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CHOICE OF APPROPRIATE PACKAGING TECHNOLOGY.
Background Paper

CHOICE OF APPROPRIATE PACKAGING TECHNOLOGY

by

M. R. Subramanian
UNIDO consultant

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0.0 ROLE OF PACKAGING

0.1 Physical Distribution:

AN IMPORTANT consideration being paid to the choice of a technology in modern times, is the economy it can offer in the cost of production. Through constant review and upgradation of prevalent technologies, the cost of production has been continuously brought down. But the experience of the developed countries indicates that the ultimate cost to the consumer has been increasing, due to a phenomenal rise in the cost of distribution of the goods produced. Packaging is a major element in the distribution system and it has, therefore, become necessary to consider the choice of a suitable technology of packaging in controlling costs.

0.2 Overall Benefits from Packaging:

PACKAGING helps preserve agricultural produce and food products. It contributes to minimising the spoilage of the food produced with great care and at great expense. Packaging protects industrial products during the stages of its movement from the production centres to the consumption points and resists the mechanical hazards encountered in the journey involving handling and storage. It saves capital goods from the influence of environment through which they need to be transported, thus minimising the chances of their deterioration enabling prompt commissioning of machinery and equipment. The problems of corrosion are minimised through the use of adequate and functional packaging. Packaging helps distribute mass-produced consumer goods from the modern sector of the industry to different destinations within the country and to the destination markets abroad. Packaging eliminates dust contamination in textile products, enhancing the saleability of textile goods, including garments and, at the same

time, prevents their being attacked by fungus and insects. Agricultural inputs such as fertilisers would be rendered totally unusable but for the adoption of the right packaging. Drugs and pharmaceuticals, the basic necessities for the maintenance of human well being, are required to maintain their integrity which is rendered possible only by the adoption of appropriate packaging carefully chosen for the purpose. It is packaging that provides the convenience features demanded by the modern society. The age of the 'instant' would not have been possible, but for the techniques of packaging to preserve the foods.

0.3 Packaging Enhances Value:

A SIGNIFICANT contribution packaging can make to a growth in the national production is by the value it can add while contributing only marginally to costs. This becomes self-evident when one analyses the pattern of imports by the developed world from the developing ones and the subsequent distribution. For example, rice imported in bulk is branded and distributed at significantly increased prices compared to the cost of importation. Cashew kernels imported in bulk is branded and distributed in consumer packages at several times the imported cost. Tea is a classic example where mainly through packaging, enormous value is added to the product. All the profits continue to contribute to the welfare of the already developed states and the developing countries which contribute to such welfare, continue to be poor just because adequate attention has not been paid to packaging technology which can be used as a very important tool in value adding to produce and products. It is not only in the field of food products such variations exist but even in the case of hand-tools, engineering accessories and spares, which are all exported in bulk by the developing countries, the same situation exists.

0.4 Packaging Prevents Losses:

LOSS PREVENTION is another significant contribution packaging makes towards increasing the economic status of any society. Whether in food production or in industrial production by merely reducing the incidence of loss and damage at the distribution stage, it is possible to make a number of countries self-sufficient in many areas, but alas, even a fraction of the attention paid to increasing the production is not paid to the development of packaging which will increase the quantum of availability to the consumer. Even the estimates of such losses mainly in the export trade alone reported to be around 30 % of the total value, do not appear to have created any feeling of the urgency with which this technology should be developed particularly by the developing world which is also the victim of such losses.

0.5 Packaging Promotes Public Health:

SOCIETY requires to be protected from the evils of contaminated or spoilt food. But, unfortunately, it is quite common in many developing countries to sell food products including primary produce in an unpackaged form. Foodgrains contaminated with such materials even as pesticides, insect infested sweet meats, decayed marine products, adulterated food, are all common phenomena in many parts of the world. The safety of public health, the prevention rather than cure of diseases, which exposed or unpacked foods can spread fast, is a major responsibility discharged by packaging. It will be futile to promote the growth of the pharmaceuticals industry without adequate safeguards by eliminating the evils that contribute to falling levels of health. It is paradoxical though, that the enormity of this problem has kept many a Planner away from taking even the initial steps to regulate packaging in the non-organised and rural sectors.

0.6 Packaging Protects Consumer:

IT IS PACKAGING that informs the buyer of the product, enables him to compare and choose, guarantees the quality and helps in protecting consumer's rights. Rightly adopted, the technology of packaging helps promote human well being and improves the quality of life.

0.7 Packaging Cuts Costs:

WHILE on the face of it, packaging would appear to be an operation after the production of goods, the lack of attention to consider packaging at the stages of planning can be detrimental not only to the producer but can adversely affect the national economy. Goods must be made available to the common man at prices which he can afford and therefore the choice of an optimum package right at the stages of planning their production assumes importance.

0.8 Packaging-Integral Part of Product:

IT SHOULD BE emphasised that, should it become that the choice of the package may unduly enhance product cost disproportionately, attention may have to be paid to modification in the product itself, in such a manner as to make it packageable economically for distribution. Redesigning of equipment, reformulation of drugs and pharmaceuticals, keeping in mind the problems that may arise in reaching them to the consumer are normal features in the developed countries of the world which have fortunately realised the peril if this aspect is neglected in the early stages of product development. That the product design or formulation must go hand in glove with package design for its ultimate delivery to the consumer economically is so obvious to need any greater emphasis.

IT FOLLOWS therefore that when choosing an appropriate technology for the production of goods whether they be agricultural produce, consumer products or industrial machinery and capi-

tal goods, attention would have to be paid to simultaneously choose the technology of packaging most suited for the product. Some important packaging considerations for selected products of immediate concern are outlined in Annexure - I to VII.

1.0 Packaging for Domestic and Export Trade:

IN DEVELOPING countries, industrialisation and the resultant urbanisation have brought in their wake enormous problems of distribution and have made varying demands on the shelf-life needs for foods, pharmaceuticals, etc. Within developing countries themselves, it is possible to observe differing consumption patterns - markets that are conscious of value and markets that are conscious of costs. Packaging is thus required to meet the demands of both the segments. It has, therefore, not been possible to arrive at a standardisation even for trade within (and in vast countries like India, this itself is a very big problem). When one considers the needs of export, there is a further complication introduced by the elements of variations brought in, especially the needs of the importing markets. There are again two divisions in the export markets, one which traditionally imports in bulk and reaps profits by packaging it in consumer packages for the market and the other is a more recent phenomenon, of the rich but industrially poor nations, viz. the oil-rich countries to which exports have to go in consumer packages, for, either they lack the facility to repack goods or their purchasing power is quite high. If, therefore, developing countries have to sustain their process of industrialisation, for which foreign trade is a must, they need to pay adequate attention to the growth in packaging standards prevalent. Unless they prepare themselves, through improved packaging in the functional and marketing features, they cannot penetrate potential markets and sustain in foreign trade.

2.0 TRANSPORT AN IMPORTANT FEATURE

THE DEVELOPMENTS taking place in the system of transportation and handling influence the design and choice of a package. As part of the programme of minimising the costs of transportation, great strides have been made in the system of transportation all over the world.

2.1 Containerisation:

IN THE MARINE movement, it started with the introduction of large Containers in order to minimise detention time of ships at ports and today we have cellular ships carrying giant Containers capable of carrying 10, 20, 25 & 30 metric tonnes at a time. The size and dimensions have been standardised in order to enable standardisation of the handling gear. The development of inter-modal Containers which are now in use as per standards recommended by the International Standards Organisation (ISO) have influenced packaging decisions not only in the developed part of the world but also in developing countries for meeting their export needs. It has been possible to minimise or eliminate packaging taking advantage of the facility offered by the Container in protecting the cargo.

2.2 Unit Load Handling:

IN ORDER TO help speed up the handling operations for purposes of storage, the concept of unitisation of loads was first developed with the adoption of palletisation of cargo. The dimensions of these pallets have also been standardised over a period of time again to facilitate mechanised handling. That the dimensions of the inter-modal Containers have naturally been tailor-made to match pallet specifications is obvious. The degree of standardisation which has been achieved in unit load handling has naturally led to the standardisation of packaging dimensions to fit into the system of pallet or system of Containers.

THE DEVELOPMENTS have been found to be so beneficial that even very large chain stores in the developed world have adopted these to suit their systems of merchandising. Even for the developing world which may not have the facility to handle pallet loads and Container loads, the advantages offered will be found to offset investment in the capital goods involved in the introduction of the system.

INCREASED protection and reduced damage to cargo would help developing nations in reducing their costs and simultaneously enhance the competitiveness of their products in the export markets where very often they are required to compete with the developed countries in quite a few areas.

3.0 USE OF INDIGENOUS MATERIALS AS BASIS FOR GROWTH

THE FACT THAT every nation cannot produce everything by itself economically, is by now so fully established that it needs any additional emphasis. The feasibility would depend on the availability of raw materials within in order that costs could be kept low. For example, where the country is abundant in bauxite and therefore aluminium, a packaging industry with a strong bias to this material can be quite successful. The availability of finished steel of the right quality can promote the development of steel container industry or tinsplates industry and can manufacturing industry. Rich forest resources would naturally lead to large scale paper industry and therefore promote paper packaging industry. Not all developing countries can boast of the availability of all the primary resources which can be ultimately converted to meet the packaging needs of the industrial or agricultural production.

3.1 Adaptation:

MANY developed countries whose resources are getting depleted at a faster rate, continue to devour the primary

resources of the developing world which do not have the wherewithal to convert these by themselves. Examples are so numerous to necessitate any listing. Fuel is a classic example. Tin, iron, aluminium, etc. are some examples where packaging materials are concerned. The efforts in the developed world have therefore been oriented to synthetics in preference to natural materials and superior technologies combined with mass-production techniques to reduce the material consumption for a given performance. As a result, the technology, information and equipment and systems available in the developed world and which are usually borrowed by the developing countries for their use, increase their dependence on identical materials in their countries also. The result is a total lack of urge to improve the indigenous materials in the developing world. The situation needs to be rectified and in this effort, the expertise of the developed world can be of help to the developing world in the modification or adaptation of their technologies to suit local materials. For example, in countries like India which use less superior qualities of kraft paper, the conversion equipment must be capable of making use of this paper. But very often, equipment for conversion is obtained first and efforts to modify the materials follow.

3.2 Traditional Materials:

AGAIN, a number of traditional materials available in plenty in developing countries are not usable in their present form for meeting the changing needs of internal trade and exports. Materials like coir (which offers cushioning properties), bamboo baskets, agricultural fibres which are converted into bags for bulk packaging, suffer from a number of 'deficiencies' and therefore unacceptable. Technologies must be provided in order to upgrade these to fit into changing needs of organised industries. Materials capable of being

used for packaging appear to be one of the main sufferers for the awareness of the advantages of improved packaging itself is low in developing countries. This is a significant area which has potential for closer collaboration between developing countries themselves on the one hand and between the developing and the developed world on the other.

4.0 PACKAGING RESEARCH AND TRAINING

AS THE industrialisation itself is a complex problem for most developing countries, very little energy is left to develop the infrastructure facilities to fully realise the fruits of production. It is no wonder therefore that losses and damages do occur to industrial production during the stages of distribution. Thus, prevention of losses to help conserve scarce industrial production has become the principal problem to be tackled in almost all the developing countries. Applied Research in Packaging, taking into account the other components of the physical distribution system, has, therefore, become the urgent need of the hour.

WHILE THE organised and what may be termed as the 'modern sector' of the industry itself is not able to pay adequate attention to the enormous problems of protecting their own goods through techniques of better packaging, it will be futile to expect the not-so-informed agricultural sector to take the first steps in such improvements of packaging technology.

AS DEVELOPING COUNTRIES continue to largely depend upon primary goods such as agricultural produce, fisheries, etc. where the losses are staggering, some organised efforts to conserve these through adequate research and development would help the common man in his struggle to survive.

A PROGRAMME of applied research with regard to conservation of agri-horticultural production as well as industrial production will have to be supported by:

- a) the development of testing facilities to test and evaluate packaging materials and packages;
- b) training facilities to train and develop packaging specialists to meet the needs of the various sectors of the industry and trade;
- c) information services on the technical and technological developments taking place in many parts of the world in order to promote learning; and
- d) the undertaking of problem-solving consultancy services to meet the immediate problems facing the industry and trade.

5.0 PACKAGING AS A SYSTEM

IN THE CHOICE of Packaging, it is necessary to view this not as mere design of a package from whatever material that is available but to look at it as a total system.

5.1 Elements of the System:

THE ELEMENTS of such a system, from the producer's angle may be any one or all of the following:

- a) The primary package containing the product;
- b) The intermediate package containing a given number of primary packages;
- c) The transportation package containing a certain number of intermediate package which is considered the most economical size unit for distribution;
- d) The pallet which is intended to unitise a certain number of bulk packages to facilitate storage and handling; and
- e) The Container which accommodates a certain combination of pallets for movement by the chosen system of transportation.

FROM the point of view of the Retailer, the elements are:

- a) The size and shape of the primary package;
- b) The marketing features of the package so that it will move fast; and
- c) The economical size of the intermediate or bulk packages which he could afford to buy at a time.

FROM the point of view of the Consumer:

- a) The primary package must have all the convenience features he looks for; and
- b) The package should be easily disposable or re-usable.

5.2 Total Systems Approach:

IT IS very obvious that the choice of the primary package by the producer will have to take into account much more than the mere characteristics of the product contained but it will have to take into account the entire cycle from the point of production till the consumption and a little beyond, viz. the ultimate disposal of the package.

IT IS further restrained by the systems of production, types of package, system of transportation, environment conditions influencing product life, methods of merchandising, preferences and tastes of the consumer, the prevalent laws of the land, if any, governing the package, etc.

IF ALL THESE have to be done economically, care has to be given to every element of the system so that the product is still competitive in the ultimate analysis. The question is, therefore, obviously of how these elements have been adequately researched into and decided upon and the technology of packaging chosen for the purpose.

6.0 APPROPRIATE TECHNOLOGY

6.1 Consumption Needs:

THE OBJECTIVE of the present forum is to provide a basic conceptual approach and specific action programme of industrial technology for the modern and dispersed sector at the national level. The programme is supposed to meet not merely the production but more importantly the consumption needs of the larger rural communities. The appropriateness of a technology to be chosen would, therefore, have to bear in mind the basic question of meeting the needs of the rural sector of the economy. It is evident, therefore, that the development of the packaging industry must be oriented to the articles of consumption by the common man and simultaneously meet the needs of the industrial sector. Thus, there are two major sectors which packaging is expected to serve - one the industrial and the other the agricultural.

6.2 What is special in Packaging ?

PACKAGING, as has been made out earlier, is a service. It serves the product needs and the market needs. In all industrialising situations, the start has to be small in many areas. When the production plans for industrial products are based on this size of demand, it automatically follows that the establishment of packaging industry or planning for packaging production will have to keep in line with this demand. While it is true that highly sophisticated packaging technologies are presently available to the developed world, it does not have to follow that these technologies are appropriate atleast where packaging is involved, for, it is just need-based. The experience in some sectors of the Indian Packaging Industry bears ample evidence of what can happen if this is not borne in mind before the acquisition of the technology. A major problem will be the high

cost of packaging resulting from abysmally low levels of capacity utilisation, a major factor which must be of concern not only to the industry but to any nation. It is seldom that a supplier of the technology in a developed world is in a position to advise a buyer from developing world with regard to the acquisition or the appropriateness on his own, but it is possible that a proper assessment of the need in the first instance by the developing country itself where necessary with the assistance of the developed world which can provide the guidelines for a subsequent decision on the technology most suited for the situation.

FORTUNATELY, the advantage in packaging industry is that it can be adapted to the individual needs - rather it should be adapted to the needs of the product and the market. It can be in the large scale organised sector (e.g. Packaging Paper & Boards); it can equally be in the cottage sector (e.g. Paper Boxes, Cartons). Starting from the 800 cans per minute activity in an organised unit, it can go down to the level of even 1000 plastic bags a day in the cottage sector. What is, therefore, important is that it has to be dove-tailed into the technologies that are chosen for improving the production of the products to be packaged. When one decides to go in for mass-production in certain areas, one would need quality packages which are mass-produced. There will be no point in mass-production of packaging, if there is no viable local demand.

SOME considerations with regard to the choice of selected packaging sectors are detailed in the Annexures-VIII to XII.

6.3 Problems Resulting from Size/Scale:

IN TALKING about the adoption of appropriate technology, the question of scales of operation always comes into picture. Low investments and increase in the number of work places, is quite often rightly considered as the motivating factors when the country goes in for industrialisation. When rural industrialisation is the key-objective, this feeling gets additional support. While there is nothing objectionable and in fact a lot desirable in this approach, the constant upgradation of the technology once adopted involves additional inputs for the promotion of research and development efforts. The low levels of investment considered attractive for the setting up of individual work places do not or may not take into account the outlays on research and development. The result is that the technology once considered appropriate, does not continue to remain appropriate. This would lead to a situation of obsolescence of these technologies and therefore the elimination of the entrepreneurs who contributed to the growth of the particular technology. Packaging Technology is no exception to this. Therefore, the establishment of a number of small work places of low levels of operation should be supported by a common research and development infrastructure promoted either jointly by the industry and the Governments or by the industrial producers and users.

A FEELING may be expressed that when industries are of large scale, they could afford and plan for R & D efforts for the upgradation of technology. At least in the area of packaging, it is observed that despite the passage of years, this thinking is not substantiated by actual performances. There are possibly other restraints in a developing economy and therefore the question of scale as a factor which will enable constant upgradation of technology, does not appear valid. Thus, it would seem that it is only a capacity to

meet the immediate and foreseeable demand that should be the criterion for the choice of the technology supported by the necessary infrastructure to constantly upgrade the capability in keeping with the increase in demand.

7.0 PLANNING FOR PACKAGING

7.1 Common Problem:

A SURVEY of the packaging situation in the developing countries of the world would reveal some common features, viz. a) Governments of the countries do not provide for priority treatment for packaging industries as other subjects like food, health, industrialisations, etc. which need to be given greater attention. However, packaging which contributes to these, is not paid attention; b) the packaging user industries are not aware of their problems; c) managements in packaging user industries do not give adequate importance to the subjects; d) packaging is considered as an additional cost; e) arising from these, there is a total lack of co-operative effort in setting up of developmental centres for the promotion of packaging.

7.2 National Packaging Centres:

IT WOULD, THEREFORE, appear essential that National Packaging Centres are set up by the Governments where such centres do not exist already. Such a national centre should aim at involving industry and trade in the promotion of packaging standards. The next step would be for the Governments to make a suitable allocation in their 'Plan' outlays, for the packaging sector of the industry whose production will go to meet the needs of the industry and the agri-horticultural sector. The packaging centres should be entrusted with the responsibility to survey the country's needs and submit proposals for the measures aimed at improvement in the status.

7.3. Work Programme of National Centres:

THE NATIONAL Centres that may be set up, may have, depending upon the skills and talents available, to begin with any of the activities based on the minimum needs of the respective countries.

- a) Applied Research: Studies of different methods of testing for deciding on the ideal choice of alternatives, performance testing for standardisation, determination of performance requirements of packages for optimising specifications, etc.
- b) Development: i.e. Development of materials, retail and transport packages; also upgradation of indigenous materials.
- c) Consultancy: To meet short-term and long-term problems of individual industrial enterprises and groups of industries, by designing and developing suitable packages for new products, improvements in existing packages, etc. This also includes trouble-shooting.
- d) Testing of Packaging Materials for their Characteristics: i.e. Materials like paper, plastics, metals, glass, timber, jute and ancillary materials like adhesives, bitumen, waxes, etc. The tests also include those for mechanical, chemical and physico-chemical properties.
- e) Testing of Retail Packages: i.e. Packages made of flexible as well as rigid materials. The tests include shelf-life studies, compatibility, resistance to mechanical and environmental hazards.
- f) Testing of Transport Packages: i.e. packages made of metal, timber, plywood, plastics, etc. The tests include transport-worthiness of packages, such as measurement of resistance to shocks, impacts, vibration, compression, rolling, stacking, rain, salt-spray, humidity, etc.

- g) Training: (a) Short-term - for senior and middle management in industry and trade (b) Long-term - for developing packaging technologists (c) Inplant - for individual enterprises (d) Industry-groups, such as pharmaceuticals, chemicals, (e) Machine Operators, such as for closing machines.
- h) Information: - Documentation, (books, periodicals, patents, bibliography, translation, reprography, standards, trade catalogues, reports), publications, techno-economic, commercial, abstracts and title service, directories, survey reports, dissemination of information.
- i) Marketing Research: Survey of demand and supply of packaging materials, research for identifying new areas of application, overseas marketing research for packaging of export products.
- j) Graphic Design: - for Consumer Packages.
- k) Promotional: - Exhibitions, Packaging Contests, Seminars, Conferences, etc.
- l) Packaging Laws: Compilation of different laws in force to promote organized growth of the packaging industry and consumer protection.
- m) Standardization: Assisting national standards body in formulation of standards.
- n) Industry Cooperation & International Collaboration: - For promoting research, transfer of technology, training, etc.
- 7.6. Regional Packaging Centres:

THE ESTABLISHMENT of Regional Packaging Centres should also be contemplated in order to avoid duplication of research and development activities and to help in the transfer of technology. Regional Centres by virtue of their international

status are likely to be in a position to influence the local Governments of the Region and the Packaging Industries to help in the upliftment of standards. In setting up a Regional Centre, the principal consideration would be the availability of the minimum facilities and skills at the chosen centre. This is emphasised by the reason that in order to guide and to co-ordinate, there must be available a body of personnel with some basic understanding of not only the right concepts but also the problems of the region. This group could be entrusted with the task of organising a meeting of the Planners in the Governments of the region with a view to highlighting the benefits of improving the status of packaging in the region. The subject would, as a result, get subsequent acceptability and the industries in the region would find it easier to plan the growth of packaging industries. The next step would be to organise group exercises for the management personnel in the industries in the region to promote the right concept, viz. that packaging is an investment and not an item of cost. The diffusion of the subject in an industrial situation would be easier if it starts from the top. When the primary acceptance of the subject is achieved, it would then become necessary to meet the demand for trained technologists, for which a programme should be undertaken. This cadre could then be utilised to identify the significant problems of the region requiring immediate attention. The programme of work which would be of immediate benefit in overcoming some chosen problems could then be drawn up and in meeting this problem, co-operation may be necessary with the developed countries of the world. Solution to problems when found should be implemented, reviewed and refined. This would develop in the industry the necessary confidence to promote such efforts by regional centres and help in planning the pattern of their future programmes of work.

IN THE SECOND stage, the Regional Centres may undertake surveys of regions' requirements of materials, machinery and equipment which need to be standardised in order to enable planning for the production of these within the region itself.

8.0 INTERNATIONAL CO-OPERATION

AS MENTIONED earlier, the Science & Technology of Packaging itself is relatively new and we have on the one side tailor-made packaging materials to suit the product and the market in the most developed countries of the world and at the same time absolutely non-standard materials and systems in many of the developing countries in the world. Depending upon the advanced country with which a developing country collaborates for its own industrial development, the choice of machines and materials, varies. Apart from this, in a freer economy, where industries are allowed to obtain the technology they consider fit for their promotion, it is possible to observe in any industrially developing country the proliferation of packaging material specifications resulting from their adherence to a given packaging machinery or system obtained from different parts of the world. It is not uncommon, therefore, that when a country wants to take up the development of packaging materials whether from indigenous sources or through borrowed technology, because of the diverse nature of the demand, a lot of hesitation is noticed as the feasibility becomes suspect. It is not as though that it is impossible to substitute materials having the desired functional qualities in order to preserve and protect the produce and products, but the problem is the lack of co-ordinated effort at the (a) level of the industry; (b) national level; (c) regional level.

8.1 Technology Transfer - Main Task of Packaging Centres:

IN THIS AREA, one does experience the need for nations to come together so that the experience and expertise are shared and the costly mistakes of the developed nations in their path to progress is not repeated by the developing ones. The examples of one-trip bottles considered a step ahead of the multi-trip bottles and the resultant problem of litter leading to the second thoughts on going back to the multi-trip bottle is a case in point where before the technology is obtained, the developing countries must be willing to study as to what is appropriate for themselves. Experience of the developed world, which can be passed on to the developing world, needs the establishment of proper channels and systems of communication.

APART FROM THE most advanced nations, even some of the developing nations like India, Argentine, Republic of Korea, Egypt, etc. have developed their own technologies which are inexpensive and suited to local conditions. Cooperation among these and the still less developed nations can be equally beneficial.

THIS IS exactly where the establishment of national packaging centres, regional packaging centres and may be, inter-regional packaging centres, assumes importance.

A MAJOR TASK which the centres can be expected to perform, besides the routine functions of information communication is the identification of technologies most suited to the nations that require it and the capability for making the technology available from within. One does visualise that as countries in various stages of development continue to grow in their process of industrialisation, there are also countries which have been in that stage quite sometime ago and have gone over to greater systems of sophistication

in keeping with the overall development and the degree of industrialisation achieved. The technologies that have been developed whether presently of significant use or not, can be channelised through the channel of packaging centres to the less fortunate ones in the developing world. Global standardisation with its concomitant beneficent effects could be realized quicker if the system of channelisation is organised by the setting up of Inter-Regional Centre for the countries which are similarly placed in terms of the levels of industrialisation which could then be supported by regional centres representing different groups of nations and by national centres for individual countries. Packaging Centres have already been established in India, Morocco, Philippines, Republic of Korea, Iran, etc. and Regional Packaging Centres are also contemplated with an agreement to set up one in Morocco for the Arab States and more to follow. The time is now opportune for the creation of regional centres in Asia, Africa, Latin America, etc, which could be encouraged as gateways for the entry of appropriate technologies from the developed world.

9.0 ROLE OF INTERNATIONAL AGENCIES

IN THE OVERALL development of packaging technology, for the benefit of mankind, international agencies have a key role to play. The United Nations Industrial Development Organization (UNIDO), the International Trade Centre (ITC), the Commonwealth Secretariat (CFTC), the World Health Organisation (WHO), the World Packaging Organisation (WPO), etc. can help in bringing together countries of the world and hasten the pace of growth. The assistance of national agencies of developed countries, such as USAID, SIDA, etc. and regional bodies like the Industrial Development Centre for Arab States (IDCAS), can also be sought in this effort.

10.0 CONCLUSION

THE TECHNOLOGICAL need for promoting packaging having been now identified and accepted, it is time, concerted efforts are taken by the developing world for implementing a planned programme of action.

AGRICULTURAL PRODUCTS

ESTIMATES prepared by International Agencies indicate that the post-harvest losses in agricultural production can be as low as 1 % or as high as 45%. Many developing countries are net importers of foodgrains. In countries like India where food production is quite high, the post-harvest losses have earlier been estimated at around 10%. Some of the losses controllable through the adoption of adequate packaging are :

1. Those occurring during field transportation ;
2. Drying to storage transportation ;
3. Storage in relation to the type of packaging and period of storage.
4. Storage to processing transportation ; and
5. Distribution - including transport and handling.

As food production increases, the quantum of loss also increases leading to continued dependence on imports unless there is a dramatic turn either in population control or in food production for the better.

SCARCITY leads to problems of adulteration which is facilitated by the absence of branded consumer packaged foodgrains in most developing countries which are also highly populated.

The exploitation of the consumer continues.

EVEN IN INDIA where presently there is no dependence on imports, no significant changes have taken place in the patterns of packaging, which continue in the age-old jute bags. Millions of tonnes of foodgrains are moved over several hundred kilometres throughout the year. Losses continue though measures have been taken to minimise the incidence of losses but packaging is yet to be utilised fully, as one of the means of loss prevention.

The concept of consumer packaging right at the production centres which could be encouraged through the forum of village co-operatives can :

1. Help achieve a higher value realisation by the farmer because of the additional process of packaging involved ;
2. Help in the starting of small scale or tiny scale industries to meet the packaging needs of the local produce ;
3. Help consumers at different centres to identify quality relative to its origin, which is not facilitated by the present system and, thereby, protect the consumer from exploitation with regard to product quality and minimise chances of spoilage; and
4. Contribute to the overall welfare of the rural sector and the community as a whole.

THE CONCEPTS of consumer packaging, if introduced at the rural level as above, can concurrently assist in the extension of this idea to such articles as sugar, vegetables (pre-packaging) fruits (pre-packaging), etc. The present levels of losses in fruits and vegetables in India alone is estimated at around 30 % which is preventable to a substantial extent. The technology is inexpensive but benefit is immense.

Experience of the developed countries will be of help.

C E M E N T

CEMENT is a product of the organised sector. Though consumed in bulk, it is always packaged in small units for transportation. The main reason for packaging is to save it from seepage or spoilage. The developed world uses paper sacks, the availability of which is restricted. The use of poorer qualities of paper has been rendered difficult because of product characteristics. India is one of the major producers of cement but it uses jute bags where the losses due to seepage are estimated to be around 7 % and in recent times, there has been imports of quantities less than the amount of losses. Measures to minimise losses have to focus attention on packaging.

FOR EXPORTS, however, the dependence on imported paper continues as the developed countries demand the use of paper to prevent dusting due to seepage. Even here, the minimum losses due to the system of handling is estimated at about 3%. Thus, there is a need to identify technologies aimed at (a) the use of modified jute bags to minimise seepage; (b) inexpensive methods of upgradation of less superior paper such as those derived from bamboo or hard woods; (c) improved systems of bulk distribution which would necessitate the requisite infrastructure for handling.

LIGHT ENGINEERING PRODUCTS

PRODUCTS that fall under this category are mostly metal manufactures, such as agricultural implements, tractor parts, pumps and oil engines, hand tools, machine tools, domestic appliances, industrial spares, etc. In recent times, a variety of electronics have been added to this list. These are either fabricated or assembled and are characterised by their vulnerability to the effects of atmosphere whereby they get corroded or are highly fragile and vulnerable to the hazards of transport handling and distribution.

IN THE design of packages for these products, a large number of materials are made use of. Moisture barriers, oxygen barriers, cushions, space fillers, corrugated boards, timber, thermo-formed packages, vapour corrosion inhibitors, etc. are all used.

PROPER product design technology taking into account the hazards of the journey alone will ensure that the product can be made available to the consumer intact and at competitive prices. While in the developing countries, no serious attention has so far been paid to this aspect, in the developed countries which export a sizeable quantity of these to the developing world, there is lack of awareness of the conditions of the distribution. In this field, there is an enormous need for a serious dialogue and exchange of ideas between the developed and developing countries.

IN THE areas of package design for these products, very little knowledge is available in the developing countries. Package Design Technology needs to be provided to the developing countries, in a big way. Here again, the developed world can be of help.

CAPITAL GOODS

(HEAVY ENGINEERING AND EQUIPMENT)

WHILE THE choice of Technologies of production is important, a major impediment is observed in the commissioning of these plants, resulting from the loss and damages occurring during transport from the production to the erection point, Breakages, atmospheric influence and other hazards during the journey from the manufacturing centre even in respect of very small components or accessories lead to major delays resulting from the need for replacement. Even in such large scale equipment as for power generation, transportation and packaging, pose great problems.

PRODUCT design for movement and techniques of particular packaging to minimise costs, are areas in which technology can be made available by the developed countries.

ADEQUATE and functional packaging minimises their being subjected to exposure to the atmospheric changes such as of humidity and from mechanical hazards experienced in the journey as well as of handling. The choice of proper packaging (the right quality of timber & design) and development of adequate systems of storage and transport are important here.

FERTILISERS AND CHEMICALS

MOST developing countries depend on imports of fertilisers and chemicals to supplement the local production in order to meet the growing needs of agriculture. Precious foreign exchange is utilised in their procurement but it happens that the infrastructure for their handling, transportation, in addition to suitable packaging systems have not developed to the extent necessary and desirable.

NEWER systems of transport may include the design of suitable bulk carriers from the ports or production centres to the consumption centres. Cost effective package designs such as flexible bulk containers of plastic, jute or other fibres may have to be developed. Simple systems of handling the bulk containers should be developed at the rural centres.

THESE measures would help cost reduction in distribution which is vital.

DRUGS AND PHARMACEUTICALS

THE importance of packaging in drugs and pharmaceuticals has been realised by all countries without any exception. But the conditions of marketing, merchandising, storage and most important of all, the ambient conditions vary from country to country. These have a great influence on costs. The need for making available to the masses drugs and pharmaceuticals at optimum costs, is self-evident. But unfortunately, the industries in developing countries cannot afford to undertake expensive research and development in packaging and therefore are compelled to adopt the patterns of packaging even where they may add disproportionately to the cost. It is not uncommon to develop packages which can give a very long shelf-life, while the markets do not need these, for, in many countries, the supply of drugs and pharmaceuticals is scarce. The emphasis in the choice of technology of packaging in this case should, therefore, be on :

- a) Cost Reduction, in keeping with marketing needs ; &
- b) Safety of human health with regard to the choice of packaging material in the context of the ambient conditions and storage life.

T E X T I L E S

DIFFERENT varieties of textiles are produced in many developing countries. Broadly, they fall into the following categories :

A. Textiles based on Natural Fibres :

- 1) Silk
- 2) Cotton
- 3) Wool

B. Man-made Fibres :

- 1) Nylon
- 2) Polyesters.

SOME of the developing countries manufacture an export yarns. Some export semi-processed fabrics and some export garments. In countries like India, all the varieties are offered in the modern sector of the industry.

AN interesting feature of the Indian economy, is its basic commitment to the handloom sector. Emphasis in the handloom sector has so far remained with production and very little attention has been paid to the distribution and the losses that might be encountered resulting from :

- 1) Effect of insects in respect of hand-made Silk Fabrics ;
- 2) Mould growth in the case of Cotton Fabrics; and
- 3) Shop soiling due to long term storage.

ALL these lead to distress sales after a limited period of storage and the products are disposed of as waste after long term storage. Considering the quantum of production and consumption, the losses arising from this post-production stage, are so great that no country, and particularly no developing country, can afford them.

THE need for adequate research in packaging is emphasised.

PAPER BOARD CONVERSION INDUSTRY (CONTAINERS
BASED ON PAPER

CORRUGATED Fibre Board is an important material used for the manufacture of containers intended for transport of cargo.

The production technologies adopted are :

- a) **Fully automatic** - right from the stage of making the board till the time of collection and unitisation of finished boxes ;
- b) **Semi-automatic** - where the critical part of the board is manufactured in a simple mechanism and all the other operations of making the board and its subsequent conversion into boxes, is done in several stages manually.

PRODUCTION in the fully automatic units can go upto about 300,000 boxes per day (two shifts).

THE semi-automatic process is capable of meeting the smallest orders for a few hundred boxes a day of various sizes and properties.

THE automatic plant can employ about 10 to 15 people while quantity for quantity, the semi-automatic lines would have to use about 8 - 10 times as many people.

THE technological choice, therefore, should be in favour of using the semi-automatic units, where labour is available economically.

AUTOMATIC equipments which operate around 200 metres per minute, produce about 8 tonnes of corrugated boards and subsequently convert these into boxes.

Semi-automatic machines produced in India operate at speeds upto 30 metres per minute and produce about 3 tonnes per day.

INVESTMENT in a simple fully automatic machine obtained from the developed world is of the order of 250,000 US dollars compared to investment of about 15,000 US dollars in semi-automatic equipment in India. Advantages of lower sophistication include the facility to use poorer but more economical paper materials as is the case with the paper made from bamboo in India.

G L A S S P A C K A G I N G

GLASS CONTAINER happens to be one of the oldest packaging materials to be used by mankind. It is manufactured from relatively inexpensive materials and it is recyclable. Energy consumption, however, is a factor. Three systems of manufacturing are possible:

- a) the semi-automatic ;
- b) three-fourth automatic ; &
- c) the fully automatic.

MINIMUM capacities for an economical plant, could be about 5 tonnes per day. The employment potential of such unit is about 250 workers. It is capable of meeting very small scale demands in terms of few thousand bottles at a time. The cost per machine can be as low as 1500 dollars besides that for the furnace. Initial investment can, thus, be very low.

THE three-fourth automatic is an intermediate stage between the semi-and fully automatic machines where investments would have to be in the region of about 1200,000 dollars. It can be had in sections of capacities of three tonnes per day each and each section costing about 150,000 dollars. The number of workers to operate is more though the total capacity for an economical unit will be equal to the fully automatic one. The choice of appropriate size unit will, therefore, have to take into account the fact that in developing countries the demand is likely to grow gradually upto a point and suddenly take-off. It may,

therefore, be desirable to start with semi-automatic and switch over to three-fourth automatic with the capacity to increase the number of sections.

THE fully automatic is usually a six section unit capable of producing about 15 tonnes per day involving the use of 2 operators for the machine and the rest for further process. Minimum capacities should be of 3 units. The cost of installation towards the equipment, furnace, etc. can be in the region of 5,000,000 dollars. The employment potential is lower at about 400 persons for the 45 tonne output.

P L A S T I C S P A C K A G I N G

THIS sector of packaging industry is highly adaptable to various stages of development in any country. The plastic raw materials sector has to be necessarily having large scale capacities and be provided with application, research and development facilities in order to guide the user. This is the pattern of growth of the industry the world over.

THE plastics conversion industry, i.e. the industry which converts the raw material to plastics packaging can be in the tiny sector, medium or small scale sector or large scale sector. The establishment of the size of the unit in this case is rendered easy, for, it has to be dovetailed into industrial or agricultural use for which it is intended.

IN THE field of injection moulding of plastics, there can be hand-operated semi-automatic units of even half ounce capacities to very large fully automatic units depending upon the size of the local demand. It is possible when one starts on a modest basis to increase the number of units to go to meet the growing demand from time to time. The minimum investments can be US dollars 200 to 500 for the purpose depending upon the type of plastics.

IN THE field of film manufacture, the blown film technology has been adopted with great success in India, where even small rural demand has been possible to be met. Investment in equipment may be of the order of US dollars 20,000. In the case of film lamination, the capacity has to be chosen with great care, for, this is intended to meet mostly organised large scale demand in keeping with the levels of value or cost consciousness not only in the user industries but in the consuming public as well.

The Indian situation would indicate that choice of the right scale of operation to begin with is extremely important. Blind copying the sophistications reached in the developed world in this behalf can be disastrous.

SIMILAR is the case with the blow-moulding of containers.

AN IMPORTANT aspect to be remembered in going in to the technology of plastics packaging, is the environment in which the containers are intended for use. This needs to be taken special note of particularly in the developing world, which are similarly placed geographically as well as economically like India.

IT SHOULD also be remembered that the plastic conversion machinery industry and the raw material industry will have to take the lead in guiding the destiny of the plastic conversion industry as well as in the promotion of applications for plastics.

METAL PACKAGING

THE metal container industry has been one of the traditional industries in all parts of the world. Steel barrels, tinsplate containers based on hot-dipped tinsplate and aluminium containers have been in use for a number of years.

IN ALL THESE AREAS, a substantial amount of substitution for certain applications/markets is taking place all over the world as the marketing needs have undergone radical changes or the systems of transportation and distribution have been vastly improved.

NEWER TECHNOLOGIES in this field have, therefore, concentrated attention on :

- a) minimising the use of the material for a given application ;
- b) use of alternative materials for coating in place of tin ; For example, tin-free-steel (TFS) ;
- c) minimising the amount of steel used for the tinsplate, such as the double cold reduced plate (2-CR);
- d) minimising the use of tin-coating by the adoption of differential coating rendered possible by the electrolytic process ;
- e) minimising the number of operations involved in the production of can by the use of such technologies as drawn and wall-ironed cans ;
- f) substitution of the metal itself by paper such as by the adoption of composite containers having metal ends only ;
- g) by the development of leak-proof containers using combination of paper and metal.

OF ALL packaging materials, metal containers offer the maximum protection to the product. That they cost relatively more, becomes obvious. Perhaps, in the early days and may be in some parts of the world, even today their adoption for purposes of packaging has been inevitable.

IN THE area of metal container technology, therefore, the basic material will have to be competitive and the choice of the technology for its production itself will have to be given primary attention. Secondly, consideration must be given as to how far this expensive material could be put to use by essentially the rural sector to which attention is presently being contemplated.

Also, whether the market at all needs the adoption of metal containers, should have to be first ascertained. In all these areas, there is a need for the acquisition of expert knowledge in regard to the local conditions, product needs and technological possibilities.

FLEXIBLE PACKAGING

THIS AREA covers both the traditional and the non-traditional materials. In the developing part of the world, natural fibres like jute, hemp and similar fibres as are locally available, are made use of. These were just sufficient to meet the demand in the early days for the packaging of bulk of the agricultural production. It is the change in the pattern of consumption as well as of distribution that newer materials as alternatives to these traditional ones, had to be developed by the industrially advanced world in keeping with its needs. The result has been the almost total neglect of upgradation of technology with regard to the traditional materials. This is more experienced in the field of flexible packaging than in the area of rigid containers. Evidently, there are two distinct areas of technology which require attention: a) the technology to modify traditional materials produced in the developing world to meet the needs of the modernising sector of the industry for purposes of packaging; b) the adaptation of modern machinery and equipment to make use of the traditional materials.

WITH REGARD TO setting up of industries in the field of flexible packaging in the modern sense, i.e. industries which will utilise such materials, as aluminium foils, regenerated cellulose film, such as polyethylene, polypropylene, nylon, polyester, etc., the choice will be determined more by the quantum of demand and significantly the ambient conditions during storage, distribution and merchandising, in addition to the systems of merchandising itself. For example, while the system of merchandising in the developed world, will demand the use of pouches that can stand up, in order to meet the needs of the self-service stores, the need is absent in the developing world where the customer is always assisted by the shop-keeper while effecting the purchase.

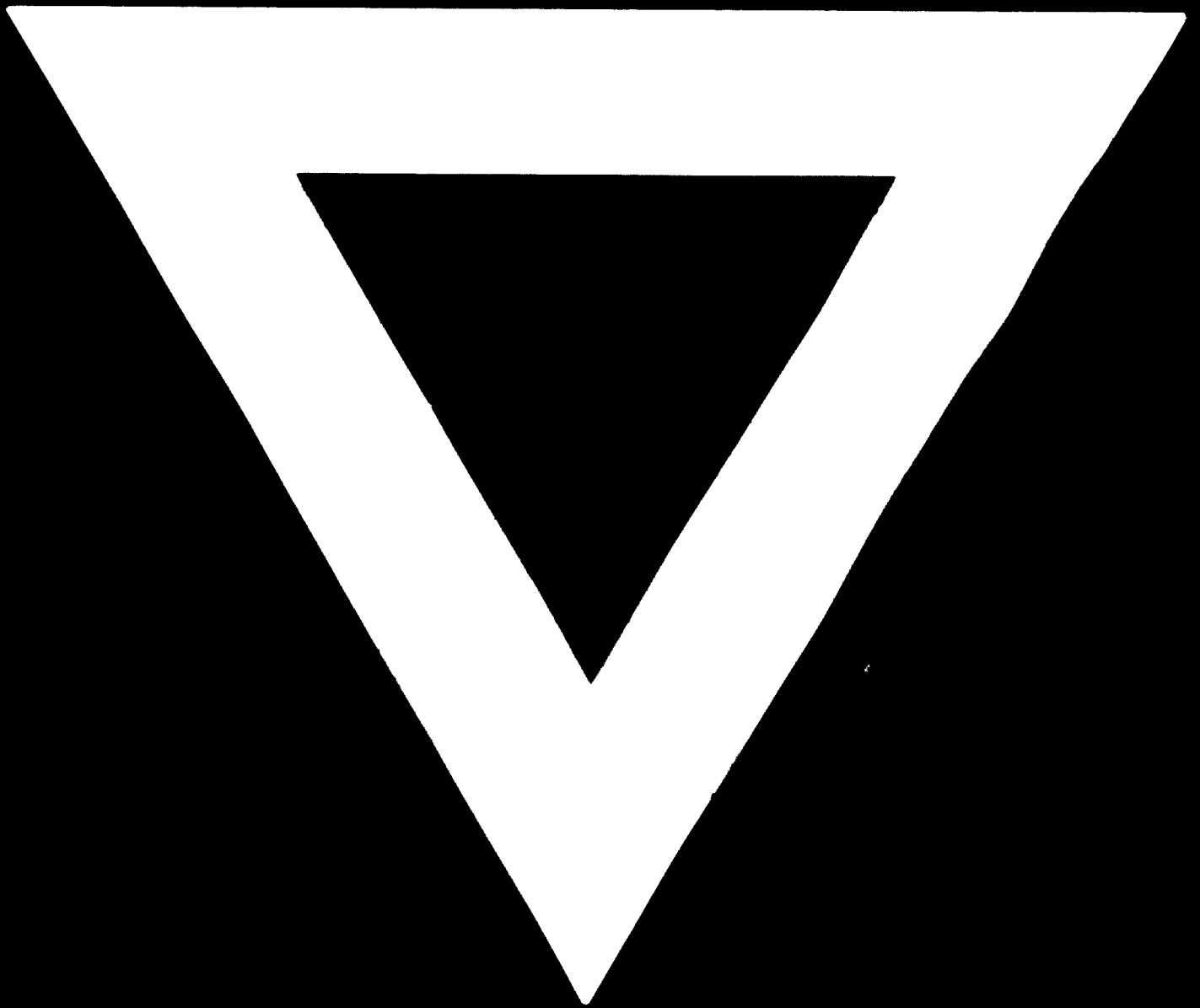
IN THE FIELD of laminates which make use of different materials to produce the ultimate flexible materials required, it is desirable to think in terms of technologies which will offer maximum economies.

IN THIS AREA of flexible packaging, essentially where modern materials are involved, there is evidence of creation of capacities totally unrelated to the needs of the market rendering the packaging materials highly expensive. Not only the size of the industry but the choice of the technology, both are very important considerations in this field.

IT IS TO BE remembered that the field of Flexible Packaging offers enormous potential for minimising the cost of packaging for a variety of products and hence its very high importance.



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