drinks and carbonated mineral water in glass bottles with crown corks lined with polyvinyl chloride (PVC) are distributed over long distances in plastic crates. Wooden crates have given place to plastic ones, since they are lighter and more durable. It is considered that the advantages of plastic crates amply justify their higher cost. Plastic crates are also widely used for the transport of fish, dairy and poultry products.

NASCO is also the distributing agency for deodorized and purified edible oils. Tin containers for them are imported in corrugated board boxes, which are subsequently used for the filled cans. The rusting of these cans and inadequate performance of the boxes are not uncommon.

The hydrogenated vegetable oil marketed in Libya is a blend. The only factory that produces it makes its own containers from imported lithographed tin plate. The wooden boxes formerly used for bulk transport have given place to corrugated board boxes.

Egg and poultry plants, which are being greatly expanded by the Government, utilize paperboard trays for egg packaging and corrugated boxes for bulk shipment. Lately, the use of plastic egg trays has been considered. Printed polyethylene bags are used for dressed poultry, and the shipping container is a covered paperboard box that holds 10 kg of the product.

There are many products such as coffee (in bean form or ground whole and ground spices, local sweets and indigenous foods, that are packaged in various ways. There is also a trend towards selling such products as pulse, cereals sugared nuts in prepackaged form, particularly in the larger shops and department stores.

While the data above portray the packaging of factory-produced products, which account for from 15 to 20 per cent of the foods consumed in Libya, there are very many items that are sold unpackaged. Furthermore, some packaging is inadequate. For example, the leakage of oil from cans, the breaking of viscose film wrappers of macaroni, soggy biscuits, the loss of gas from carbonated beverages and of aroma from coffee and spices, as well as infestation by insects of various packaged goods, are all too common.

Moreover, in bulk packaging, mention should be made of the frequent failure of corrugated board boxes, in the stack as well as during transport, with resultant damage to their contents.

While the foregoing are examples of under-packaging, there are also instances of over-packaging, as in the case of tinned sardines. The cannery that is now in operation puts the plain cans in printed cardboard boxes instead of using a lithographed tin cover and dispensing with the boxes. While the lithographed lids would be more costly than the boxes, there would be a reduction of the labour input. The cups used for yoghurt are another example; the situation could be improved by increasing the wax content of the paper cups now used. Furthermore, although plastic cups would be even cheaper than the wax-paper ones, they are not used because the filling machine does not appear to be suited to them. Other areas in which there is an urgent need to improve packaging materials and methods, with benefit to both industry and the consumer, can easily be identified.

Fresh foods

The foregoing section reflects the packaging patterns of factory-produced food products, but they account for only a fraction of those consumed in Libya. Furthermore, such products are intended for people at the higher income levels; most Libyans still obtain their primary food requirements unpackaged in any way. Most surprising is the almost total absence of packaging in any form for highly perishable products such as fresh meat, fish and poultry, which are often sold

in the open, exposed to dust and flies, to the detriment of the health of the population. Perhaps the only packaging medium used for these products is coarse brown paper, which itself is not free from infection, dirt or dust.

The situation is no better as regards fruits and vegetables. Indeed, these living products are susceptible to rapid spoilage. It is reported that nearly 20 to 25 per cent of the produce harvested becomes inedible before it can be sold because of spoilage or wilting, as can be observed in the wholesale and retail markets. Typical examples are onions, tomatoes and green vegetables. One of the tomato processers reported that he had to reject nearly 15 per cent of fresh tomatoes received at his factory.

According to one estimate, hardly 25 per cent of the dairy products are sold in packaged form; this is also the case with poultry products and edible oils. Thus the consumers, particularly in semi-urban and rural areas, must accept many dietary requisites of indifferent quality. Many basic foodstuffs, such as wheat flour, sugar, indigenous sweets and confectionery, bread and other items are sold to the consumer in only some sort of improvised packaging media.

In this connexion, mention must be made of the inadequate packaging of date pulp and dates, which may be considered the national fruit. The bulk of these commodities is packaged in palm-leaf baskets, the condition of which is often poor. The exposure of these packages to dust and flies is quite common. This situation needs urgent attention. Only a small fraction of the dates grown in Libya are packaged in polyethylene bags in a factory at Hones; they are destined for schoolchildren and for sophisticated customers. Also, large baskets of woven grass are used to transport fruits and vegetables to the markets. Such baskets are also used for the bulk transportation of bread.

The Government is well aware of such shortcomings in packaging and is taking energetic action to correct them. It has adopted measures designed to ensure that all foods will reach the consumer in usable and hygienic condition. It is aware that many food products must travel over long distances under climatic conditions that vary widely as regards temperature and humidity. New packaging patterns must be adopted that can cope with these conditions.

Non-food products

Factories in non-food industries that use quite a large bulk of packaging materials were visited, as shown in table 1. The packaging pattern adopted by each industry for its products is included in annex VI.

In most food products, practically all of the packaging materials used are imported. The most important of these are moisture-proof viscose film, printed paperboard flats, gummed tape, aluminium foil laminated corrugated board for cigarettes; multiwalled valve-type paper bags for cement, animal feed and flour; plastic bottles for insecticides; and printed paperboard cartons and corrugated board boxes for dry batteries, shoes and safety matches.

The paint factories have their own container-forming lines, using imported components. When these are insufficient, additional containers are obtained from the only domestic container-making unit or from abroad.

The garment factories mostly use locally available packaging media such as brown paper, printed paper and polyethylene bags.

Libyan industry is dissatisfied with present packaging materials; their prices are high and rising, their strength properties are often inadequate, and supplies are irregular. For example, the cement industry in Homs is experiencing failure of about 1.8 per cent of its bags. While this rate is really not very high, it could be reduced by increasing the strength of the paper used for them. Similarly, the cigarette industry feels that the quality of the viscose film it uses could be improved. However, in no case does there appear to be any specification for the quality of packaging materials used; such determinations are made primarily by the overseas suppliers of packaging machines. Similarly, the corrugated board boxes used for various products do not have any specification such as the heaviness of the plies, the bursting and tensile strengths and their functional performance.

Domestic sources of packaging materials

While Libya imports most of its packaging materials, there is some domestic production. A few units product packing and shopping bags from plastic film and paper, and there is a tin container unit for the paint

industry. A completely up to date plant to produce tin cans is being erected for the lubricating oil factory at Zawia. A factory to produce multiwalled bags, with a daily output of 600,000 bags per shift, is under construction near the cement factory at Benghazi. This plant is intended also to supply the needs of the new cement plants that are being erected. Table 1 shows the number of producers of packaging materials that were visited.

At present, none of these industries is contributing significantly to the requirements of packaging media for products such as biscuits, confectionery and macaroni, with the possible sole exception of one at Benghazi. This unit, which in addition produces paper bags and shopping bags, produces a laminate of polyethylene, viscose film and aluminium foil; two new heavy-duty plastic extruders are being installed. The factory also has multicolour printing equipment. Nevertheless, its production is hardly sufficient to meet the requirements of the Benghazi area.

The plastic conversion units, some of which have printing equipment, appear to be content to supply material to serve only for wrapping. However, one of them is investigating the possibility of producing printed polyethylene bags for the packaging of fermented skim milk; these bags are now imported.

While most packaging paper is imported, two units with a total annual capacity of about 4,500 tons produce a coarse brown wrapping paper from waste paper and discarded corrugated board boxes. This material is used mainly to wrap meat, fish and the like. It is reported that only about 20 to 25 per cent of available waste paper is used for this purpose. One of these plants is expanding its capacity to about 10,000 tons.

With regard to corrugated board boxes, it is reported that a factory with a yearly capacity of 4,500 tons, using imported corrugated board sheets, had to be closed down when it became unprofitable because of an unfavourable import duty situation. Whereas there is a 10 per cent levy on corrugated board, the raw material enter the country duty free. This policy naturally impedes the establishment of an essential packaging materials industry.

Libya's packaging industries are, for the most part, in the earliest stages of development. This is largely because there has been little dialogue between the users and the producers, and the plants that convert waste paper and corrugated board into wrapping paper consequently try to satisfy only the most elementary packaging needs. Moreover, packaging expertise is practically non-existent in either the industries that consume these materials or those that produce them. Although the general public is exposed to modern packaging, which it encounters in all of the larger stores, which are flooded with imported goods in attractive and functional packages, little effort has yet been made to develop suitable packaging for domestic products. In all sectors, the processing industries seem to be content with obtaining foreign packaging know-how. Moreover, these industries are not fully aware of the effectiveness - or lack of it - of the packaging patterns that they have thus far adopted.

Packaging for export

With the notable exception of petroleum and its products, the export of neither raw nor processed materials is yet very significant. Consequently, there has been no effort to adopt packaging patterns suited to foreign markets. However, in view of present improvements in industry, agriculture and other areas, Libya should be entering the export markets in a very short time. This probability is exemplified by the envisaged expansion of the cigarette industry. Furthermore, the anticipated increase in the production of horticultural crops in the near future might well result in crop surpluses and the need to seek overseas markets. Fruits such as oranges, lemons and dates and vegetables such as tomatoes are typical examples. Similarly, processed foods, particularly in the fruit and vegetable groups, should have good acceptability if offered in attractively designed and functional packs. Furthermore, Libya produces a number of traditional foods, such as tahina (based on sesame seeds) and harissa (a tomato and pepper paste) which, if well packaged, may find favour in foreign markets.

RECOMMENDATIONS

There is a pressing need to develop packaging expertise and facilities for up-grading the status of packaging in Libya. Meeting this need will be important for the rapid growth of all economic sectors. This thought was expressed by everyone, in all institutions and industries, with whom this subject was discussed. Furthermore, it was generally agreed that there was also an urgent need for a testing facility for packages and packaging materials and for a centre for information on various aspects of packaging.

Consequently, it is recommended that adequate laboratory and testing facilities be created at the Centre for Industrial Development and Research, Tripoli, as soon as possible. Although there is a need for a full division of the Centre on this subject, this activity could begin as a small Packaging Advisory Service, with the objectives outlined below and developed on the lines indicated.

Establishment of a packaging advisory service

Objectives

The proposed packaging advisory service should be able to:

Serve the immediate needs of the existing industries in solving day-to-day problems in materials testing, the performance of compatibility studies, determination of the transport worthiness of filled packages, and evaluation of the current packaging patterns for some important products, with a view to improving them and reducing their cost.

Carry out intensive studies on presently used packages for perishable food products and develop improved methods that would reduce wastage and provide food to the consuming public in a hygenic manner. Immediate action is called for in the matters of meat, fish and dates.

Promote the establishment of new package-making industries by initiating detailed surveys in each case so as to reduce imports as far as practicable.

Provide information on package machinery and materials and their proper use for each product to all those concerned.

Initiate work programmes on the development and packaging of commodities with export potential. In this connexion, work on citrus fruits and dates seem particularly relevant.

Convince everyone concerned of the advantages of the adoption of appropriate packaging techniques, particularly for food products, through the media of news bulletins and radio and television programmes.

Formulate standards for packaging materials and packages for internal trade and exports.

To achieve these objectives, the following action is proposed.

Staff

Bearing in mind the interdisciplinary nature of packaging, and that the Centre for Industrial Development and Research already has experts in economics, statistics, food sciences and related subjects, the proposed unit should be staffed with specialists in packaging, with necessary supporting personnel consisting of:

Two professionals with basic degrees in science or technology, plus adequate training in packaging technology.

One technician with requisite qualifications in chemistry or physics.

Equipment

A list of equipment together with sources of availability and approximate cost is given in annex III. This list was drawn up taking into consideration the existing equipment at the Centre and the immediate requirements of the proposed unit. However, the acquisition of some items, such as the Honeywell automatic water vapour transmission apparatus and equipment for testing plastic materials, could be postponed, depending on the progress of the work.

The types of tests that must be carried out in the evaluation of packaging materials and packages for transport worthiness are listed in annex VII.

Space

Since tests on flexible packaging materials such as paper, films, foils and laminates must be carried out under standard conditions, it is necessary to house the related instruments in a room maintained at 25°C and 65 per cent relative humidity. The floor area required for this purpose would be about 300 square feet.

In addition, an additional area of about 300 square feet would be required to house the compression tester, vibration tester and drop tester used to determine the transport worthiness of packages.

Training

At present, no one in the Centre is conversant with the various facets of packaging research or technology. The need for adequately trained personnel for this unit who could assist the industries in solving their day-to-day problems and develop better packaging for various products is urgent, as the unit could not function without them.

It is therefore recommended that the two officers provided for the unit be sent for overseas training, one at a time, in a phased manner, for periods of 6 to 9 months, to any of the institutions listed in annex II, but preferably to those in the United Kingdom, since the packaging situation there appears to be quite relevant to that in Libya.

During the period of the study, two counterparts worked with the expert (annex VIII). Through lectures, discussions, tests on packaging materials and a limited packaging study on biscuits and macaroni, they came to appreciate some of the basic principles of packaging. This initial background has prepared them well to take up detailed training in any of the places listed in annex II. Nevertheless, on their return, they would still need guidance by a competent packaging expert for at least two years before they would be able to apply the knowledge gained to actual problems in the field.

Further assistance from the United Nations

As in the case of any other applied science, successful application of knowledge gained during training to problems in actual practice requires much practical experience. Packaging is no exception; the solution of its problems involves an interplay of various subjects, among them physics, chemistry, biology and engineering, to say nothing of very sound common sense. The most important point in the solution of any packaging problem is that the person who is trying to solve it should have the ability to pick out the essentials and apply the appropriate basic principles, no matter which disciplines may be relevant to the given situation. It is therefore necessary that, in the initial stages, the services of a competent packaging expert should be obtained for a period of two years under the auspices of the United Nations. The job specifications for such an expert are given in annex V.

Information and documentation

When the proposed Packaging Advisory Service begins to function, there will be demand for information on several areas in packaging from various sources, such as the Government and the industries. At present, with the exception of one or two books, information on packaging is lacking in the library of the Centre for Industrial Development and Research. To meet this need, it will be necessary to take immediate steps to obtain the books and periodicals listed in annex IV.

New packaging industries

In addition to the need to develop packaging expertise in Libya, it also appears to be urgently necessary to establish factories to produce packaging materials so as to reduce dependence on imports as far as practicable.

An estimate of the requirements of some of the more important materials, most of which are now being imported, of various industries in Libya is shown in table 2. In some cases, the estimate takes account of expansion programmes that are in progress in different areas.

Table 2. Estimated requirements of some important packaging materials for various Libyan industries

Container type	For food industries	For non-food industries	Totals
Tin cans (tons)	3 800	3 200 a/	7 000
Glass containers (tons)	4 000	200	4 200
Crown corks (millions)	290	-	290
Plastic bags and sheets (tons)	1 000	200	1 200
Plastic crates (millions)	1.6	-	1.6
Plastic, other forms (tons)	100	100	200
Textile bags (millions)	6	2.5	8.5
Paper sheets and bags (tons)	2 800	1 000	3 800
Brown wrapping paper (tons)	4 500	1 000	5 500
Multiwalled paper bags (millions)	-	40	40
Corrugated board boxes (tons)	3 200	1 000	4 200
Viscose film, aluminium laminates etc. (tons)	700	350	1 050

a/ Three thousand tons for petroleum products, 400 tons for other goods.

Taking into consideration the needs and problems of importation faced by various industries, action has already been taken to establish a few packaging materials industries, as shown below.

Tin containers

A tin-can making factory with a capacity of about 3,000 tons of tin plate is being erected mainly to meet the demands of the tomato processing industry. It is understood that, in time, a new line will be added to produce cylindrical cans for the edible oil industry.

While this factory is a step in the right direction, the feasibility of the introduction of a crown corkmaking line to satisfy the demands of the soft drink and mineral water industries, both of which are expanding, is well worth examination. The capital investment required would be amply justified.

Glass bottles

It is understood a glass factory with a capacity of 10,000 tons, which will include about 4,000 tons of glass bottles required by various industries, will shortly come into production. This development probably reflects the proposed expansion of the soft drinks industry.

Multiwalled paper bags

In order to satisfy the demands of the cement industry, an up-to-date and high-speed multiwalled paper bag factory with an output of 600,000 bags per 8-hour shift is expected to come into production in about four months at Benghazi. The unit will also have facilities for printing and lamination. While this unit would be able to satisfy the demands of the cement industry, there are other products such as bran and animal feed that are currently being packed in multiwalled paper bags in sizable quantities. Consideration may now be given to installing another line with appropriate capacities within the same premises.

Wrapping paper

As has been mentioned, there are two units near Tripoli with total capacity of 4,500 tons/year that produce wrapping paper of heavier

weight from waste paper and boards. One of them is expanding its production to about 9,000 tons/year. While this expansion may satisfy the demand for paper of this quality in the Tripoli region, there is no such unit in the Benghazi area, where waste paper is plentiful. The establishment of a unit at Benghazi on the same lines as the one which is expanding its production at Tripoli is therefore recommended.

Corrugated board. During the course of the study, it became clear that in practically all areas the corrugated board box has completely displaced the conventional wooden one. All of the requirements for corrugated board boxes by various industries are now imported, with resulting problems of cost, delays in delivery, and damages that occur during transport. In the context of the problems faced by the existing industries and those under contemplation, there is now an urgent need to establish a complete corrugated board plant with machines for boxmaking. The present needs of the industries come to about 4,200 tons of corrugated board boxes. However, in view of the expansion of agro-based industries and those in the area of light engineering and durables that may be expected to occur in the near future, there will probably be a demand for 5,000 tons of this material.

The immediate establishment of a corrugated board plant with a capacity of 5,000 tons/year is strongly recommended. Enquiries have revealed that complete machinery for conversion, printing, stitching and boxmaking can be obtained from a firm in the United Kingdom for about £753,000 plus shipping costs. It should be borne in mind that there are suppliers in France, Italy, Japan, Sweden and the United States of America that might offer competitive terms.

Flexible packaging materials. Although the volume of the consumption of flexible packaging materials such as printed viscose film, aluminium laminates, paper bags and shopping bags in the Tripoli area is more than in Benghazi, there is no unit there that caters to the needs of the consuming industries; in fact, most of the requirements of the Tripoli area are imported. The two units are producing plastic materials that do not appear to be suited to the exacting requirements of the biscuit, confectionery and dairy industries. Therefore, there seems to be scope for the establishment of a flexible packaging material conversion factory at Tripoli. This possibility is well worth investigating.

With regard to plastic crates, textile bags and other ancillary material, the requirements of the industry will have to be met with continued imports. For instance, in the case of plastic crates, until wooden crates have been completely replaced by plastic ones, replenishment imports will still be required. In the case of textile bags, there is always the possibility of their partial replacement by bags of jute, woven plastic or of plastic laminates. This possibility must be kept in view in the context of the establishment of the petrochemical industry. In all of these cases, the proposed packaging advisory service at the Centre for Industrial Development and Research should actively assess the situation and take whatever measures may be considered necessary.

Annex 1

ORGANIZATIONS VISITED AND PERSONS MET

Organisation	City	Product or subject	Person met
Mansura Tomato Processing Co.	Tripoli	Tomato paste	Ahmed Abu-Shalla
Fellah Libi Co.	Tripoli	Tomato paste	M. Aball Faturh
National Fish Canning Co.	Zansour	Fish canning	K. Abdul Hamid
Government Fruit Processing Factory	Tripoli	Squashes, jams, dats syrup	M. Abdul Rahman
Syria Bakery	Tripoli	Cakes, bread and confectionery	Burshet Hestram
BAMIFA	Tripoli	Olive pickles harissa, green pepper pickles	A. S. Sherif
Zahra Industries	Tripoli	Sweets and sugar confectioneries	M. Tmoman
Mineral Water Plant	Benghasher El-Hadaba	Mineral water	A. Khairy Sayyid
Pepsi Cola Co.	El-Hadaba El-Kadre	Asrated water, carbonated soft drinks	M. Imam
Rabona Industries	Tripoli	Biscuits	M. Rabona
National Flour Milling Co.	Tripoli	Wheat flour, semolina and bran	Yousef Oman
Ghedha Industries	Tripoli	Biscuits, confectionery, detergents, cosmetics	Y. Abdul Rahman
Libyan Macaroni Factory	Tripoli	Macaroni	Hawas Siddiqui
United Plants	Tripoli	Olive oil, macaroni, soap alcohol	Abdullah El-Mabrouk
Macaroni Factory	Tripoli	Macaroni	Omar Poha
International Frozen Products	Tripoli	Ice cream, yoghurt etc.	M. Majib
Libo Dairy Plant	Tripoli	Yoghurt, fresh milk, cheese etc.	Morsi Ahmed
University of Tripoli Department of Agriculture		Packaging research	Omar El-Muksi Vice-Dean

Organization	City	Product or subject	Person met
Tobacco Co.	Tripoli	Cigarettes	A. Naas
General Organization for Industrialization	Tripoli	Packaging industry	M. Najah
Godain Poultry Farm	Godain	Dressed poultry	Manager
Ministry of Agriculture	Benghazi	Poultry development	A. El-Azim Turki
Arabic Plastic Co.	Tripoli	Polyethylene bags etc.	A. Abu-El Enen
Department of Agriculture	Benghazi	Fruits and vegetables	Abdul Fatah-Al-Aashek
Horse Brand Dry Battery Factory	Tripoli	Dry cells	A. Trabulse
Isdehar Paper Co.	Tripoli	Wrapping	M. Taher Uunes
Batâ Libya Co.	Tripoli	Leather slippers	Awad Sabat
Musrate Shoe Factory	Musrata	All varieties of shoes	A. Bugarsa
Government Animal Feed Factory	Garabolli	Animal feeds	M. Saad
National Supply Corp. (NASCO)	Tripoli	Olive oil	A. Omar
Government of Libya, Director of Industries	Benghazi		M. Yemeni
Government Cement Factory	Benghazi	Cement	M. A. Berruin
Multiwalled Paper Bag Factory	Benghazi	Multiwalled paper bags	I. Youssef
Libyan Paper Factory	Benghazi	Flexible packaging materials	T. A. Bouhdeimah
Hydrogenated Oil Factory	Benghazi	Textile products	Y. A. Ismail
Shadd Chemical Industries	Benghazi	Liquid disinfectant	A. El Mansur Saagbi
Government of Libya Director of Agriculture		Agriculture and dairying	F. A.-J. A. Rasheed
Government Dairy Project	Benghasi	Poultry	Ahmed Amer

Organization	City	Product or subject	Person met
National Organization for Industrialization	Benghazi branch	Packaging industries	Muhammed El-Nawal
Libyan Chamber of Commerce	Tripoli	Industrial packaging	B. El-Genayyene
Homes Cement Factory	Homes	Cement packaging	M. Ibrahim
Government Fish Canning Factory	Homes	Fish canning	O. M. Salati
Government Date-Packing Plant	Hone	Date packaging	A. M. Mazen
Co-operative Stores	Tripoli	Department stores	Several
Wholesale Market	Tripoli	Fruits, vegetables, fish, meat etc.	Several
Match Factory	Tripoli	Safety matches	F. El-Mujrab
Paints and Chemicals Industries	Tripoli	Paints and varnishes	E. Pinto
Bithamer Tin Factory	Tripoli	Tin cans for the paint industry	M. El-Miligi
Libyan-Norwegian Industrials Co. Ltd	Tripoli	Paints and varnishes	Reider Grostad
Sardine Canning Factory	Zwara	Sardine canning	Mustafa El-Hasein
National Plant for Paper Manufacture	Tripoli	Grey wrapping paper	G. Leotta
Brega Luboil Plant	Zawia	Lubricating oil packaging	Mohammed Bougheya

Annex II

SOME INSTITUTIONS THAT OFFER TRAINING IN PACKAGING

Paper and Packaging Industries Research Association
Leatherhead, Surrey
England

Packaging Institute
Malcom House
London
England

College of Industry
Wisconsin State University
Platteville, Wisconsin
United States of America

Applied Management and Technology Center
Wayne State University
Detroit, Michigan
United States of America

Mankato State College
Mankato, Minnesota
United States of America

Graduate Program in Creative Packaging[a/]
Pratt Institute
Brooklyn, New York
United States of America

School of Packaging, Michigan State University[a/]
East Lansing, Michigan
United States of America

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a/ Postgraduate degree courses.

Annex III

EQUIPMENT FOR THE TESTING OF PACKAGES AND PACKAGING MATERIALS REQUIRED BY THE PROPOSED PACKAGING ADVISORY SERVICE AT THE CENTRE FOR INDUSTRIAL DEVELOPMENT AND RESEARCH, TRIPOLI a/

Equipment	Type and specifications b/	Possible suppliers c/	Approximate cost ($) d/
Basic weight scale (with template)	TMI-70-2-1	TMI, Messemer	250
Bursting strength tester with extra gauges and spare rubber diaphragm	TMI-13-1-1	TMI, Messemer	1 400
Folding endurance tester	Schopper type TMI-13-1	TMI, Messemer	2 000
Micrometers	Dead weight TMI-551-M	TMI, Messemer	1 000
Micrometers (hand)	TMI Model 25	TMI, Messemer	100
Cobb sizing tester	Gurley type TMI -441M45	TMI, Messemer	200
Densometer	Gurley type TMI-58-18	TMI, Messemer	300
Beach puncture tester with accessories	GE type TMI-66-1	TMI	1 000
Stiffness tester with specimen sleeve	Taber TMI-79-3-1 TMI-79-3-2	TMI, B and T	1 000
Elmendo tearing tester, with accessories	TMI-83-1 TMI-83-1-1 TMI-83-1-2	TMI, Messemer	900
Tensile strength tester	Schopper TMI-84-1-1-	TMI, Messemer	2 200
Water vapour transmission apparatus with all accessories	PATRA TMI-58-7	TMI, B and T	800
Oxygen analyser (gaseous and dissolved)	Beckman type 777000	Beckman Hertman and Braun	1 500
Oil penetration tester	Model B TMI-58-9	TMI, Messemer	1 300
Paper cutters, all-purpose, for a wide variety of materials	TMI-22-13-1	TMI, Messemer, B and T	150
Laboratory crushing tester: flat crush and ring shiftness	No. 936 TMI-17-8	TMI, Messemer	2 500
Carson curl-size tester	TMI-58-11	TMI	1 000

Equipment	Type and specifications b/	Probable suppliers c/	Approximate cost ($) d/
Polariscope, with accessories	TMI-63-1	TMI	1 000
Continuous-band heat sealer	Doughboy	Domain	500
Impulse heat-sealer	TMI	TMI	750
Box compression tester	Model TM 49005	TMI (or others in UK and FRG)	10 200
Vibration table	400 V, 4'6" x 6'6" TMI-91-1	TMI	1 500
Drop testers	SR2-R, 10-R and 5-R TMI-25-3-2	TMI	1 500
Plastic materials and container testing machines	To be determined later		6 000 e/
Bulge meter for carton board boxes	TMI 13-9	TMI	500
Automatic water vapour transmission apparatus	Honeywell model	Honeywell	18 000 e/
		Total	57 050 000

a/ In all cases, spare parts and required accessories should be obtained.

b/ All equipment must be graduated in c.g.s. (centimetre-gram-seconds) unit.

c/ TMI - Testing Machine Inc., Amityville, New York, United States; Messemer - H. E. Messemer Ltd, London, United Kingdom; B and T - Baird and Tatlock London Ltd, Laboratory Centre, Manchester, United Kingdom; Beckman - Beckman Instruments Inc., Fullerton, California, United States; Domain - Domain Industries, New Richmond, Wisconsin, United States; Honeywell - Honeywell Ltd, Birmingham, United Kingdom.

d/ These prices are only indicative and do not include packing, freight or other charges.

e/ Acquisition may be postponed.

Annex IV

SOURCES OF INFORMATION ON PACKAGING REQUIRED FOR THE LIBRARY OF THE CENTRE FOR INDUSTRIAL DEVELOPMENT AND RESEARCH

Books

Friedman, W. F. and J. Kipness. Industrial packaging. New York, Wiley and Sons, 1960.

Modern packaging encyclopedia. Modern Packaging, P.O. Box 809, New York, New York 10036.

Paine, F. A., ed. Fundamentals of packaging. London, Blackie and Sons Ltd.

_____ Packaging materials and containers. London, Blackie and Sons Ltd.

Sacharow, S. and R. C. Griffin. Food packaging. London, AVI, 1970.

Pamphlets and periodicals

Aerosol age (monthly) Box 31, Caldwell, New York 07006.

Australian packaging. Bell Publications Pty Ltd, Box 4850, G.P.O. Sydney, New South Wales 2001.

Bottler and packer. 33 South Audley Street, London, W1.

Boxboard containers. MacLean-Hunter Publishing Corp., 300 West Adams Street, Chicago, Illinois 60606.

British paper and packaging digest. 311 Gray's Inn Road, London, WC1

Canadian packaging. McLean Hunter Publishing Co. Ltd, 481 University Avenue, Toronto 3, Ontario.

Converting industry. S. C. Phillips and Co., 50 Fetter Lane, London EC4.

Food and drug packaging. Magazines for Industry Inc., 777 Third Avenue, New York, New York 10017.

Good packaging. Pacific Trade Journals Inc., 151 Mission Street, San Francisco, California 94105.

Hard and soft goods packaging. Magazines for Industry Inc., 777 Third Avenue, New York, New York 10017.

Hoare, W. E. Tin plate handbook. Tin Research Institute, United Kingdom.

Indian food packer. Kissan Products, Bangalore, India.

Materials handling engineering. (monthly) Industrial Publishing Co., 614 Superior Avenue, Cleveland, Ohio 44113.

Modern packaging. (monthly) McGraw-Hill, 1301 Avenue of the Americas, New York, New York [illegible].

[illegible]down in packaging. PIRA, Leatherhead, Surrey.

Package engineering. Angus J. Ray Publishing Co., 2 North Riverside Plaza, Chicago, Illinois 60606.

Packaging. Tudor Press, 75 Carter Lane, London, EC4.

Packaging abstracts. PIRA, Leatherhead, Surrey.

Packaging code (BS 1133). British Standards Institution, 2 Park Street, London, W1.

Packaging India and packaging digest. Indian Institute of Packaging, Plot E2 Andheri (East) Bombay.

Packaging series. American Management Association, New York.

Paperboard packaging. Magazines for Industry Inc., 777 Third Avenue, New York, New York 10017.

Plastics. Temple Press Ltd, Bowling Green Lane, London, EC1.

TAPPI journal. Technical Association of Paper and Packaging Industries. [illegible] Lexington Avenue, New York, New York [illegible].

United States Department of Commerce. Containers and packaging industry report. Washington, D.C., United States Government Printing Office.

Wood and wood products. Vance Publishing Corp., 300 West Adams Street, Chicago, Illinois 60606.

Other sources

Packaging Machinery Manufacturers Institute
2000 K Street North West
Washington D.C. 20006
United States of America

Japanese Packaging Manufactures Association
1-8, 3-Chome, Nishi-Shimban
Ninato-Ku, Tokyo
Japan.

Annex V

JOB DESCRIPTION FOR ADVISER IN PACKAGING a/

Post title: Adviser in Packaging

Duration of assignment: Two years

Date required: To be determined

Duty station: Tripoli, with travel in Libya.

Duties: The adviser will be a member of an international team of experts and will work in collaboration with the Project Co-ordinator. He will work at the Centre for Industrial Development and Research in an advisory capacity to the Director of the Techno-economic Department of the Centre. Specifically, the adviser is expected to:

Assist and co-operate in the procurement and installation of appropriate instruments for testing and evaluating packages and their materials;

Organize the establishment of a Packaging Service Unit at the Centre;

Train counterpart staff in the determination of functional properties of packaging materials and the behaviour of some selected packaged products under various climatic conditions;

Train counterpart staff in the development of suitable packaging media for some important product categories;

Select some typical products where losses are reported to be excessive, and demonstrate means of developing better and more functional packaging patterns;

Promote surveys on the usage of certain important packaging materials now being imported, and identify those that could be manufactured locally;

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a/ This post represents follow-up action of the recommendations of the short-term expert in packaging who was in Libya from September 1974 to January 1975.

Assist in the organization of seminars, lecture courses and the preparation of news bulletins on packaging for the benefit of trade, industry and all others concerned;

Assist in the formulation of standards for packaging materials and packages.

Qualifications: A postgraduate degree in science or technology, with broad experience in various facets of packaging and its modern trends and in the evaluation of packaging materials, packages and methods. Research experience in the packaging of food products for tropical conditions and for export will be necessary.

Language: English.

Background information: The Government of the Libyan Arab Republic, in an effort to supply needed testing, consulting, economic and technological services for the industrial development of the country, has established the Centre for Industrial Development and Research at Tripoli, with the assistance of UNIDO, acting as the executing agency for a large-scale project of UNDP. The duration of the projected assistance is to be four years. In the course of this period the Centre will undertake the following activities:

a) Provision of technical services to industry, including:

Collection and dissemination of technical information, including technical enquiry services;

Organization and implementation of quality control programmes at the plant level;

Physical measurement, chemical and materials testing, as well as the analysis of industrial raw materials and products;

Socio-economic and techno-economic feasibility studies, including market surveys to identify feasible industrial projects;

Engineering and management services for the organization and planning of production plants, including cost-accounting systems;

Trouble-shooting to identify various industrial problems at the factory level and recommending technical solutions;

b) Advise the Government and act as its technical arm on industrial standardisation programmes including preparation and implementation of national standards, quality control and all of the technical work related thereto;

c) Undertake applied research programmes related to industrial operations in Libya. It is expected that such programmes will result in the development of new products and the improvement of the existing operations and methods of production to optimize the utilization of local raw materials and mineral resources;

d) Training of local personnel in these fields by means of fellowships and on-the-job training.

The international team comprises experts in the following fields: industrial cost accounting, food processing, standardisation, industrial economics, technical information and documentation, building materials, laboratory and process research, and instrumental chemical analysis.

Annex VI

PACKAGING PATTERNS OF SOME IMPORTANT LIBYAN PRODUCTS

Product	Packaging pattern	Source of original packaging material
Cereals and cereal products		
Wheat flour (bulk)	Cotton bags (25 and 50 kg)	Imported
Wheat flour (retail)	Loose, in paper bags	Partly imported
Semolina (bulk)	Cotton bags (25 and 50 kg)	Imported
Semolina (retail)	Loose, in paper bags	Partly imported
Rice (bulk)	Cotton bags (25 and 50 kg)	Imported
Rice (retail)	Loose, in paper bags	Partly imported
Lentils (bulk)	Jute bags (50 kg)	Imported
Lentils (retail)	In polyethylene bags and loose in paper bags	Partly imported
Bread of all types	Loose, wrapped in brown paper and in polyethylene bags	Local
Biscuits	Units in viscose film, aluminium foil laminate, polyethylene bags, paperboard cartons, and in bulk in corrugated board boxes	All imported
Confectionery (cakes etc.)	Paper board, wax paper, grease-proof paper	Imported
Macaroni	Cloth bags (10 kg and 1 kg) in printed cellophane. Bulk packaged in corrugated board containers	Imported
Sugar and sugar products		
Sugar (crystal)	Polyethylene-lined cloth bags (50 kg)	Imported
Sugar (loose)	Loose in paper bags	Partly imported
Hard-boiled sweets and toffee	Units in viscose film, aluminium laminate, wax paper, polyethylene bags, tin cans, and in bulk, packaged in corrugated board boxes	Imported
Tahina (traditional sugar sweets)	In polyethylene bags, plastic and tin containers	Local and imported
Beverages		
Carbonated beverages, carbonated mineral water	Glass bottles, crown corks and plastic crates	Imported

Product	Packaging pattern	Source of original packaging material
Dairy products		
Fresh milk	Wax paper cartons, polyethylene bags, glass bottles, and sold loose	Imported
Fermented skim milk	Polyethylene bags for units and for 10 units	Printed bags, imported
Ice cream	Plastic cups, wax paper cups, aluminium foil, corrugated board boxes for bulk movement, cardboard	All imported
Yoghurt	Plastic cups, wax paper cups, aluminium foil, corrugated board boxes for bulk movement, cardboard	All imported
Cheese	Loose, grease-proof paper	Imported
Butter	Loose, grease-proof paper	Imported
Edible oils		
Olive oil	Tin cans for units and corrugated board containers for bulk	Imported
Groundnut oil	Tin cans for units and corrugated board containers for bulk	Imported
Hydrogenated oils	Tin cans for units and corrugated board containers for bulk	Imported
Meat of all types	Brown wrapping paper	Local
Fish		
Fresh fish	Brown wrapping paper	Local
Canned fish	Tin cans, aluminium cans, paperboard cartons, and corrugated board boxes for bulk movement	Imported
Poultry products		
Eggs	Moulded paper-pulp trays and corrugated board boxes	Imported
Dressed poultry	Polyethylene bags, paperboard boxes	Imported
Baby chicks	Plastic crates, corrugated board boxes	Imported
Chickens	Plastic crates	Imported
Fruits and vegetables		
Fresh fruits and vegetables	10-kg wooden boxes, large grass baskets	Local
Dates (table), fresh	10-kg wooden boxes lined with paper	Local

Product	Packaging pattern	Source of original packaging material
Fruits and vegetables (continued)		
Jams, jellies and tomato paste	Corrugated board boxes for bulk movement	Imported
Squashes	Glass bottles, metal closures and corrugated board boxes for bulk shipment	Imported
Date syrup	Wax-paper cups (½ kg)	Imported
Pickles and olives	Glass bottles, metal closures and corrugated board boxes for bulk shipment	Local
Pickles, mixed	Sold loose in waste paper	Local
Pickles, pepper	Sold loose in waste paper	Local
Harissa (tomate and pepper paste)	Sold loose in waste paper	Local
Dates (for school feeding)	200 g in polyethylene bags and corrugated board boxes	Local
Dates (without stones)	10 kg in bulk in date palm leaf matting	Local
Dates with almonds (processed)	500 g in viscose film and corrugated board	Imported
Other products		
Honey	Glass bottles with metal closures, corrugated board boxes	Imported
Coffee (roasted beans)	Glassine-lined paper bags	Imported
Coffee (ground)	Glassine-lined paper bags	Imported
Animal feed	Cloth bags, multiwalled paper bags, polyethylene bags (heavy duty)	Imported
Bran	Multiwalled paper bags	Imported
Spices (ground)	Units in polyethylene bags	Local
Spices (whole)	Loose in paper bags	Local
Salt	Jute bags (25 and 50 kg), loose in polyethylene bags	Imported
Cosmetics such as shampoo and hair oils	Plastic bottles, glass bottles, corrugated board boxes	Imported
Soaps (laundry)	Corrugated board boxes	Imported
Detergent powders	Paperboard cartons, plastic bucket-type containers, corrugated board boxes	Imported

Product	Packaging pattern	Source of original packaging material
Other products (continued)		
Stationery items, exercise books	Corrugated board boxes	Imported
Ready-made garments	100-g paper, polyethylene bags, corrugated board boxes	Imported
Toilet paper	Corrugated board boxes	Imported
Disinfectant solution	Plastic bottles, corrugated board boxes	Imported
Matchboxes	Corrugated board boxes	Imported
Cigarettes and tobacco	Viscose film, paper, printed box board flats, corrugated board, aluminium foil, laminate, gummed tape etc.	Imported
Cement	Three-ply multiwalled paper bags	Imported
Dry batteries	Corrugated board boxes, printed boxboard cartons	
Foot-wear	Printed box board cartons, tissue paper, polyethylene bags, corrugated board boxes, gummed tape	
Motor oils and greases	Tin cans, corrugated board boxes	Imported
Paints and varnishes	Tin cans, corrugated boxes	Imported and local

Annex VII

TESTS FOR DETERMINING THE FUNCTIONAL CHARACTERISTICS OF PACKAGING MATERIALS AND PACKAGES a/

Test	Procedure b/	Equipment used	Remarks
Paper, paperboard, films, foils, laminates, coated papers and the like.			
Acidity or alkalinity (water soluble) of paper	D 643-41	PH meter	Available
Alkali staining of paper	D733-45	Laboratory reagents and glassware	Available
Ash in paper	D 586-63	Muffle furnace	Available
Chloride content in paper	D1161-60	Laboratory reagents and glassware	Available
Sulphate content in paper	D1099-64	Laboratory reagents and glassware	Available
Bleeding resistance of asphalt paper	D 917-49	Pressure block, bedplate etc.	To be made locally
Basis weight of paper etc.	D 646-7	Basis weight seals and cutting template	To be imported
Bursting strength of paper board, liner board, corrugated and solid fibre board	D 7 4-67 D2529-63 D2733-68	Mullen-type burst tester with two-gauge range	To be imported
Folding endurance of paper	D 643-69	Folding endurance tester (Schopper type)	To be imported
Grease resistance of paper (turpentine test)	D 722-65	E. I. du Pont's oil-soluble red dye (chemical)	Dye to be imported
Machine direction of paper	D 523-70	Glass trough	Available
Fungus resistance of paper and paperboard	D2020-65	Autoclave and glassware	Available
Moisture content of paper and paperboard	D 644-55	Drying oven	Available
Paraffin wax absorptiveness of paper	D 983-50	Oven ($105^{\circ}C \pm 2^{\circ}$)	Available
Gloss of paper (specular)	D-1223-67	Gloss meter	To be imported
Resistance of paper to passage of air	D 726-65	Densometer (Gurley type)	To be imported
Tearing resistance, internal	D-689-62	Elmendor tearing tester	To be imported
Tearing strength, edge	D 827-67	Edge-tear stirup attachment to a pendulum-type tension-testing machine	To be imported

Test	Procedure b/	Equipment used	Remarks
Tensile breaking strength of paper and paperboard	D 828-60	Tensile tester, Schopper type, with recording device and accessories	To be imported
Thickness of paper, films, foils, boards etc.	D 645-67	Dead-weight micrometer	To be imported
Water absorptiveness (Cobb test) (tentative)	D 2045-64	4-in. high brass cylinder, bedplate etc.	To be imported
Water-resistance of paper boards etc. by dye indicator	D 779-65	A. J. Laker (or other) stop watch	Available
Water vapour transmission of materials in sheet form	D 96-66	1. Petri dishes, cutting template, creasing bed etc.	To be imported
		2. Honeywell automatic water vapour transmission apparatus	To be imported
Edgewise compression strenght of corrugated board	D2808-69	Compression testing machine (TMI) c/	To be imported
Flat crush of corrugated board	D1225-66	Compression testing machine (TMI)	To be imported
Ring crush of paper board	D 1164-60	Compression testing machine (TMI)	To be imported
Flat crush of corrugating medium	D 2806-69	Compression testing machine (TMI)	To be imported
Ply separating of solid and corrugated board	D 1028-69	Usual laboratory type	Available
Puncture resistance and stiffness of paper board, corrugated board and solid fibreboard	D 787-68	GE puncture tester, with attachments	To be imported
Compression test for shipping containers	D 642-63	Box compression tester; range 0-300 kg and 0-3000 kg	To be imported
Drop tester for shipping containers	D 775-63	Drop tester (Reference; TMI 25-1)	To be imported
Drop test for cylindrical shipping containers	D 997-68	Drop tester with sling	To be imported
Drop test for shipping bags	D 959-68	Drop tester with sling	To be imported
Vibrator test for shipping containers	D 999-68	L.A.B. vibration tester	To be imported
Static bending test for corrugated paper board	D1098-68	Only attachment required for the Universal Testing Machine available at Cariri	To be fabricated locally
Gas transmission rate of plastic films etc.	D 1434-66	Gas transmission apparatus	To be imported

a/ All paper-based packaging materials must be conditioned for 24 hours at 25°C and 65 per cent relative humidity before testing with the appropriate testing instruments in an air-conditioned room that has been maintained at these levels of temperature and relative humidity.

b/ References are to ASTM (American Society for Testing Materials), Part 15, 1971.

c/ TMI is Testing Machines Co., Amityville, New York, United States of America.

Other tests for product evaluation[d/, e/]

Determination humidity moisture
Equilibria for food products - PI Test procedure 1p-52

Test of water vapour transmission in screw cap closures -
PI closures 1t-51

Screw cap liner test for determining compatibility of liner with specific product - PI closures 2t-51

Testing of compatibility of pharmaceutical solution in contact with rubber closures - PI closures 4t-54

Shelf-life of packaged articles: see Pain, F. A.:
Fundamentals of packaging: Blackie and Sons, 1967

Compatibility tests of lacquers for foods: Obtainable from Metal Box Co., United Kingdom

Odour pick-up test for packaging materials: Obtainable from PIRA, Leatherhead, United Kingdom

Rolling test for filled packages: Obtainable from British Standards Institution, London

Rain Test (TC 122 Sc2) for filled packages to be obtained from the International Organization for Standardization (ISO), Geneva.

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d/ These are some of the basic tests. In actual practice, appropriate tests will have to be devised and their sequence determined, depending upon the information actually required on the functional behaviour of specific packages and packaging materials.

e/ PI refers to the Packaging Institute in New York.

Annex VIII

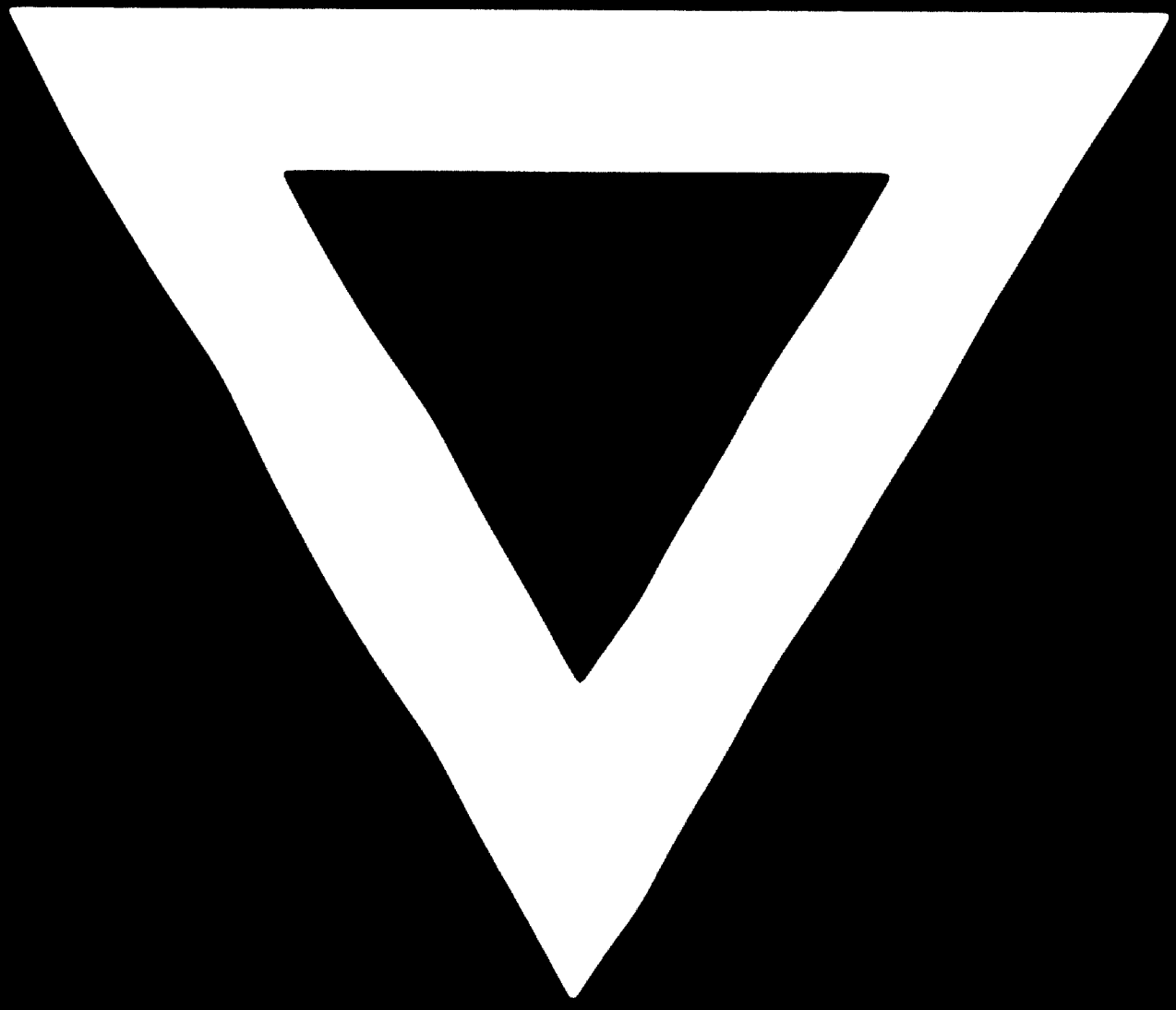
PROJECT PERSONNEL

International

Job title	Name	Nationality	Entry on duty	Conclusion of duty
Expert in Packaging	M. V. R. Iyengar	Indian	19 Sept. 1974	14 Jan. 1975

Libyan counterparts

Mouhamed Soliman Barouni
Mohammed Abo-Zriba El Aghel



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