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TECHNOLOGIES FOR THE PRODUCTION OF STEEL AND ALUMINIUM PACKAGING

Background Paper

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TECHNOLOGIES FOR THE PRODUCTION OF STEEL AND ALUMINIUM PACKAGING

by

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INTRODUCTION.

1. The emphasis on packaging for the developing countries acknowledges the importance to increase the sales of packed consumer products for the export and for the domestic market.

2. The yearly world consumption of packaging materials amounts to 9.000×10^6 tons. The share of steel amount to 10% of the total tonnage. Aluminium 1%.
   Other packaging materials:

paper + board	44 %
plastics	7,5%
glass	26 %
board	10 %
miscellaneous	12 %

3. From the total world consumption of steel of 695×10^6 tons, 2% is used for packaging purposes.
   From the total world production of aluminium of 13×10^6 tons, 1% is used for packaging purposes*).

4. Metal packages consist of many types, mainly: barrels, food cans, aerosols, tubes, films, cases, closures.
   Metal packages are used for: food, chemical products, pharmaceuticals, dried food, milk and milkproducts, liquid food and beverages, tobacco, etc.
   The biggest use for barrels is for packages of chemicals for industries. Cans are mostly used for food and beverages.
   These cans take approximately 50% of the total metal packaging use.

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*) Extracted from:

- Report of the proceedings 11th Conference 1977 of the World Iron and Steel Institute
- Emballages (French packaging periodical)

5. The paper deals with the ways to approach the problems of appropriateness of technologies for the steel and aluminium can production.

6. Cans are the most appropriate package for processed foods in the developing countries, because of the properties: rigidity, sterilisable, optimal protection of the content because of its highly impermeability, highly inertness,resistancy against moisture and tropical temperatures and humidities, shock resistancy.
The cans are appropriate either for export purposes as well as for the domestic market if the markets are rather away from the food production.

DESCRIPTION OF APPROPRIATE TECHNOLOGY.

7. The following workable description of appropriate technology is used in World Bank circles:
   - In most developing countries capital and sophisticated skills are scarce and relatively expensive, unskilled labor is plentiful and cheap, and unemployment is a serious problem. Consequently, appropriate technology tends to be that which makes use of labor intensive methods which concurrently require relatively low inputs of scarce capital and technical skills. This applies to a greater or lesser extent in all sectors of developing economies.
   - The first step towards identifying the technology appropriate to a particular development task is to identify the purpose which it serves and who the beneficiaries will be. The second step is to design the product or service to be delivered (the "appropriate product") in the light of a systematic analysis of the overall problem. For example, if the goal of the investment is to provide production capacity for metal packiging, the choice between village or regional production depends on an analyses of the markting chain from producer to consumer.
   The third step is to select from among the alternative production techniques that one which makes the most economic use of available resources, and produces the desired good or service at minimum social cost. This is the appropriate technology for the paricular task.

- Technology used in developing countries need also to be appropriate to the size and standards of local markets, to the sophistication of the local work force and managerial cadre, to the local environment and cultural setting, to locally available semi-finished materials and capital goods, and to the need for local planning, implementation, operation and control. Finally, a technology adopted of developed today must in a broad sense be appropriate not only for today's needs, but also to the future. However all of these requirements may not be compatible in practice. For example, technologies which save capital may also require larger managerial capacity.
- In summary, we may distinquish four dimensions of appropriateness:

1. Appropriateness to Goal.
   Does the technology support the goals of development policy?
2. Appropriateness of Product.
   Is the final product or service delivered useful, acceptable and affordable to the intended users?
3. Appropriateness of Process.
   Does the production process make economic use of inputs?
4. Cultural and Environmental Appropriateness.
   Are the production processes, the products delevered, and institutional arrangements compatible with the local environment and cultural setting?

8. Prof. Dr. Bos from the Erasmus University Rotterdam expertly summarized the definition as follows:
   - Appropriate technology is a technology that makes the greatest contribution to development objectives in the light of existing economic, political and other relevant conditions.

9. The strength of this definition is the fact that it emphasizes the approach from its goals and not, as many other definitions, from the technology itself. This has been the advantage of a clearer vision of the problem. It systemizes the approach: first: define and indicate the requirements of the society and secondly: indicate the aspects of appropriate technology, which has to be considered.

ASPECTS OF APPROPRIATE TECHNOLOGY.

10. In accordance with aformentioned definition appropriate technology can at least the following aspects:

- labor intensive. In an attempt to make use of the large number of unemployed in developing countries, such a strategy can turn this liability into a resource.
- small scale. The roots of a technologically progressive society must be developed before the tree can grow. People must grow incrementally in their capacity to use and understand technology. Small industries also require less capital investment, an item of scarcity in most developing countries.
- optimum use of local resources. Use of local resources lessens the balance of payment problems associated with imports. One must insure, however, that 'optimum use' is carefully defined and that these resources are not over exploited.
- cost effective. Certainly appropriate technology should pay for itself and provide a profit for the person using this technology. However, social profits and costs should also be considered, and some form of subsidy might be necessary to return a monetary profit to the entrepreneurs.
- ecologically sound. It helps achieve a balance between population, resources, agriculture, and industry.
- self-perpetuating. Each transfer of technology cannot be an end to development. It must be a path that builds on the present and leads to a future. It is intended to kindle the innovative process that will allow for continuing advances.

11. These aspects create possibilities to grow without a lasting dependancy. In other words appropriate technology promotes self-help and self-reliance. It is recognized that mar's greatest sence of pride comes from being able to help himself.

12. It is quite possible that aspects are not compatible. It is for instance possible that a small scale technology needs more skilled and trained labourers than its large scale counterpart.
In such cases it is necessary to consider the aspects and decide, based on the requirements of the society conditions, which of the contradicting aspects will have the highest priority. Thus in this example whether 'labourintensitiveness' or 'small scaleness' has the highest priority.

CONSEQUENCES FOR THE STEEL PACKAGING INDUSTRY

13. Considering the tin can production, the following steps can be distinquished:

- Iron making out of ore
- Steelproduction from iron
- Rolling of steel to produce steelplate
- Tinning to make tinplate
- Lacquering and printing the tinplate
- Canmaking out of tinplate.

14. Iron out of ore is mainly produced by large scale industries by a well-established production process as the blast furnace process. But many attempts and much development work has been done and is being done to establish small scale foundries.
An Italian study on the Italian steel industry *), however, showed that the scale of works had been determined primarily by market and technological developments in which bulk steel was produced by large process units. An important conclusion has been that the establishment of small plants had been favoured by the combination of electric furnaces operating on scrap and continuous casting.

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*) The Iron and Steel Industry in the developing countries, 99 pages. Published by UNIDO, sales number 74.II.B.15; $6.

At the other hand small and medium scale fourdries in the developing countries are mainly used for the endproduction of heavy cast iron products.
In Afghanistan are tried out village scale foundries, using mainly scrap steel and old iron and producing, among others, ploughshares. The produced metal is however mainly not suitable as a source for steelplate for cans.
At the other hand the possibilities of the direct-reduction processes for small scale production are promising, but still in its development stage. It is moreover not sure that the product will be suitable as a resource for tinplate.

15. To produce steel, a technology is necessary to remove carbon; to a lower degree phosphorus and other elements. To obtain a sufficient ductility of the steel, the oxygen blow techniques can be applied. This technique however can only be used on a large scale. It is not sure that small scale continuous steel making will provide the needed quality of steel for tinplate.

16. Rolling of steel to obtain steelplate needs heavy rolling equipment and high energy supplies.
Roughly we can distinguish two types of technology: hot rolling and cold rolling. Hot rolling ,the oldest known technique, rolls hot steel into plate. As hot steel is easier to process, less heavy equipment and less energy is needed. Hence, capital investments are lower and steelplate production at small to medium scale level is technologically and economically possible. The disadvantage is that the steelplate quality is for canmaking rather low.
Cold rolling, the now mostly used technique, needs high energy and very heavy equipment. The capital investment is high and steelplate production is only on a large scale level economically possible. The advantage of this plate is the high quality for producing tincans. In particular the ductility,the evenness of the plates and the dimensional quality are mainly of a very high standard. Moreover an economic advantage of this large scale technology is the fact that plate can be produced with less steelwaste than ever can be reached at small scale level.

17. The tinning of the steelplate is necessary to protect it from corrosion and other chemical reactions.
Nowadays electric tinning is mostly applied on steelplate, although hot dipping is still in use.
The advantage of electric tinning is the fact that the tin layer can be distributed very evenly on the steelsurface. Futhermore a high rate of control of the process is possible, hence very thin layers of tin can be applied. The tin amount on tinplate for canmaking is nowadays mainly of a total of 5,6 grams per m^2 tinplate. The amount of pinholes in the tinlayer is by this amount acceptable, if coated tincans are used. And lacquered tincans are mostly used for the different foodstuffs, such as beer, beverages, edible oils, milkpowder.
Some products need for the maintenance of their light colour unlacquered tincans. Examples are grapefruitjuice, beans, liquid evaporated milk, applesauce. To diminish the amount of pinholes, a thicker tinlayer has to be applied. There are vegetables needing uncoated tincans with tinlayers up to total 24 g/m^2. But the quantities of needed tincans are of minor importance.

Hotdipping of tinplate cannot be controlled so well. So the minimal thickness is 4 times the main thickness of electric tinning, being of the order of 24 g/m^2.
The advantage of hotdipping however is the fact that the quality is better than electric tinned plate with the same tinlayer. If the products requires a thick tinlayer, the keeping quality will be better in hotdipped tincans. Futhermore hotdipped tinplate can be produced economically in small scale enterprizes.
Electric tinning only on a large scale level.
The wall thickness of tincans vary according to size and form and is mostly within the range of 0,2 - 0,25 mm.

18. Coating and printing of tinplate.

- Coating of tinplate is technologically very difficult in order to quarantee a good adhesion. The process must be rigouriously controlled. The stoving of the just caoted tinplate for instance must be controlled within the narrow limits of plus or minor 5^0 F!
  The coating quality however is not scale sensitive, so small scale production is very well possible, if skilled labour is available.

- Printing is even more difficult than coating. The printing proces on metal surfaces requires a highly controlled operation. The printing ink must be of such a quality, that the printed surface must be very abrasive resistant. It must withstand the deforming operations during the canmaking and the filling operation in the canfilling units at the foodprocessing and other user's plants. It is however very possible to avoid tinplate printing and to stick to labelling the filled cans instead.
  This has two advantages: firstly the printing operation on labels is much easier and is in many conditions cheaper than printing the can. Secondly canned products industry can choose its label shortly before shipping its canned goods. If this industry uses printed cans, they have to decide, already far before the processing and filling of the cans, on questions as:
  - design
  - produce to be filled with
  - information to be printed
  - language of information.

  This means a most important complication that sales must be contracted very far ahead of production.

19. Canmaking from tinplate.

The consideration will be limited to the cylindrical can. More than 70% of all the used cans are of this type. Moreover it is the easiest to make.

The canmaking process consists basically of:

- the making of the body
- the making of the ends
- the closing of the bottom end.

Moreover the supply of the tinplate and the packing of cans and topends has to be arranged.

There exists very sophisticated, highly automated and quick producing large scale equipment, which needs high capital investments and needs relatively little labour. But this large scale level is not necessary to produce high standard cans.
On a small scale level, the needed equipment is not very complicated. This equipment consists basically out of machines for:

- slitting tinplate
- soldering the body
- pressing tinplate for the ends
- compound lining the rims of the ends
- flanging the bottoms of the bodies.

If a rigid quality control is applied, special skilled labour is not necessary.
The most simple line for canmaking produced 30 cans per minute. The investments involved are of the order of US $ 100.000 and the production line needs 15 labourers.
As small capacities are already feasible it can be advantageous to attach a canmaking unit to the production enterprize of the can user, for instance to the unit of a foodprocessing industry.
In doing so, one uses the infrastructural conditions, created already by this industry.

CONSEQUENCES FOR THE ALUMINIUM PACKAGING INDUSTRY.

20. Out of the view point of appropriate technology, the aluminium can production is to a certain extent similar to the tincan production.

21. The following steps can be distinguished in the aluminium can production:

- reducing of bauxite ore to canmaking alloys for aluminium
- rolling of aluminium to plate
- canmaking out of the plate.

22. Production of aluminium out of bauxite is a highly energy consuming process.
Supply of high power electricity must be available, so the process can only be executed on a large scale level.

23. As aluminium is a relatively soft material, the rolling equipment is lighter than aforsaid for steelplate. The rolling process consists of different steps, characterized by the fact that during the rolling process the metal has to be reheated several times in order to obtain a sufficient flexible plate, suited for canmaking.
The technology is nevertheless suited for smaller units, so small to medium scale production is quite feasable.
In a chemical way, aluminium cans are more inert to its content than tincans. For instance the beverage '7-Up', being relatively agressive, requires for aluminium cans a thinner innercoating than for tincans.
The aluminium can is suitable for instance for beer, beverages, powdered food like milkpowder, liquid evaporated milk. As the mechanical properties of the aluminium sheet is lower than the tinplate the wallthickness of an aluminium can is mainly 0,3 - 0,4 mm, dependent on size and form of the can.

24. Canmaking

Basically canmaking consists of the following steps:
- deepdrawing the open top can
- deepdrawing the top-end.

Moreover the supply of the plate, the packaging of the cans and tops and the dispatch of the cans has to be organized.
Canmaking can be done on a small scale level. Rather simple equipment, needing not specially skilled labour, is available.
The needed equipment on a small scale barically is needed for:
- slitting the aluminium plate
- pressing for deepdrawing the can
- pressing for deepdrawing the top
- compound lining the rims of the top
- coating the inside and outside of the can.

25. A possible disadvantage for the aluminium can is the fact that the production is rather high energy consuming. Table 1 gives the energy consumption in tons oil equivalent (t.o.e.)

Table 1. Energy consumption of some packages.

Product	tons oil required to produce 1 million 1/3 l. containers
Tinplatecan	75
PVS bottles	81
Glass bottles	90
Aluminium can	142

Source: calculations of the firm Thomassen and Drijver, Deventer, Holland

APPROPRIATENESS OF THE METAL PACKAGING INDUSTRY TECHNOLOGY

26. In points 10. and 11. are considered the most important aspects of appropriate technology. Table 2 judges the appropriateness of the different technological steps in canmaking.
The meaning of the used signs is:

\+ : technology complies with the aspect

\- : technology does not comply with the aspect

$\pm$: complies more or less.

Table 2. Appropriateness of canmaking.

Technology	Appropriateness of canmaking						
	labour intensive	small scale	local resources	cost effective	effective sound	self perpetuating	self reliance
Steel:							
Ironmaking	-	-	+	+	-	+	+
Steelmaking	-	-	$\pm$	+	$\pm$	+	+
Sheetmaking	$\pm$	$\pm$	-	$\pm$	+	+	$\pm$
Coating and printing	$\pm$	$\pm$	-	-	+	+	-
Canmaking	+	+	-	$\pm$	+	+	-
Aluminium:							
Aluminium making	-	-	+	+	-	+	+
Sheetmaking	-	$\pm$	-	$\pm$	$\pm$	+	$\pm$
Canmaking	+	+	-	$\pm$	+	+	-

The table shows that a technology can have contradicting aspects. It is therefore necessary to weigh the importance of each aspect in relation to each other.

27. In nearly every paper or speech it is stressed that employment for unskilled labour is one of the major problems confronting developing countries.
The ILO estimates more than 200 Million new entrants to the labour force in the developing countries in the last decade, while absorption into urban industry could be only 10% of it.
Generally is stated that the aspects of appropriate technology will be (in order of importance):

- labour intensive
- simple
- small scale
- low cost *)

It stands to reason to conclude that in general the opinion is that employment is considered as the most important aspect.

28. Another question is how scale of work contribute to employment. In this respect it is necessary to define what is understood by "small scale industry".
It is beyond the scope of this report to develop a objective, always solid definition. Moreover it is doubted whether such a definition will ever be found, bearing in mind the many definitions which are already given. Table 3 gives 11 definitions, all solid for different regions in the developing world. The criteria are either a maximum amount of employees or a maximum value on assets or both.

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*) A handbook in Appropriate Technology
Canadian Hunger Foundation
Ottawa, Canada
April 1976

Table 3. Definitions of small industries in different countries

Country	: Sri Lanka
Concept	: Small industries
Definition	: Using power but having capital investment in machinery and equipment not exceeding $ 40,000.
Remarks	: Small-scale manufacturing is officially divided into: cottage industries carried on wholly or primarily with the help of family members; handcraft industries products; and small industries.
Country	: East Africa
Concept	: Small unit
Definition	: Manufacturing unit employing workers not exceeding 100.
Remarks	: ------
Country	: Germany, Federal Republic of
Concept	: -----
Definition	: -----
Remarks	: There is no official definition. Generally units employing less than 300 employees are considered as small units.
Country	: India
Concept	: Small-scale industry.
Definition	: Industries with fixed capital investment in plant and machinery, excluding land and buildings, not exceeding Rs 750,000.
Remarks	: Ancillary units with capital investment not exceeding Rs 100,000 are treated as small-scale.

Country : Indonesia

Concept : Small industries

Definition : Those production units, which employ less than ten full-time workers and do not use mechanically driven tools or machinery.

Remarks : Home and cottage industries are also covered under this classification.

Country : Iran

Concept : Small industries

Definition : Fixed assets at the time of occupancy of a factory must not exceed 5 Million Rials (about $U 60,000); and maximum number of employees is about 50 per shift.

Remarks : The industry must have wholly Iranian ownership and the product must not be of an artistic nature.

Country : Japan

Concept : -----

Definition : -----

Remarks : The concept of small enterprices varies from 30 employees or less in wholesale trade to 300 or less (or ¥ 50 Million capital) for pottery manufacturing.

Country : Pakistan

Concept : Small-scale industries

Definition : Ceiling of PRs 750,000 in fixed assets.

Remarks : This ceiling extends from PRs 1,2 to 1,3 Million for capital-intensive industries.

Country : Philippines

Concept : Small-scale industries

Definition : Units employing less than 100 workers.

Remarks : -----

Country	: Republic of Korea
Concept	: Small-scale and medium-sized industries.
Definition	: Units having less than 200 employees or fixed assets less than W 50 Million.
Remarks	: -----

Country	: Turkey
Concept	: Small industries
Definition	: Units employing less than ten workers and using less than 10 hp of electricity.
Remarks	: -----

Source: R.K. Vepa, Small industries in the Seventies, (Vikas, Dehli, 1972).
Maharashtra Small Scale Industries Development Corporation Limited.
Laghu Udyog, Annual 1969, Bombay.

30. For practical purposes (while employment has as stated, the highest priority) in this report is followed a much used (but arbitrary) limit of 100 employees for smallnes of scale.

31. To judge industry sectors for their contribution to employment in relation to the smallnes of the business, this report follows the criteria, developed by the Australian Committee for Economic Development. To this effect this committee used a measure reflecting the incidence of small industry in various industrial groups.

32. Definition: the incidence of small industry is the proportion of the total employment in a industrial group, which is found in enterprises in this group having each an employment of less than one hundred persons.

33. Although this incidence for one industrial group can vary from region to region one can conclude several valuable indications from the incidence in one region.

34. Table 4 gives for Australia the incidence of small manufacturing industry. This table learns for instance that the industry sector "Wood and wood products" possesses the highest incidence (77,1%). (This means that small scale industry contribute to 77,4% of the total employment, hence the medium and larger scale industry in this sector only to 22,6%.)
At the other end, petroleum refining has the lowest incidence of 0%. That means that in this industry sector is no small scale industry. This complies with the general knowledge.

Table 4.

Incidence of small business in Australian manufacturing industry.

High incidence of small business	
Wood and wood products	77.4%
Furniture and mattresses	72.6%
Leather products	72%
Miscellaneuos non-mineral mining products	65.1%
Fabricated structural metal products	61.6%
Clothing	60.2%
Medium-high incidence of small business	
Flour, mill and cereal foods	56.1%
Nuts, fittings, handtools and other fabricated metal prod.	52.7%
Printing and publishing	49.6%
Cement and concrete products	49.3%
Industrial machinery and equipment	49.2%
Bread, cakes and biscuits	48.9%
Hosiery and knitted goods	48.4%
Sheet metal products	47.7%
Beverages and malt	46.4%
Floor coverings, rope & other textile products	45.6%
Plastic products	45.4%
Medium incidence of small business	
Margarines, oils and fats	44.0%
Milk products	43.6%
Clay products	42.5%
Photographic and scientific equipment	39.6%
Footwear	37.3%
Tobacco products	34.8%
Basic chemicals	33.5%
Soaps, cosmetics and other chemicals	30.8%

Medium-low incidence of small business

Fruit and vegetable products	26.5%
Sugar, fish and other food products	24.6%
Paper and paper products	24.2%
Meat products	22.5%
Textiles, yarns and worsted fabrics	22.5%
Appliance and electrical equipment	20.3%
Basic iron and steel	19.3%
Non-ferrous basic metal products	16.9%
Rubber products	15.7%

Low incidence of small business

Motor vehicles and parts	12.3%
Other transport equipment	12.2%
Glass plate, bottles, etc.	7.1%
Petroleum refining	0%

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35. Composing table 2 with the incidence of Australian industry groups (table 4), the following conclusions can be drawn:

- The Australian Grouping "Sheet Metal Products" has a high incidence of 47.7%. As canmaking belongs to this group, it fits well, that in table 2 tin-canmaking and aluminium-can-making comply with the aspect "labour intensive" and "small scale".
- The Australian Grouping "Basic Iron and Steel" and "Non Ferrous Basic Metal Products" has a low incidence of 19.3% respectively 16.9%.

  As iron, steel and aluminium making belongs to the mentioned groupings, it fits well that in table 2 they did not comply with the aspects "labour intensive" and "small scale".

36. In the industrialized world, a tendency to promote small scaleness is observed. One of the reasons is stated to be the indication that small firms are sometimes seen as a buffer to sharp fluctuations in employment *). The Japanese Ministry of International Trade and Industry reports **) that during the recent recession a substantial decrease in employment was recorded in manufacturing corporations with 500 or more employees. This was offset by an increase in employment in enterprises with one to twenty-nine employees, chiefly in wholesale retail, services and construction.

IMPLEMENTATION OF SMALL SCALE CANMAKING TECHNOLOGY IN DEVELOPING COUNTRIES BY LICENSING.

37. To establish small scale canmaking industries, it is necessary to obtain the necessary equipment and knowledge. There are basically some ways to obtain the equipment, for instance:
- to develop it in the countries themselves.
- to buy new equipment and know-how in the developed countries,
- to buy equipment and know-how from the canmaking industry in the developed countries under the restriction that it is technically up to date and only not in use because of the labour problem or other infrastructural conditions.

38. The last way is not much used by small scale industries. This is a pity, while this way has the advantage of obtaining up-to-date technologies combined with know-how. It has not the disadvantage of buying second-hand equipment, those often being obsolete and devoid of know-how.

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*) Report on Small and Medium Sized Manufacturing Firms, prepared for the Six Countries Programme and Government Policies towards Technological Innovations and Industry.(European Common Market.)

**) White paper on small and medium business enterprices 1977.

39. A number of International Agencies already have acknowledged this last mentioned way of obtaining know-how. It is understood that licensing can be an important means to transfer the technological knowledge.
Two activities are very worthwhile mentioning:
- The UNIDO published in 1973 the "Guidlines for the acquisition of foreign technology in developing countries" (ID/98, $1, 55 pp.).
- The World Bank formulated in the beging of 1978 a "Research Proposal or Transfer of Technology to small and medium enterprises".

40. - The UNIDO-publication described comprehensively how to proceed in obtaining a licence and to be a licensee in a developing country. A very important part of this publication is the chapter dealing with the problems for developing countries to select a particular technology as well as to select the licensor and supplier of technology.
Special reference is made to the course of negotiating and drafting of licence agreements.
- The World Bank proposal is meant to produce basic data, needed to analyse the cost and benefit of technical information to small and medium scale enterprises and about the most effective manner in which such information can best be provided.

41. Our TNO-organization has acknowledged the problems how to establish a good communication and understanding between possible licensors and possible licensees.
In order to solve the problems the TNO-organization has established a licensing assistance service.

42. In the annex is described how this counselling service operates on the side of the developed countries and how the counselling tasks should be performed in the developing countries.

43. Packaging Centres in the developing countries should be assigned the task of counselling and assisting the industry not only in obtaining canmaking equipment and know-how but as well for all needed packaging technology.

ANNEX

HOW LICENSING OPERATES FOR DEVELOPING COUNTRIES

- It is known that bigger companies are very active in the field of patents and they have their own channels to establish the contacts necessary for licensing.
  They also have their own personnel with experience in negotiating licenses. For these companies it is no exception that total packs (patents, know-how) are exchanged.

  For small and medium sized companies however this situation is totally different. From this category of companies only a very small percentage is active on the licence market.
  In America 20 - 25% of the companies with more than 100 employees are active on this market; in the Netherlands this percentage is lower than 10%.
  Since the big companies are also included in this last figures, one may presume that these figures will be much lower if only the small and medium sized companies are considered (America: 15 - 20%, The Netherlands lower than 5%).

- The major constraints for the small and medium sized companies appear to be that:
  - They are hardly aware of the opportunities of taking licenses with respect to innovation and of giving licenses in order to improve the financial return on the companies industrial knowledge. Even they are not able to judge their own knowledge as being worthwile for other companies.
  - They do not have personnel with experience in negotiating licenses, so they are afraid of making errors.
  - They are not sufficient familiar with the local infrastructure on aspects like financing, filing patent applications, market and technical advising, etc.
  - The licence market is far from translucent.
  - The individual licence demand is often vague. The demanding company may be aware that it needs a new product or process, but it seldom will be able to define the demand clearly.

A LICENSING ASSISTANCE SERVICE IN THE NETHERLANDS.

- To make the industrial companies aware of the opportunities of patents and licenses, several seminars have been organized recently by employers organizations, industrial organizations and TNO (the Organization for Applied Scientific Research in the Netherlands). The latter organization has recently published a guide in giving and taking licenses. In this guide attention has been given to aspects like industrial knowledge as an important asset of the company, laws and agreements in this field. The guide also gives a list of groups, bodies, institutions, organizations, etc., which may assist in companies in dealing with all kinds of aspects related with licensing.
- In January 1978 TNO has also been started in Holland an "Innovation Service".
  The purpose of this service, which will be in an experiment basis during two years, is to make the license market accessible for the Dutch industry. With respect to the licence offers TNO uses a computerized licence databank (Technotec of Control Data Corp.) but also the licence bulletins of institutes like ANVAR (France) NRDC (England, India). East- European official licence im- and exportoffices are used as a source of licence offers. Of course licenses offered by our own organization TNO and by individual companies and inventors can also be included in the collection of licence offers.

- TNO assist the individual companies in:
  - filling the gap between "innovation need" and"licence demand".
  - carrying out the process of searching in the various sources of licence offers
  - evaluating roughly the licence offers found.
  - showing the company the way in the relevant Dutch infrastructure.
  - preparing licence offers if a company wants to put an offer in the database.

The projectgroup, that is occupied with this Innovation Service, consists of employees of TNO and Mikrocentrum, the latter being an association of industrial companies.
The experiment is financially supported by the Ministry of Economic Affaires and TNO.

- The reason that so much attention is paid to this new Innovation Service is, that the results obtained so far give useful information about the problems that can arise talking about appropriate technology.
  As is mentioned before this service is started in January 1978. In a short time about 400 companies have taken contact by telephone or by letter. With about 150 of these companies has followed a more intensive contact trough a personel discussion. For the most companies (more than 95%) it was the first time they were talking about the possibilities of licenses. They have become curious by all the publicity about the new Innovation Service and they should like to know what this Service could do for them.

- Of course it is to early to give a profound analysis about the results at this moment. Still it is possible to draw some conclusions:
  - it is remarkable that most companies are more interested in giving licenses than in taking ones. They assume that this gives "easy money", but they also do not realise that selling products -and in this case technology too- always costs time and money.

- As remarkable as well is that after an intensive introduction about the possibilities of the Service, the companies are not able to transfer this information to their own situation. Only in that cases where the company has been visited it was possible to find the right subjects and the way to handle these.
  This is not only the situation in the Netherlands. License offers collected internationaly in databases or bulletins indicated that only in very rare cases the right information is given; in the most cases however this information is too little or not of importance. In some cases it is not clear what is really offered for licence. So assistance is necessary to formulate the right licence offer.

- Assistence is also necessary when a company is looking for something new. It is no exception that somebody asks: "I want to make something new, it does not matter what it is, I will make it". They obviously think that one has a drawer, filled with licence offers, which they can get directly, free of charge, and which they can produce within some months.
  So assistance is necessary to formulate in close co-operation with the interested company the correct licence demand.
- The licence market is far from translucent. Licence offers, amounting in the order of 100.000, are found in a wide variety of sources:
  . licence bulletins of which 100 - 200 exists, mostly appearing in the USA.
  . publications of R&D organizations like "INNOVATIE" (TNO, Dutch), "Marché de l'Innovation" (ANVAR, France).
  . licence brokers
  . computerized databanks.

- Of course there are in the total amount of licence offers some specially suitable for developing countries. Even a special publication is brought out by the Yugoslav Chamber of Commerce with some 200 technologies offered for potential users in developing countries. But in general too little attention is paid to the appropriate technologies.

WAYS TO IMPLEMENT LICENSING ON APPROPRIATE TECHNOLOGY FOR DEVELOPING COUNTRIES.

- First of all it should be necessary to organize a Centre where all kinds of licence offers specially suitable for developing countries are collected. This Centre should not only collect this licence offers, but should also
  . give instructions about the information that should be given in licence offers,
  . give also instructions to which requirements appropriate technology must come up.
  Possibly TNO would be able to do this job.

- Secondly there should be Centres in the developed countries having the task to find appropriate technology; technology which are in confirmity of the requirement of developing countries.
  The task of these Centres should be:
  . to stimulate companies to offer appropriate technology,
  . to assist these companies in finding the right subjects,
  . offering assistance in formulating the licence offers in the desired way,
  . assisting the companies to negotiate offers to companies in the developing countries.
  TNO performs this task already in the Netherlands.

- It is necessary to realize that no company will be willing to give away their knowledge free of charge, not to mention spending money on selling this knowledge.
  Transfer of technology however always costs time and money (making reports, descriptions of apparatus, training, etc.).
  So companies can only be interested if it costs little time and yield a profit!

- The last point where attention must be paid to when building up a system for transferring appropriate technology is the assistance that is necessary in formulating the correct licence demanded. It was clear that in the developed countries companies had to be counselled to formulate their right demands, for certainly this will be necessary for companies in the developing countries.

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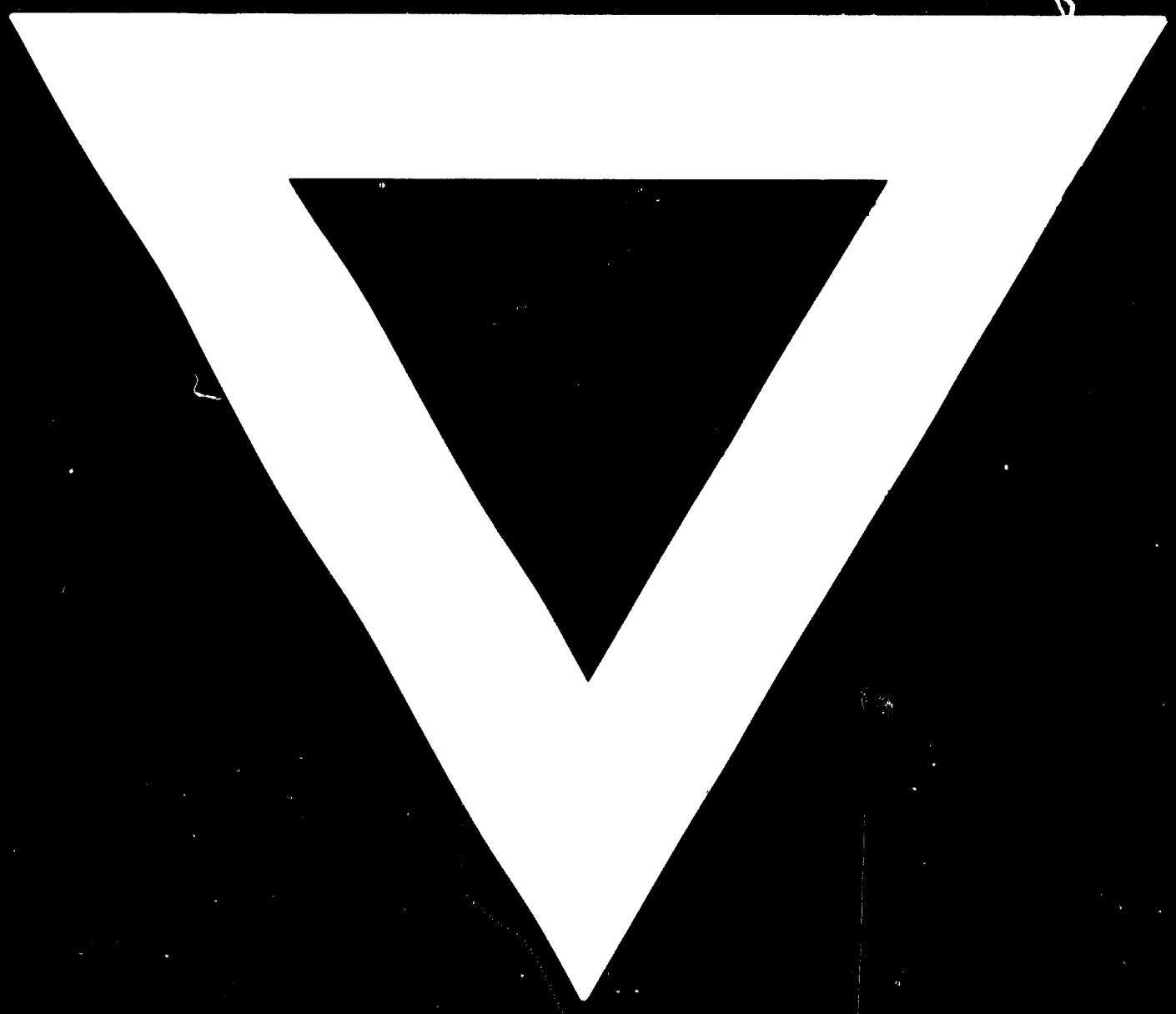

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