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REPORT ON TECHNICAL ASSISTANCE TO THE PLASTICS FABRICATION INDUSTRY IN NICARAGUA AND PROPOSALS FOR THE ESTABLISHMENT OF THE PLASTICS TECHNOLOGY CENTRE 1/

by

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NIC-053 (SIS)

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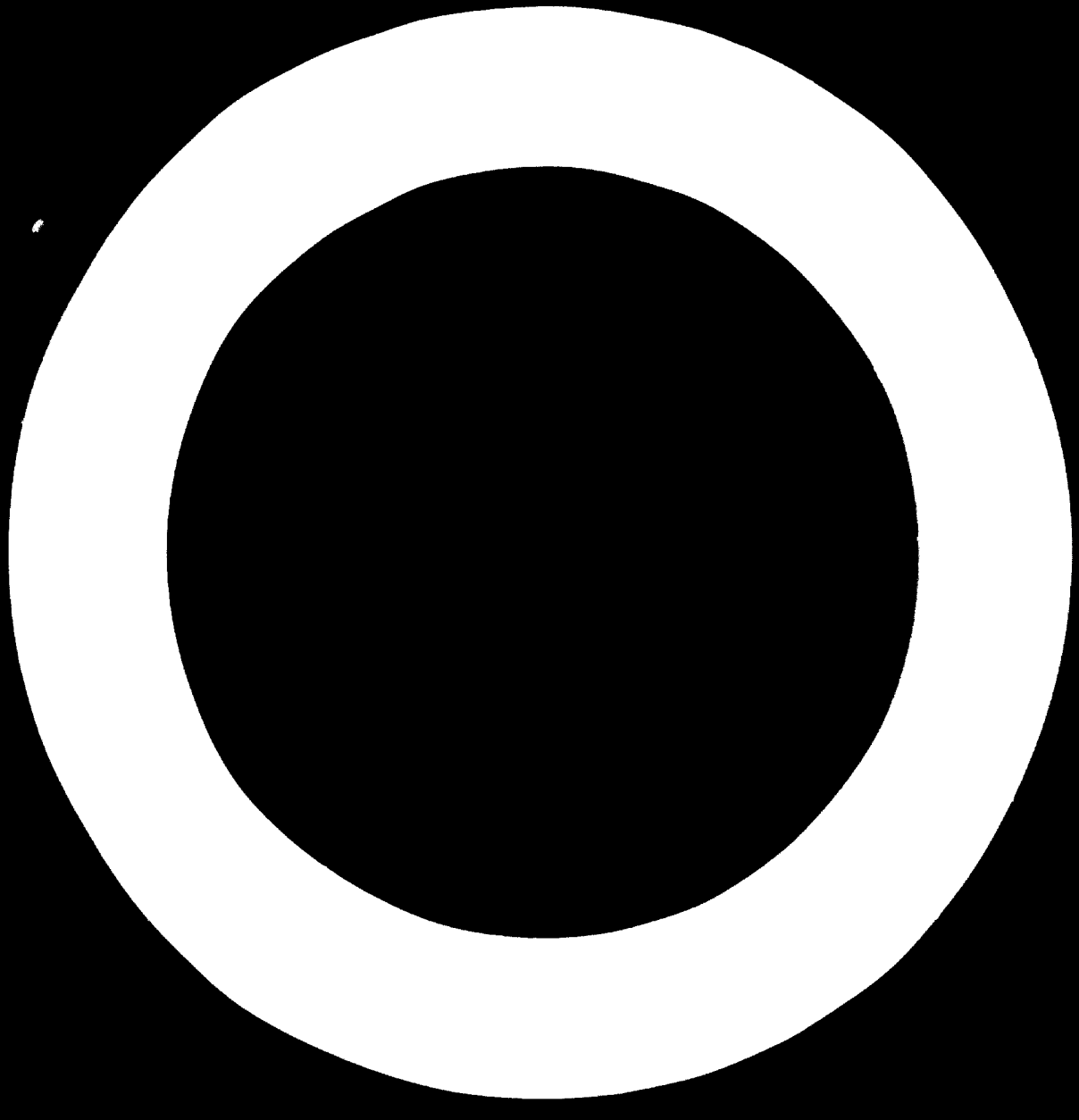

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and the whole of the plastics fabrication industry.

II INTRODUCTION

The UNIDO mission in Nicaragua consists of a team of plastics experts, and it was organized in response to the request by INFONAC, Instituto de Fomento Nacional, the government agency responsible for the development of the industry in Nicaragua.

The team members are Mr. Alom Griff, Mr. Leslie Breden, Mr. Jean Delorme; headed by Karl A. Rohé, visited Nicaragua for the purpose of

i. discussing with plastic manufacturers and convertors, as well as government agencies and other relevant institutions, the specific needs of the industry short and long-range;

ii. establishment of standards, standard procedures and quality-control methods;

iii. compose proposals for the establishment of a plastics technology centre in Nicaragua in line with the immediate requirements of the industry;

iv. immediate technical assistance to the fabricators;

v. initiate a number of seminars covering the major technical and economical aspects of the industry.

Government and Plastics Industry

In establishing the plastics technology centre, special attention has been given by the mission to the interacting domains of government, the plastics industry, and the proposed plastics technology centre itself. Consideration has also been given to the importance of the plastics consumers in the development of the plastics industry in the future.

Government

The plastics industry is undergoing a process of backward integration from the production of plastics finished goods to the manufacture of polymers. In view of the recent growth of the plastics industry, however, increased priority has been given by the Government in the development of this industrial sector.

The mission therefore, conducted a number of discussions with the appropriate Government and industrial authorities. (See appendix 1)

The outcome of these discussions led to the assurance by these authorities to give their support to the establishment of the plastics technology centre including financial contributions in the form of land, buildings, utility services and other miscellaneous expenses. The authorities agreed that there was an immediate need to request UNDP/UNIDO technical assistance in the form of experts, fellowships and equipment. Details of these are given under VI.

The Plastics Industry

The plastics industry is developing rapidly to satisfy the local consumer needs particularly in the areas of packaging, agriculture and building. The industry is facing a number of problems which are affecting its development. The main problems are:

i. lack of standards, testing and quality control procedures
ii. insufficient qualified technical personnel
iii. out-dated processing techniques and equipment
iv. out-dated dies, tools and moulds
v. lack of up-to-date information on plastics technology and application.

These problems were conveyed to the mission through plant visits and organized lectures given by the mission members.

Following these discussions it was decided by the manufacturers that a plastics manufacturers association should be set up as soon as possible. This new association would give its full support to the establishment of a plastics technology centre through its members. The association would also make contributions including money and personnel.

The mission also got favourable response from some equipment manufacturers in Europe to set up a plastics equipment spare parts service in Nicuragua.

III STATUS OF THE PLASTICS INDUSTRY IN NICARAGUA

1. Number of companies

At the end of 1971, there are twenty-eight companies. The oldest ones are three acrylic-sign factories and a welding and seaming factory which dates from 1950.

The first industrial plants were established in 1958-59. The growing number of companies is the following: 1958-5; 1959-6; 1960-8; 1961-9; 1962-11; 1963-13; 1964-19; 1965-21; 1966-25; 1967-26; 1968-26; 1969-28; 1970-28; 1971-28; The PVC plant (Policasa) dates from 1969.

Annex 1, is a guide to the Nicaraguan companies established and to the products manufactured by them.

2. Installed equipment

2.1 Molding by compression

There are only two companies using this system. The distribution of the machinery by capacity is the following:

Automatic presses	from 2	to 4	tons	2
"	"	of 50	"	1
"	"	" 150	"	1
			total	4

One of the factories makes records with four record-pressing machines.

2.2 Injection molding

Five companies are using this system, and their equipment is distributed by molding capacity as follows:

Presses of	less than 20 grs. shot capacity	5
"	from 20 to 30 grs. shot capacity	-
"	" 31 to 60 " " "	7
"	" 61 to 90 " " "	2
"	" 91 to 120 " " "	4
"	" 121 to 150 " " "	-
"	" 151 to 200 " " "	2
"	" 201 to 250 " " "	3
"	" 251 to 300 " " "	2
"	" 301 to 500 " " "	2
"	" 501 to 750 " " "	2
"	" 751 to 1000" " "	2
	more than 1 kg. " "	-
		31

2.3 Blow molding

Three companies use this system. The distribution of equipment by molding capacity is as follows:

less than 1 lt.	1
from 1 to 1.99 lts.	3
" 2 to 2.99 "	2
" 3 to 3.99 "	2
" 4 and more "	1
total	8

There is only one machine that blow molds rigid PVC bottles of a liter.

2.4 Extrusion

This section is most important; it comprehends eight factories using the following equipment:

extruders of a screw diameter of less than 30 mm.	2
from 30 to 39 mm.	6
" 40 " 59 "	8
" 60 " 74 "	5
" 75 " 89 "	1
" 90 " 119 "	5
" 120 " and more	-
for sheet of rotating tables of 2 molds	6
total	38

The majority of the equipment is good for producing film (15); polypropylene fibers (2), pipe (9). One machine is equipped to handle laminated flat sheets, another with crosshead die for insulated electrical wire.

2.5 Rotation molding

This system is used by one company only, with three ovens, and they could manufacture molded products of vinyl plastisol or of polyethylene up to a capacity of approximately 2 liters.

2.6 Thermoforming

The acrylic-sign factories use the system of forming by heat sealers and compression, or vacuum application with an inferior-quality equipment of local manufacture.

The continuous-automatic thermoforming has not been used yet in Nicaragua.

2.7 Foam

There are two kind of installations for expanded polystyrene in blocks or molded parts. One installation for continuous-flexible polyurethane and one for rigid polyurethane in blocks.

2.8 Laminating

One company manufactures Formica with a press of five platens.

2.9 Secondary technics

We use this term, by comparison with the term basic technics of compression, injection, extrusion, in regard to the finish or decoration of finished or semi-finished products.

There are eight flexographic machines for printing film:

10 cm. of one color	2
40 to 49 cm. two colors	1
50 to 59 " three colors	1
50 to 59 " four colors	1

The heat sealers for bags and sacks of polyethylene are distributed as follows:

automatic machines of less than 1 meter wide	6
" " " 1 meter wide and more	1
total	7

There are some heat-sealing hand machines that have not been taken into consideration because they are rather rudimentary.
There is one laminating device for film and one for embossing. The high-frequency welding machines used for PVC sheet are distributed as follows:

high frequency generators from 1 to 1.99 kw.	4

high frequency generators from 2 to 2.99 kw.	9
" " " " 3 to 5.99 kw.	-
" " " " 6 to more "	3
total	16

2.10 Mold-making equipment

Some companies have a tool room for making most of their molds. The installed equipment of fair quality comprises:

lathes	16
drills	11
millers	4
pantographs	3
hopping machines	2
grinders	3
annealing ovens	2
spark erosion	2
plating	2

There is only one training tool-making school that makes molds, accessories, and tools.

3. Life and obsolescence of the equipment

3.1 Life of main equipment

In industrialized countries life of the fabrication equipment is estimated as follows:

	years
compression presses	12
injection presses	3 to 5
blow molders	3 to 5
extruders	10
calanderettes	15
multiple pletens presses	15
high frequency welding machines	10

In Central America these statistics can be increased by using a coefficient of 1.5 for extruders, compression presses, blow molders, multiple platen presses, up to 2 for injection presses.

3.2 Equipment-replacement plans

We would have to consider replacement plans for equipment installed, taking into consideration the approximate date of installation of the equipment.

The following plans for replacement would supply, theoretically, the future dates for replacement of important equipment.

1972-73 Injection blow molding: 5 of 60 grs; 1 of 90 grs; 3 of 120 grs; 2 of 120 grs; 3 of 240 grs; 1 of 350 grs; 1 of 450 grs; 1 of 720 grs; Extruders: 1 of 45 mm, 1 of 60 mm, blowers: 4 of 1 liter, 1 of 2 liter, 2 of 3 liter, 1 of 4 liter;

1974 Injection machines: 5 less than 20 grs; 2 of 60 grs; 1 of 90 grs; 1 of 120 grs; 1 of 250 grs;

Extruders: 1 of 35 mm; 1 of 60 mm;

1975 Extruders: 2 of 30 mm, 3 of 45 mm; 1 of 60mm; 1 of 90 mm; Blowers: 1 of 10 liter;

High-frequency welding machines: 4 of 1 kw; 3 of 2 to 2.5 kw; Shoe machines: 1

1976 Extruders: 2 of 30 mm; 1 of 60 mm; 2 of 90 mm;

1977 Injection machines: 1 of 300 grs, 1 of 720 grs, 1 of 1 kg; High frequency welders: 6 of 2 kw;

1978 Extruders: 1 of 45 mm; high frequency welders: 1 of 6 kw;

1979 Extruders: 1 of 50 mm, 1 of 80 mm, high-frequency welders: 2 of 6 kw. and more

1980 Extruders: 1 of 45 mm.

Estimating the replacement of machines of the same capacity and at the same price of that of 1971, and taking into consideration a growth rate of production which would duplicate itself in five years, the minimum amount of conversion during the lapse of ten years could be approximately estimated as follows at the same rate of growth:

1972-73	US$ 2.300,000.	dollars
1974	" 1.000,000.	"
1975	" 1.200,000.	"
1976	" 1.100,000.	"
1977	" 1.100,000.	"
1978	" 1.000,000.	"
1979	" 1.100,000.	"
1980	" 1.050,000.	"

Installation for new fabricating methods have not been included here. They are included in the annexes. We also include here new projects based on known technics. In other words, the annual conversion should be around one million dollars.

4. Consumption of plastic raw materials

4.1 Consumption by material

Table I gives the estimated amount of consumption by tons of the different materials used in 1962, 1963, 1964, 1967 and 1971. Resins for paint and adhesives have not been included.

TABLE I

	1962	1965	1964	1967	1971
Polyethylene low density	285	482	1067	1000	1.838
Polyethylene high density	-	-	-	35	298
Polypropilene	30	200	413	750	809
Polyvinyl chloride *	44	71	498	948	850
PVC plasticizers	22	47	121	240	850
Copolymers VC-AC	-	-	-	48	35
Standard polystyrene				...	18
Polystyrene rediux impact	79	156	365	...	104
Polystyrene high impact	79	156	365	...	40
Expandable polystyrene	-	-	-	...	110
ABS and SAN	-	-	-	...	-
Polymethylmethacrylate	3	2.5	4	...	8.5
Phenolformaldehyde for impregnating	-	-	-	...	180
Phenolformaldehyde powder for molding	-	-	-	-	-
Melamine for impregnating	-	-	-	...	110
Melamine powder for molding	-	-	-	-	29
Polyesters	35	38	50	...	65
Polyurethanes **	-	-	-	-	90
Polycarbonate	-	-	-	-	4.5
Other	-	-	30	-	-
	498	996,5	258,8	(3500)est.	4599
* PVC for plastisol	-	-	-	-	25
** rigid PVC	-	-	-	-	25

4.2 Consumption by fabricating process

Table II gives the consumption by fabricating process and for the distribution of the different resins for 1971.

The extrusion process consumption of [illegible] tons for this year, which is 75 percent of the total consumption of resins. Half of this consumption was used for polyethylene resins, 25 percent for fibrilated polypropylene, and 12.5 percent for shoe molding and an 12.5 percent for pipe and profiles.

Injection-molding consumption was 450 tons, which is 10 percent of the total consumption. Blowing, expanded, laminates represent 5 percent of the total.

TABLE II

Consumption of plastic materials by process for 1971

Materials	C	D	E	EF	EM	EP	EX	F	I	IR	FM	R	S	SE	V	total
PE hd	-	-	78	-	-	1740	-	-	-	-	-	-	20	-	-	1 [illegible]
PP hd	-	-	-	-	-	-	0	-	100	-	-	25	12	-	-	225
PP	-	-	15	600	-	-	-	-	194	-	-	-	-	-	-	809
PVC	-	-	268	-	464	-	-	-	23	-	-	25	10	70	-	860
PVC plasti-sivers	-	-	-	-	464	-	-	-	-	-	-	25	-	70	-	560
PVC - AC copo vaer	-	95	-	-	-	-	-	-	-	-	-	-	-	-	-	95
PS Standard	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	18
PS medium impact	-	-	24	-	-	-	-	-	80	-	-	-	-	-	-	104
PS high im-pact	-	-	2.4	-	-	-	-	-	37	-	-	-	-	-	-	39.4
PS expanded	-	-	-	-	-	-	110	-	-	-	-	-	-	-	-	110
ABS and SAN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PMMA	-	-	-	-	-	-	-	8.5	-	-	-	-	-	-	-	8.5

Materials	C	D	E	EF	EM	EP	EX	F	I	IR	PR	P	S	SS	V	t
PF for impregnating	-	-	-	-	-	-	-	-	-	180	-	-	-	-	-	
UF-MF for impregnating	-	-	-	-	-	-	-	-	-	110	-	-	-	-	-	
UF-MF for molding	28,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Polyester	-	-	-	-	-	-	-	-	-	-	65	-	-	-	-	
flexible polyurethane	-	-	-	-	-	-	70	-	-	-	-	-	-	-	-	
rigid polyurethane	-	-	-	-	-	-	20	-	-	-	-	-	-	-	-	
Polycarbonate	-	-	-	-	-	-	-	-	0,5	-	-	-	4	-	-	
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Totals	28,8	35	3874	600	464	1740	200	8,5	452,5	290	65	50	207	70	-4,5	

Code:

C - compression molding
D - records
E - pipe and profile extrusion
EF- fibrilated extrusion
EM- extrusion molding for shoes
EP- extrusion of film
EX- foam, expanded products
F - vacuum forming or low pressure
I - injection molding
L - high pressure laminates
PR- reinforced plastics
R - rotation molding
S - blowing
SS- high frequency welding
V - other

4.3 Consumption by application

Table III gives the distribution of consumption of plastic materials among the different sections of application.

TABLE III

CONSUMPTION OF PLASTIC MATERIALS BY APPLICATION SECTIONS (1971)

Applications	PELD	PEHD	PP	PVC*	PS	PSexp	PMMA	EC	PF	UF	MF	Polyester	EP	total
Pipe	78		15	233										326
Construction														
Furniture				26		107			180	110		60	80	563
Shoes				309	12(oi)									321
Packaging	1635	148	618	10				4						2415
Agriculture	100			14										124
Base, toys		125	176	48	15(GP)									
					82(e.i)[3]					13.8				490.2
					27.4(a.i)									
Office, school				36	3 (GP)									39
Advertising							8.5	0.5						9
Other				22						15		5	10	52

PVC does not include plasticizers.

The most important sector is packaging, which represents almost 55 percent of the total consumption of raw materials. Construction comes next with approximately 12 percent, after this, household items and toys with 10 percent, pipe and shoes, each one, 7 percent. Agriculture represents only 2.4 percent, and other applications approximately 6.5 percent of the total.

Most of the low-density polyethylene goes to packaging; the same for polypropylene.

The major user of PVC is the shoe industry, just ahead of pipe. Polystyrene is mainly used for household items and toys. Expanded polystyrene is mostly used in construction.

Tables IV, V complete this study.

TABLE IV

DISTRIBUTION OF CONSUMPTION OF RAW MATERIALS BY PROCESSES

Extrusion 69.2 percent	Extrusion of film PE	37.8	percent
	Extrusion of fibrilated PP	13.9	"
	Extrusion of shoe molding PVC	10.0	"
	Extrusion of pipe and profiles	8.4	"
Injection molding		9.8	"
High-pressure laminates (Formica)		6.3	"
Blow molding		4.5	"
Expanded		4.3	"
High-frequency welding		1.5	"
Reinforced plastics		1.4	"
Rotation molding		1.1	"
Records		0.8	"
Molding by compression		0.6	"
Vacuum formed		0.2	"
Other		0.3	"
		100	percent

TABLE V

DISTRIBUTION OF CONSUMPTION OF RAW MATERIALS BY TYPE OF PROCESS

Packaging	52.5 percent
Construction, furniture	12.2 "
Household articles, toys	11.2 "
Sheet	10.3 "
Pipe	7.1 "
Agriculture	2.6 "
Office, school, articles	1.2 "
Advertising	0.2 "
Other	
	100 percent

5. Employees

5.1 Important

By the end of 1971, the number of people employed in the fabricating industry of plastics was 926, as follows:

Technicians	18
Workers	781
Office workers	127
total	926

For the year 1964, it was as follows:

Technicians	5
Workers	333
Office workers	64
total	402

The region industry employs about 176 people: workers 131, and office 45.

5.2 Skilled and unskilled labor

The labor force for the plastics fabricating industry is distributed in three categories, including an additional one, which is mold-making personnel.

unskilled workers	378
semi-skilled workers (operators)	292
skilled workers (professionals)	81
mold mechanics	30
total	781

Training of personnel

The majority of the industries are in the position to train their personnel in-plant, but some industries would prefer to have a center capable of training unskilled people. This center should be ready to accept the future factory operators and train them in a matter of a few days about:

1. the importance of fabricating machines;
2. temperature, pressure, and the effect of these on plastic materials;
3. basic characteristics of the most important plastic materials like rigid and plasticized PVC, polyethylene, polystyrene;
4. how to operate a machine;
5. the maintenance of machines in order to keep them in good working condition, and to avoid damages.

On the other hand, skilled workers and mold mechanics could also take an additional course in molds and tools (projects).

Manufacturing facilities

Presently a major portion of the existing equipment is outdated and should be replaced, however, there is another sizeable part which could be brought up to date by partly rebuilding, using standardized elements, which may be made available within the scope of UNIDO assistance programs.

It is also obvious, however, that an extensive educational and training progrss is necessary in the following fields: equipment handling, tooling and tool design, production programming and statistical quality control in order to improve the all-over efficiency equipment-wise and the quality as far as the finished products is concerned.

Quality control of finished products

In order to improve the all-over performance of the plastics fabricating industry product-wise, quality standards ought to be issued and implemented as soon as possible. Also allowing the industry to become competitive export-wise. With the help of a plastics technology center and competent representatives of the industry, such quality standards could easily be composed and adoptad.

Testing of raw materials

The absence of any test procedures regarding plastic raw materials is an important factor and has significant impact on equipment performance and quality of the end product it, therefore, is considered to be highly desirable to implement standards and standard procedures for raw materials as well as finished products in line with the specifications drafted and already submitted to the Chamber of Industry. In addition, health and safety standards should be reinforced, which relates specifically to F & D Administration regulations.

Quality of finished products

The quality of end products, and this relates to finished as well as semi-finished products, is below international standards in general, however, a sizeable portion of the products examined by the Mission must be classified as fair.

The major reasons for the low level of quality and also for the low output rate, production-wise, are closely linked with facts and findings dealt with in Paragraph V in this report, however, the expanse of standards and quality-control methods, raw material and product-wise, are unquestionably primarily responsible.

Conclusion

Taking into account the rapidly growing consumption of raw materials, the expansion in the fabricating and application areas, and the steadily increasing range of plastic end products, Nicaragua, and this also applies to the other members of the Central-American Common Market, to the best of the knowledge of the Mission, is only able to handle existing and future problems if the needs of the plastics industry are dealt with in accordance with the procedures defined in Paragraph V of this report.

IV SPECIAL ACTION PROGRAM OF THE EXPERT GROUP

Soon after taking up work in Nicaragua, and after starting to give technical assistance to the plastics processing industry, the UNIDO mission came to the conclusion that it would be highly advisable to hold at least a limited number of informative seminars limited to one a day each, and spread over a period of approximately two months to

a) lecture to the permanent representative of the industry regarding world-wide developments in the plastics fabrication industry, including procedures and the development in the raw material areas, and

b) at this occasion, get the industry as a whole together on round-table discussions.

The results experienced are most encouraging and, therefore, it seems to be most desirable to get most of the materials composed for these lectures, printed and circulated by UNIDO, throughout the developing countries.

V. NEEDS OF THE PLASTICS INDUSTRY OF NICARAGUA

a) Application engineering

The needs in application engineering are manifold. The most immediate need is for the application of plastics in all packaging areas, for example, in meat and food processing. Besides health benefits, other advantages are also gained by wrapping, for instance, more consumer appeal. Another important area of application is in the packaging of produce. Plastics will reduce the shipping costs. They will also prevent rapid decomposition, and thus preserve the food longer.

In housing, and specially in the area of low-priced shelters, plastics become more and more the key material world-wide, especially in developing countries, plastics materials offer, besides low cost, a number of other advantages like unsophisticated manufacturing methods and semi-finished products, simple means of installation, excellent temperature shielding, etc.

In Nicaragua so far, no major efforts have been made to introduce these materials in an industrialized manner. In housing they are specifically needed for the use of plastics in building and construction.

As far as the application of plastics in agriculture is concerned, immediate steps should be taken to introduce packaging-in-the-field programme, plus other applications like the production and use of plastic foam as a soil-improvement additive, and plastic film as a shelter.

The government agencies in connection with the plastics industry and the proposed Plastics Technology Centre, should immediately submit requests to UNIDO in this particular area. It also seems to be desirable to expand the use of plastics in irrigation and similar applications. This also applies to the use of plastics in appliances.

VI PROPOSAL FOR THE PLASTICS TECHNOLOGY CENTER

The screening of the plastics-fabricating industry in Nicaragua has been completed.

The major reason for this program was to identify the needs of the plastic fabricators, in order to specify clearly the layout of a plastics technological center in order to enable this institute to serve the industry in accordance with the requirements.

The findings are as follows:

1. in the field of processing engineering, equipment handling, molds and mold design, extensive efforts seem to be necessary in order to optimize production runs and output rates;

2. the absence of standards and test procedures must be eliminated as a major step towards quality control and product improvement;

3. taking into account the rapid industrialization of Nicaragua and Central America as a whole, extensive efforts must be made in the area of application engineering and product selection, specifically in the field of the use of plastics in building, agriculture and packaging;

4. the obvious needs for highly skilled equipment operators and production supervision calls for the introduction of training schemes in the various sections of plastics fabrication;

5. the art of mold design and mold-making are the major factors for the manufacturing of high-quality and low-cost products and must be promoted in due course with the expansion of the plastics industry. This relates specifically to mold design and standardization of tools and fixtures;

6. the mission recommends also to check on a laboratory level all incoming raw materials and semi-finished products in order to eliminate manufacturing problems and other errors usually only detected after the materials are processed already, or during conversion;

These findings are related to the conditions found regarding the Nicaraguan plastics industry, but they are also representative of the absolute majority of plastics convertors in the whole of Central America.

It is the firm opinion of the mission that the given situation urgently calls for the establishment of a plastics technological center in Managua, facilitated to handle the problems of the plastics industry lined out before. It should consist of the following sections:

a) test laboratory able to handle raw materials evaluation, instructing on compounding, carrying out all necessary work on the F & D (Food and Drug) requirements, and physical and chemical tests generally described as quality control.

b) technical assistance in the field of application engineering, processing, equipment selection and maintenance, tooling, including design of molds and fixtures;

c) training facilities in highly sophisticated processing areas which, furthermore, will be dealt with separately.

The minimum staff required will consist of one senior engineer with an all-around background processing knowledge of quality control, standards and test procedures. He could also be responsible for administrative matters, if such occur.

	Cost per year: approx. US$10,000. dollars
One senior manager in charge of technical assistance to the industry well-experienced in plastics fabrication and processing. He should also be able to organize in-plant training programs.	" " 8,000. dollars
Experts on equipment selection and plant layout which may be drawn from outside, based on requirements.	" "10,000. dollars
The assisting personnal should consist of one female assistant to the administrator, also handling accounting and keeping all records.	" " 4,000. dollars
One female operator for laboratory testing, etc.	" " 3,000. dollars
One male operator in charge of the machine shop and assisting in the laboratory whenever required.	" " 4,000. dollars
Other costs (office)	3,000. dollars
Total	US$42,000. dollars

The equipment proposed, including building, installation, is specified as follows:

1) <u>Laboratories</u>

a) one UV - spectrophotometer	
b) one IR - infrared spectrophotometer	
(a) and (b)(approx.	US$12,000. dollars
c) one refractometer (approx.	" 500. "
d) one reometer (approx.	" 3,000. "
e) one XT" colorimeter (EIREFC) (approx.	" 2,000. "
f) one consistormeter (approx.	" 3,500. "
g) one injection-molding machine with a 2 oz capacity (approx.	"12,500. "
h) one mold for test specimens (approx.	" 2,000. "
i) heating equipment for molds (approx.	" 1,500. "
j) one scrap-mill (approx.	" 1,000. "
k) one viscosity-meter Brabender (approx.	" 4,000. "
l) one thermostat (approx.	" 750. "
m) IP - seed (approx.	" 1,250. "
n) tensile-testing devices	
- one elongation-testing device (approx.	" 3,000. "
- one impact " " (approx.	" 2,500. "
o) contingencies on the equipment (approx.	" 5,000. "
	US$54,500. dollars

2) Processing equipment

1)	one two-inch extruder with a screw 24 diameter length	US$22,000. dollars
2)	two additional screws	" 3,500. dollars
3)	one sheet-die of 500 mi. wide and sheet thickness between 5 and 6 mi. including control cabinet	" 8,000. dollars
4)	one take-off system suitable for the aforementioned sheet-die (approx.	"11,000. dollars
5)	one tubular-film die for light and heavy-duty film with a maximum diameter of 300 mi. (approx.	" 3,500. dollars
6)	one film-die for multiply film (three layers) (approx.	" 5,000. dollars
7)	one additional extruder for multiply operation 1 1/2 inch screw and 18 diameter length. (approx.	"14,000. dollars
8)	one universal film take-off (approx.	" 7,500. dollars
9)	one drying oven (approx.	" 1,500. dollars
10)	one rotational-casting machine, able to handle items up to 600 liters (approx. capacity	"40,000. dollars
11)	one rotational-casting mold (approx.	" 500. dollars
2)	one injection-blow molding device attachable to the testing machine in the laboratory (approx.	4,000. dollars
13)	contingencies for processing-equipment (approx.	" 5,000. dollars
		65,500

Installation

1)	one transformer of 100 kw. (approx.	" 3,000. dollars
2)	installation of equipment (approx.	" 5,000. dollars
		8,000

Building

240 m^2 US$30,000. dollars
Furniture " 5,000. dollars
Total investments US$

Operation costs

The operation costs (out of pocket spending)

A) Personnel US$42,000. dollars
B) Floor space - 240 m^2 (including air-conditioning, light and cleaning) " 3,000. dollars
C) Utilities (includes electricity, water, compressed air) " 1,500. dollars
D) Contingency " 3,500. dollars
Total operating costs per year without depreciation, equivalent to US$50,000.

The Plastics Technology Center will be established by INFONAC with the objectives described before. It is a non-executive body in all manners other than its own internal management.

The PTC will also act as a bridge between the Government and private interests in the plastics industry. It will also be a connecting body between the industry, the universities and other educational, national or international training institutions translating the industry's needs for manpower in both, quality and quantity to the universities and institutes, and advising the industry on future requirements of trained personnel.

It will also act as a catalyst to promote much closer contacts between the industry and the universities than what exists at present.

The PTC will contact and cooperate with similar bodies in other countries. It will set up and maintain statistics and an information center on plastics for the benefit of its members which should, in the interests of good public relations, be available to other interested bodies within reasonable limits. This center should also undertake publication of bulletins and should promote publication of appropriate information and articles on the plastics industry in other journals and magazines.

The educational program of the PTC, specially the guidelines on seminars, training courses, professional meetings, etc., are specifically outlined in the suggested working plan. The location of the PTC should preferably be in Managua. INFONAC will make available a suitable site for the PTC building. The Plastics Technology Center will be incorporated as a foundation in accordance with Nicaraguan laws.

VII SUGGESTIONS FOR WORKING SCHEMES OF THE PLASTICS TECHNOLOGY CENTER IN NICARAGUA.

The UNIDO mission in consideration of the above-mentioned situation will suggest the following working plans for the starting period of the PTC.

a) staff of the Plastics Technology Center described under the proposals of the PTC on page

b) working plans for UNIDO experts:

the project manager will be available for a period of three years with intervals of six months per year;

the senior engineer technical assistant will start full time the middle of 1973, after the first pieces of equipment of the PTC are ready for operation;

the equipment-selection expert will be made available by UNIDO on request from case to case;

the UNIDO team members will also be active in scheduling of seminars and conventions, invitations to participants, and act as a coordinating factor for long-term training schemes.

They will visit raw-material fabricating plants in order to assist the industry in the field of processes, application, quality control of plastics and plastic articles. They will also program in-plant training courses. They will actively assist in implementing standards and test procedures for the Nicaraguan as well as the Central-American plastics industry in cooperation with the standard institutes which are now in the process of getting established.

VIII RECOMMENDATIONS

1. The government should submit as soon as possible a request for technical assistance to UNDP for experts, fellowships and equipment as described under VI.

2. Prior to the implementation of the project, suitably qualified technical personnel should be trained abroad.

3. The new plastics manufacturers association in co-operation with its members, should organize an in plant training programme at member factories. This training programme should be later co-ordinated with the plastics technology centre's own training course.

4. By-laws of the plastics technology should be established.

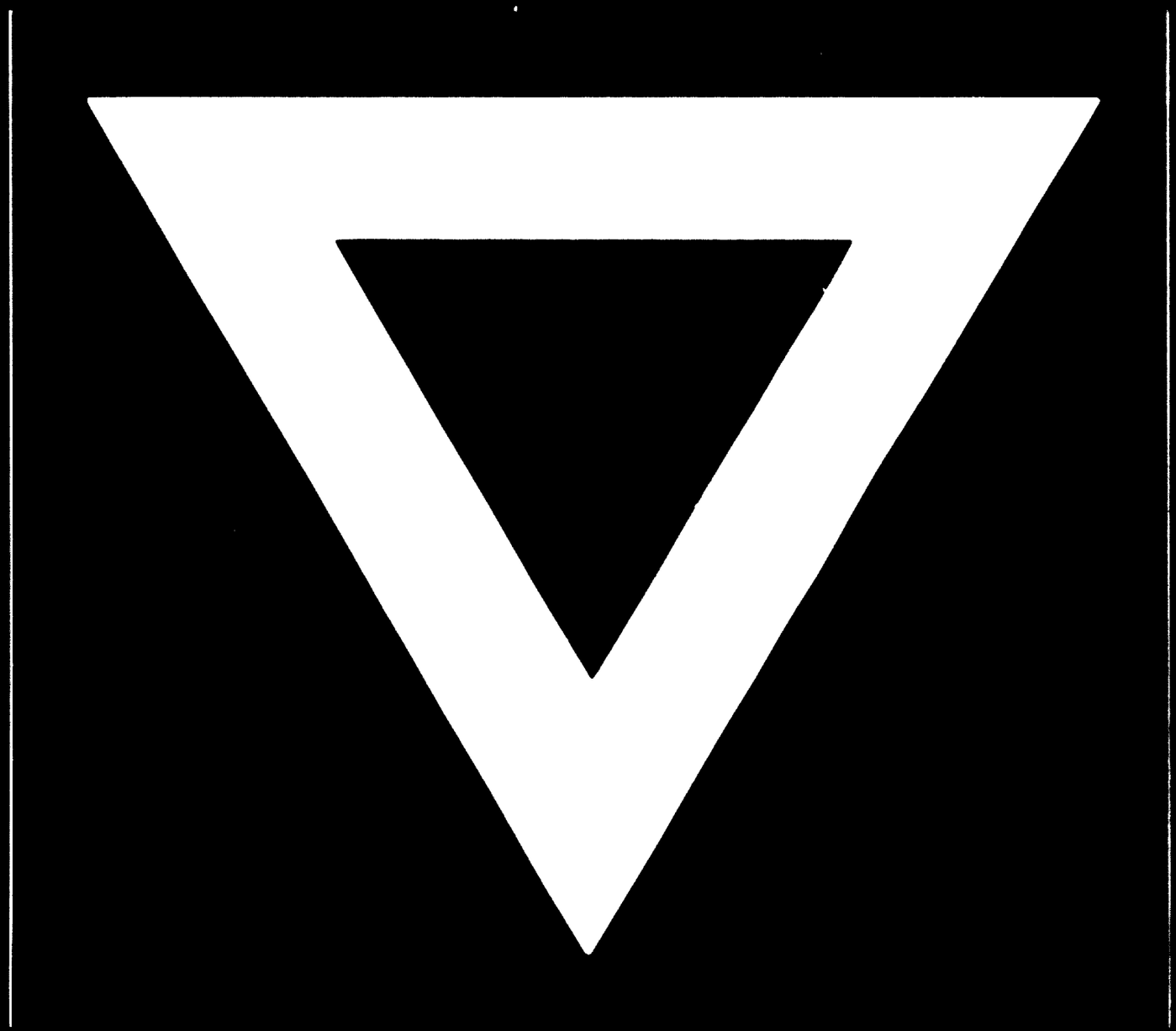
5. Steps should be taken to co-ordinate the plastics technology centre with those organizations which might effectively contribute to the work of the centre. These organizations include:

   The technical training centre in Leon
   The educational centre in Managua
   The universities in Managua

APPENDIX

LISTA DE ASISTENTES A REUNION CELEBRADA EN EL BANCO CENTRAL EL 26 DE ENERO, 1972 PARA TRATAR DE LA FUNDACION DEL CENTRO DE TECNOLOGIA DE PLASTICOS

Dr. Roberto Incer	Presidente del Banco Central.
Dr. Jorge Armijo	Presidente del Instituto de Fomento Nacional.
Sr. Eric Ericson	ONUDI
Dr. Karl Rohé	ONUDI
Sr. Mauricio Robelo	Representante del Presidente de la Cámara de Industrias.
Ing. René Lacayo	Representante de la Gremial de Plásticos de la Cámara de Industrias.
Don Alfredo Palazio	Presidente de la Cámara de Comercio.
Dr. Luis Mejía González	Coordinador de Organismos Internacionales - Ministerio de Economía.
Lic. Guillermo Lugo	Instituto de Fomento Nacional.
Dr. Adolfo Calero	Cámara de Comercio.
Lic. Donald Spencer	Gerente Policasa.
Dr. Orestes Romero	Cámara de Comercio.
Lic. Lucía Medina	Banco Central.
Ing. Bayardo Cuadra	Instituto de Fomento Nacional.
Ing. Oscar Stadthagen	Director del Centro de Productividad Industrial - Cámara de Industrias.



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