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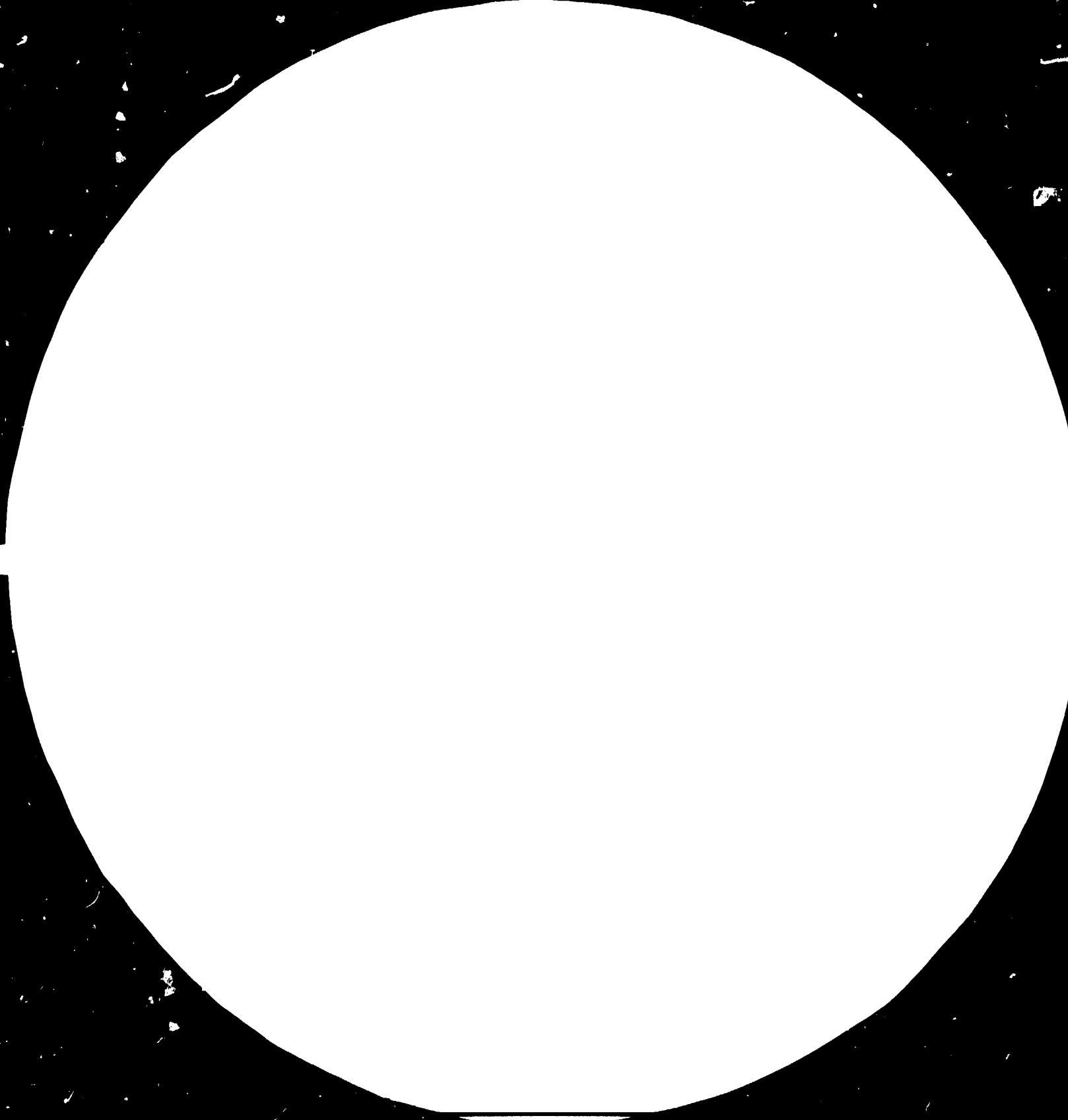
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MICROSCOPY RESOLUTION TEST CHART

1570-B
NATIONAL BUREAU OF STANDARDS
GAITHERSBURG, MARYLAND 20899
APPROXIMATE TEST CHARACTERS

14221

11 July 1984

English

DEVELOPMENT OF THE PLASTICS INDUSTRY,

SI/PDY/83/801/11

PDR Yemen

Technical Report:

Study of the future development
of the country's plastics industry .

Prepared for the Government of the PDR Yemen
by the United Nations Industrial Development Organization

Based on the work of Helmut Hubeny
expert in plastics technology

United Nations Industrial Development Organization
Vienna

This report has not been cleared with the UNIDO which
does not, therefore, necessarily share the views presented.

CONTENT

Abstract	1
Introduction	2
Recommendations	3
Findings	5
Evaluation	6

LIST OF ANNEXES

Annex I: Printing equipment laboratory	7
Annex II: References	3
Annex III: Selected Plastic Centres	8
Annex IV: Additional equipment list for mould making .	8
Annex V: List for mould making equipment M. REUSS . .	9
Annex VI: List for testing equipment K. RAMAMURTHY . .	11
Annex VII: Work plan proposal	14

ABSTRACT

The mission has to support the expansion of the plastics industry in the PDR Yemen by improving step by step the facilities in plastic processing, mould making, mould repair, and quality control in the Algundi Plastic Factory (AGPF), Aden.

Evaluating personal observations, reports of co-experts and relevant discussions it is found out that AGPF is the most adequate place to act as a nucleus for a future Plastic Processing and Application Centre (PPAC) in the PDR Yemen for the application of plastics in agriculture, water management and fishery in order to meet the most important development objectives of the country.

By turns of priority it is recommended to strengthen training of the staff, to establish facilities for mould repair and mould making, to establish facilities for quality control and to establish facilities for local training including experimental stations.

A work plan proposal for the phase II of a UNIDO project including financial requirements subdivided in 14 steps of development was drafted and discussed with the UNIDO Headquarter Vienna and the Ministry of Industry in PDR Yemen.

INTRODUCTION

The mission has to support and to strengthen the expansion of the plastics industry in the P.D.R. Yemen so that it may make a continuing contribution to the economic development of the country. It also has to provide the range of consumer goods that are needed to promote the rapid improvements in the standard of living of the population.

The expert will specifically be expected to:

- a) Study the direction in which the future development of the country's plastics industry, covering processing and new applications, should take
- b) Advice in the selection of materials, equipment and processes
- c) Recommend additional plastics processing and testing equipment necessary for fabrication, demonstration and training purposes
- d) Deliver a lecture in the field of his speciality
- e) The expert will also be expected to prepare a final report, setting out findings of his mission and his recommendations to the Government of future action which might be taken.

The mission took place in Aden, Algundi Plastics Factory, from 24 June to 6 July 1984.

In order to meet the purpose of the mission the expert has made use of the excellent reports of his co-experts D. CLARKE, Dr. K. RAMAMURTHY, S. ARUTJUNOV, and M. REUSS.

A lecture "Aspects of Development in Plastics Technology" has been delivered by the expert to the management of ALGUNDI PLASTIC FACTORY.

Detailed recommendations and advices in electrical power connections and in the layout of the new printing laboratory have been given (Annex I).

Grateful acknowledgement is made for the kind co-operation and assistance given by the Chairman of the Board of Directors and Director General of the Algundi Plastic Factory (AGPF) Mr. HASSON M.A. REHMAN and the Chief of the Technical Section of AGPF, Mr. NASSER H. ALALAH.

Many thanks are due also to the Deputy Minister of Industry, Mr. OTHMAN A. GABAR, to the Assistant Deputy Minister of Industry, Mr. ABDUL REHMAN S. DAIBAN, and to all staff members at the Ministries and at the UNDP Office who rendered valuable assistance to the project.

RECOMMENDATIONS

1. Future Plastic Processing and Application Centre (PPAC)

Considering the importance of plastic processing in the industrial development of the P.D.R. Yemen it is recommended that Algundi Plastic Factory (AGPF), Aden, P.R.D. Yemen, should act as a nucleus of a future Plastic Processing and Application Centre (PPAC) for the improvement of plastics processing and plastics application in the different fields for the benefit of the country. AGPF and later PPAC will provide technical support also to other industries by training, documentation and standardization. Co-operation with relevant training and research institutions in the P.D.R. Yemen is recommended.

2. Comprehensive Recommendations by
K. RAMAMURTHY, S. ARUTJUNOV, M. REUSS

Following the reports of the UNIDO experts K. RAMAMURTHY (3), S. ARUTJUNOV (4) and M. REUSS (5) a comprehensive recommendation by turns of priorities may be given as follows:

- a) One-week-mission of the Director-General and senior staff to CIPET to work out relevant training programmes and to implement the results as well as for local training in the P.D.R. Yemen. Other organized visits made by the Director.
- b) Provision of technical assistance and training for personnel (engineers, technicians) at CIPET or equivalent institutions using facilities of technical co-operation between developing countries (TCDC) in the fields of mould repairs and maintenance, mould making, mould design and quality control
- c) Set up a workshop for maintenance, mould repair and mould making (proposed equipment list in ref. 5) (Annex V)
- d) Set up of a quality control and testing laboratory (proposed equipment list in ref. 3) (Annex VI)
- e) Provision of practical and theoretical training of operators
- f) Set up of documentation and standardization facilities and training aids
- g) Recommendations in details of mould design, repair, maintenance, and betterment (ref. 3)
- h) Recommendations in details of processing organization (ref.4)
- i) Diversification proposals for pipe production, blow moulding, and woven sack production (ref.4)

3. Additional Remarks (July 1984)

The expert agree with the well prepared comprehensive recommendations in completion of the requirements of earlier documents (ref.1, 2) adding the following remarks:

- ad a) The mission should include at least one relevant member of the Government of the P.D.R. Yemen because of the public structure of AGPF.
- ad b) It is strongly recommended that training provides mould making personnel with extensive practical knowledge in operating all necessary machine tools like grinding, milling, drilling units, lathes and hand tools. 90 % of training time has to be work at the machines, 10 % only theoretical introduction. At the end of the training programme the candidate has to produce a complete mould at his own.

- ad b) Training should also be provided for administrative personnel in the field of administration and accountancy.
- ad c) The equipment list should not comprise only one single offer. Therefore some other producers are listed in Ann.IV.
- ad f) Any documentation and standardization work in the Arabic language should be done in contact with other Arabian Plastic Centres in order to reduce duplication (III)
- ad i) Not only PVC- but also a polyethylene-pipe production for water pressure pipes and perhaps for gas pipes up to 16 bar should be considered.

4. Local Training

In order to overcome present and future shortage of skilled personnel it is recommended to implement also local training after completion of the training of engineers and technicians at CIPET or other equivalent training institutions. The start of local training courses is recommended for operators first.

5. New Applications

In view of the climatic and economical situation of the P.D.R. Yemen some ideas of new applications of plastics are recommended:

- plastics in reversed osmosis water desalination plants
- polyethylene pipes and fittings in the low temperature range for water desalination systems using solar energy
- acrylics for reflectors in solar energy systems
- expanded use of polyethylene - film for waste management, taking in account the future development of waste incineration in caloric power stations
- high molecular weight HD - PE containers for storage and transport of dangerous goods according to UN/IMDG-Code (International Maritime Dangerous Goods Code)
- polyurethane foams for thermal isolation (heat protection)
- glass fibre reinforced polyesters for water tanks.

It is recommended to update the feasibility study 1982 (2) during the next Five-Year-Plan of the P.D.R. Yemen.

6. Experimental Stations

In order to inform farmers and fishers in the correct application of plastics in agriculture and fishery it is recommended to set up local experimental stations using training and demonstration facilities of AGPF.

7. Caders Selection

The Director-General has the impression that for plastic technology mostly chemical engineers are selected. It is strongly recommended to select cadets for plastics technology primarily from plastic technology, if not available secondly mechanical engineers and thirdly electrical engineers or physicists. Chemical engineering is adequate to plastics production but not for processing and application.

8. Work Plan Proposal

Phase I of the project has successfully been implemented. It is recommended to continue the good co-operation between UNIDO and the Government of the P.D.R. Yemen by extension of the activities in a phase II according to the work-plan proposal (Annex VII) The work plan proposal is considered to be a discussion basis.

FINDINGS

1. Factory Data (July 1984)

Founded 1971, public sector, belonging to the Ministry of Defense (welfare found), supervised by the Ministry of Industry

Personnel: 90 staff, 3 shifts

Equipment: 6 injection moulding machines (4 to 12 years old)
2 cooling lines
2 grinding machines
44 moulds (2 to 12 years old)
1 extrusion line for PE blown film bags (July 1984)
1 printing line with auxiliaries (July 1984)

Buildings: administration: 300 m²
production: 2 400 m²
storage and others: 1 100 m²
expansion in phases
II and III: 5 400 m²
total area: 226 400 m²

Facilities: electricity: 750 kW, final capacity 2 000 kW
water, compressed air, waste and sewage management
telephone, copying device

Materials: 366 tons in 1983: polyethylene, polypropylene, styrene-polymers, master-batches.

2. Positive Valuation

Using the information given by the Director-General, the results of private observations in the factory and evaluating the technical reports (ref. 1, 3, 4, 5) many positive aspects in the development of Algundi Plastic Factory may be found as follows:

- active management and respondend senior staff
- marketable products and profitable production
- good selection of equipment and materials for the film- and bag making machine as well as for the printing plant including auxiliaries according to the latest technical development
- adequate location with adequate infrastructure
- diversification in progress
- excellent standard of new investments
- rational 3 shift working
- successful completion of phase I of the UNIDO project (UNIDO experts, LKT group training programme)
- yearly financial control and surprise checks by the Central Audit, Ministry of Industry
- development according to the Five-Year-Plan of the P.D.R.Y.
- good co-operation with the Government of the P.D.R. Yemen through the relevant Ministries
- good co-operation with the UNIDO and other foreign institutions
- employment of working people
- realistic plans for the future development
- availability of future expansion possibilities and utilities.

3. Negative Valuation

Considering the objectives of development some negative aspects have to be considered as follows by turns of importance:

- low productivity (utilization factor only 0,46 ! including holidays)
- shortage of motivated, experienced and skilled personnel (technicians, operators)
- lack of facilities and skills for maintenance, repair and mould making
- lack of spareparts
- lack of facilities and skills for quality control and technical process control
- shortage of qualified administrative personnel
- shortage of financial resources.

EVALUATION

1. UNIDO Mission D. CLARKE 1977

The basic recommendations of D.CLARKE (ref 1) have been considered extensively till today by

- consolidation of existing resources
- participation of the Director-General H.M.A. REHMAN and the Chief of the technical department N.H. ALALAH at the 14 th UNIDO Group Training Programme in the Field of Plastics Technology, Laboratory of Plastics Technology, LKT - TGM, Vienna 1980
- market survey and feasibility study by WMW, 1982 (ref 2)
- introduction of new processes on a step by step basis by investment of a complete plant for PE blown film bags (self contribution)
- introduction of the flexographic process for printing of PE-film (self contribution)
- three shift working since 1978
- reorganization of the scrap rework system in the injection moulding department

Not considered till today are the following recommendations:

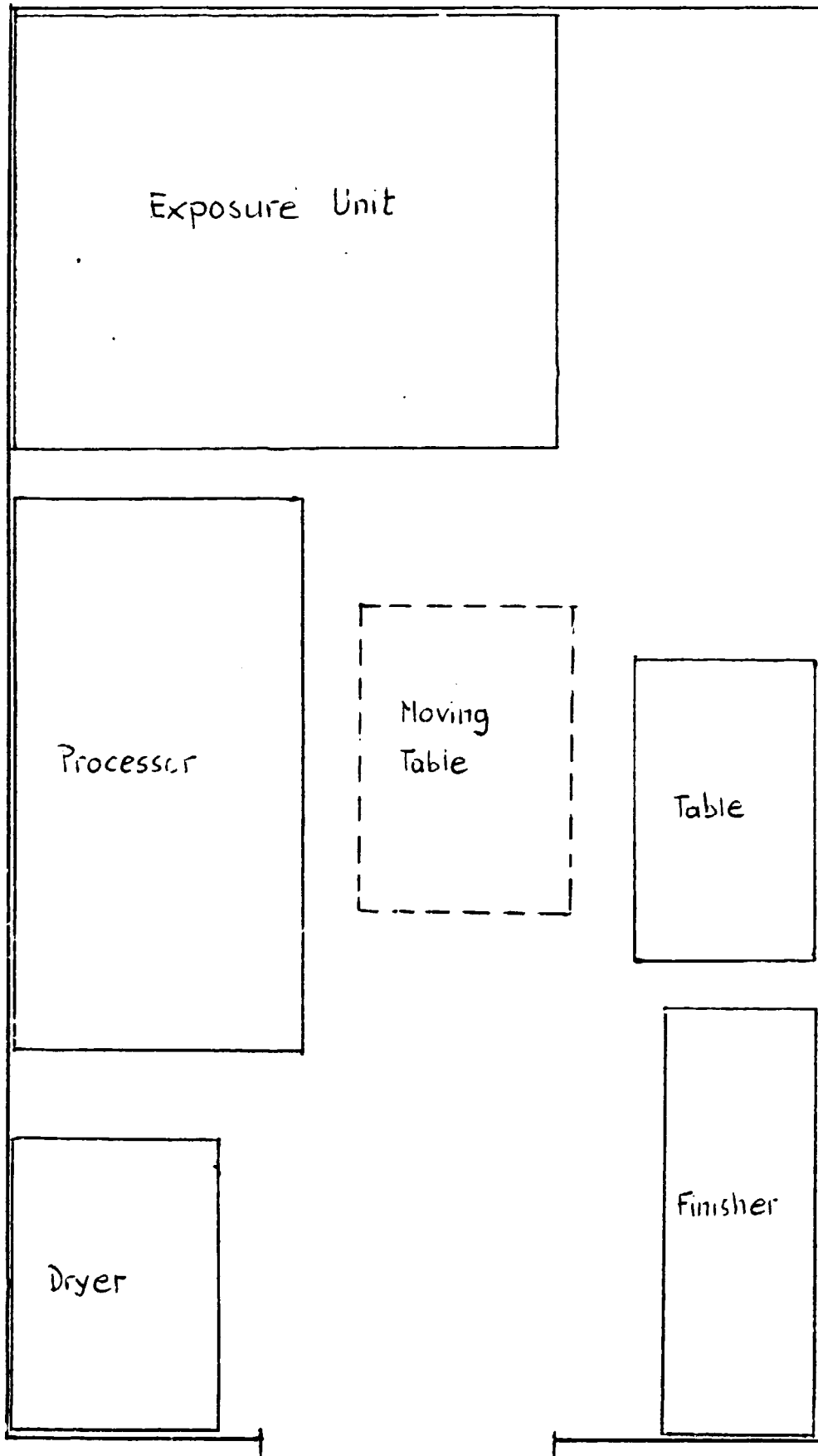
- training of additional personnel over 6 months before 3-shift operation
- setting up a mould repair facility
- UNIDO international fellowships in plastics factory management and in plastics technology
- organized visit to a plastics exhibition and/or conference at least once per year be made by the Director-General to keep updated
- basic control of quality .

2. Feasibility Study WMW 1982

The study is based on a data collection of 40 institutions. In the experts opinion some forecasts are too optimistic and they could not have regard to the special price control system in the P.D.P. Yemen. Even though the study is considered to give a reasonable basic information for future investment.

PRINTING EQUIPMENT LABORATORY

Annex 1



28. June 1984 *lu*

REFERENCES

1. D. CLARKE, Terminal Report, UNIDO SM/PDY/75/02, Aden 1977
2. WMW-EXPORT-IMPORT, Engineering Consulting, Study of Feasibility, Schwerin, December 1982
3. K. RAMAMURTHY, Technical Report: Testing and Quality Control, UNIDO SI/PDY/83/801/11-01, Vienna, 20 May 1984
4. S. ARUTJUNOV, Final Report: Production of Plastic Articles, UNIDO SI/PDY/83/801/11-02, Vienna, 15 May 1984
5. M. REUSS, Final Technical Report: Training in Mould Design, Mould Making, Betterment and Creating a Tool-Room, UNIDO SI/PDY/83/801/11-03, Vienna, 20 May 1984

Annex III

SELECTED PLASTIC CENTRES

Arabian Countries

Research and Development Centre Damascus, SYRIA

Plastics Development Centre (PDC) Alexandria
Alexandria-Victoria, EGYPT
Cable: Egyplas, Tel: 60 914, 61 664, Tlx: 54 223 EGYPLAS UN
Director General: OMAR ABU ZEID
Manager: NADIA NOSSEIR

Kuwait Institute for Scientific Research (KISR)
P.O.Box: 24 885 Safat, University Campus
Tel: 81 69 88 Tlx: 22 299, 23 570
Director of Petroleum, Petrochemicals and Materials Division:
Dr. SAED AKASHAH
Manager of Products Department:
Dr. SHAWQUI LAHALIH

Eastern European Countries

MÜKI, Budapest, Hungaria

VUGPT, Gottwaldov, CSSR

Annex IV

ADDITIONAL EQUIPMENT LIST FOR MOULD MAKING

Hahn & Kolb, Stuttgart, FRG

Cincinnati Milacron, USA

Heid, Stockerau, Austria

Machine Factory Beijing, PR China

Mitsubishi, Japan

and many others. This list might be considerably expanded

Offer for a maintenance shop WMW offer Reg. No. 461/A
date 30/9/1983 validity upto 31/3/1984. Orig. total amount
US\$ 277,908.

Needed machines and devices for moulds maintenance and repairs
work; basis for a tool room in order of importance, with a
minimum of expense to start with.

MACHINES:

All Prices in US\$

- 1. 04.05 Lathe instead of 1400 MM, compl 58674/ a smaller
one 800 MM compl. Approx 35000/-
- 2. 0.09 Bench Drill Compl 4511/-
- 3. 04.01 Horizontal surface grinding machine
200x600 MM, compl. with electro magnetic table/ 19921/-
- 4. 04.06 Universal Milling machine compl/instead of
315x1250 MM 42358/- a smaller one about
300 x 800 MM compl about 32000/-
- 5. 0.03 Electric Chamber Furnace/instead of
400 x 300 x 600 3595/- a smaller one of
400 / 150 x 100, Laboratory size, 950°C, about 1800/-
- 6. 03.04 Pillar Drill 4- 32 MM, Spec, Access, Spare
Parts, Workbench Equipm, Mandril 9837/-
- 7. 04.08 UNIV Tool Grinding Machine, Hand Operated
with spec, access, spare parts, workbench, universal
mandrel and sinus-table included 14567/-
- 8. 0.08 Arbor Press 3 to 198/-

In the WMW offer not included, but very important and could
be placed between 4.5 or 5.6 . Cylindrical Grinding
Machine, with internal grinding unit, 200 x 500 MM compl
about 28000/0

DEVICES. HAND TOOLS

- 1. 01.01 3 pcs Job Specific Equipment
1 Set only 1944/-
- 2. 01.02 Cab.net for Tool 3 148/-
- 3. 0.12 Steel cabinet for measuring instr. 148/-
- 4. 05.07 Hand operating Devices 1481/-
- 5. 01.14 Angle steel Racking Unit, 2 pcs only 131/-
- 6. 02.05 Workbench 2000 MM but 2 pcs. 430/-
- 7. 05.02 1 Set Job Spec. Equip. for Electrician 215/-

8.	01.13 Surface Plate, Cast Iron, but not 1000 x 1000 for 398/-, only 600 x 600 MM about	20C/-
9.	0.10 Hand Lever Shear	241/-
10.	05.03 1 Set Equip. for Servicing Electrician	86/-
11.	05.06 Electrical Measure and testing Equip.	1590/-
12.	04.02 Tool Cabinet 4 pcs.	276/-
		<hr/>
	U S \$...	<u>152724/-</u>

Important but in the offer not included Hand tools, hand grinding and polishing machines from 1000 to about 8000 RPM, smaller Diprofil and bigger Black and Decker ones, with flexible spindled.

- Parallel Clamps^p, Joiner's Clamps.
- Sorts of grinding, polishing papers, cloths.
- Hand grinder stones/Rods/ ϕ ,
- Vernier - Deepness Calipers, Angle Meter, dial indicators with Magnetic bottom, Gauge Blocks, MicroMeters, Precision straight edge, Vernier high gauge.
- Hardness Tester, see Appendix III.

There aren't any steels, non-ferrous metals, stuff materials /loc-tite O-ring adhesive set for sorts of O-rings// Vulkollan-Bayer AG LeverⁿKusen, W. Germany; Pemⁿ, Budapest, Hungary, blocks for other special stuffs to turn on Lathe/ for mould repairs, for pins, punches, bushings ejectors mentioned, although many sortiments of them would be profitable to have on store or in an accessible nearness.

Some home made devices for surface and polishing work:-

- Rotating table for indicating.
- Polishing Wheel with Rubber-Scratching-Ring.
- Forhead Rubber Spindle for Abrasive Paper/Cloth Discs.
- Inside Files.

EQUIPMENT LIST K. RAMAMURTHY

Annex VI 1

Stage 1

A. General test equipment

<u>Equipment</u>	<u>Supplier</u>	<u>Approx cost US\$</u>
(1) Condition Chamber (Temperature & Humidity)	Fisons Ltd/ UK. Daven test Ltd/UK.	3 10,000
(2) Temperatur - Humidity Indicator/Recorder	Testing Machines Inc./USA Daven Test Ltd/UK	3 500
(3) Density Gradient Column (Two Column apparatus)	Daven Test Ltd/UK	3 3,500
(4) Polariscopes	Gardner Lab/USA	3 1,000
(5) Viscometers (U - tube and Ubbelohde)	Gardner Lab/USA	3 1,000
(6) Melting point - apparatus (Capillary Method)	TEI / USA Daven test/UK	3 1,000
(7) Large Air circulating Oven	TEI/ USA Eigelmann & Buckhorn Ltd. /UK	5000
(8) Impact testing with notch	Zwick GmbH/West Germany Ceast - Spa /Italy	3 10,000
(9) Durometer (Shore)	H.W. Wallace & Co. Ltd/UK	3 1,000
(10) Rockwell hardness tester	Zwick GmbH/W.Germany	3 3,000
(11) Environmental stress apparatus (with 5L recagent)	Daven test Ltd/UK Kansley Technical Centre/UK	3 5,000
(12) Falling Weight Impact Tester (Pipes, plates and moulded articles)	TEI/USA Daventest/UK	3 15,000
(13) Universal Tester (100 kN) (For Tensile, Compression & Flaccural)	Instron /UK Zwick GmbH /W.Germany	3 50,000

(14)	Heat distortion ; Vicat softening) point Apparatus) (3 station model)	H.W. Wallace & Co./UK Daventest Ltd/UK	→	5,000
(15)	Elemental tear tester	Daventest Ltd/UK	→	5,000
(16)	Dart Impact tester	Daventest Ltd/UK	→	6,000
(17)	Burst Strength Tester	Daventest Ltd/UK	→	3,000
(18)	Gloss/Haze/Clarity Meter	GARDNER Lab/USA	→	10,000
(19)	Folding Endurance tester	ZIL/USA	→	7,500
(20)	Slip and Friction Tester	Gardner Lab/USA	→	5,000
(21)	Blocking apparatus (to suit universal tester)	Daventest Ltd/USA	→	3,000
(22)	Electrostatic field Meter	Daventest Ltd/UK	→	3,000
(23)	Gas permeability apparatus	" " "	→	6,000
(24)	Water Vapour permeability apparatus	" " " H.W. Wallace & Co./UK	→	5,000
(25)	Flammability Tester	ZIL/USA Ceest SPA/Italy Stanton Redcraft/UK	→	7,500
(26)	Stereo Microscope	Olympus /Japan	→	5,000
(27)	Volume and Surface resistivity apparatus with electrodes	Beckmann / USA	→	5,000
(28)	Low temperature brittleness tester	Tinus Glasco/USA Daventest /UK	→	6,000

Further Recommendation by H. HUBENY for a complete training equipment (flip-chards, pin-board, overhead projectors, film-projectors, communication systems for training and conferences):

Neuland Kommunikationssysteme
Valenting. 16, A-1238 Vienna, Tel (A)-222-88 55 34
Gen. Manager: Mrs. E. STIEGER

→ 15 000

(B) Test Specimen Preparation

Hydraulic press	Laventest Ltd/UK	£ 15,000
Clamping force 50T/20T		
Platen size minimum 150 x 130 mm		
Heating & Covering - Temp up to 300°C		
<u>Two roll mill</u>		£ 25,000
200°C Speed contave, heating	Bogelman & Buckham Ltd/UK	£
& Cooling - roll size approx		
180 x 360 mm		
Stamping press	H.W. Wallace & Co./UK	
Cutting press	Daventest Ltd/UK	
Precision Contour Cutter	Go'ttfort Feinwerk Technik/	£ 15,000
copying machine	CEAST SPA/Italy	W.Germany
Strip Cutter for films	TEI/ U S A	£ 2,000
Standard Moulds	-	£ 20,000

(C) Miscellaneous Testers / Apparatus

1 Set

US\$ 35,000

U.S.\$... 300,000

Stop Watch/ Timer

Digital Temperature Indication with thermocouples

Calculator (Scientific and Statistical)

Low Temperature Circulator

Glassware like glass tubes, heaters, conical, glasses, flasks

Standard Flasks, burettes, pipettes, desiccator, distillation

flasks hydrometers

Water distillation unit, thermometers, Bunsen burners, hot plates,

heating mantles, water baths and stirrers.

IEC cupboards

Chemical reagents & solvents

Plain paper copier, Dia projector, overhead projection

WORK PLAN PROPOSAL

Discussion Basis for the UNIDO Project Phase II

Part A: BASIC DATA

Country: P.D.R. Yemen
Project title: Technical Assistance to the Algundi Plastic Factory (AGPF) aiming the future establishment of a Plastics Processing and Application Centre (PPAC), Aden, P.D.R. Yemen
Scheduled start: January 1985
Scheduled completion: December 1986
UNIDO Contribution: Up to US \$ 666 500

Part B: NARRATIVE

1. Proposed Objectives:

a) Development Objectives:

Main objective is to support and strengthen the expansion of the plastics processing industry so that it may make a continuing contribution to the economic development of the country.

Emphasis will be on the application of plastics for agriculture in order to irrigate and cultivate arid areas, application of plastics for water management, new applications for plastics in fishery, introduction of modern technologies in plastic processing and permanent training of technical personnel.

Furthermore it is to provide the range of consumer goods that are needed to promote rapid improvements in the standard of living in the population.

b) Immediate Objectives:

- i) Upgrading the knowledge of the AGPF staff in adequate techniques of mould making and mould design, as well as resolving their technical problems in maintenance, repair and operation of machinery.
- ii) Strengthening of the existing mould making and maintenance facilities to provide industry with a source of technical assistance in this field.
- iii) Improving the ability of the AGPF staff to carry out quality control and laboratory testing work in the field of plastics technology.
- iv) Strengthening of the existing quality control and testing facilities to provide industry with a source of advice and service in this field.
- v) Establishing capability at AGPF for the improvement of plastics processing, of products and their properties, including the selection of materials and equipment.

- vi) Setting up local vocational training programmes in maintenance, mould repair, quality control and plastics processing using the facilities at AGPF.
- vii) Setting up local experimental stations using training facilities of AGPF for plastics in agriculture and fishery to provide farmers and fishers with a source of technical assistance in the optimal application of plastics in this field.
- viii) Creating a centre for documentation and standardization at AGPF in the field of plastics technology.
- ix) Upgrading the knowledge of the AGPF - staff in resolving administrative and accountancy problems.
- x) Establishing capability at AGPF for the improvement of marketing and feasibility estimations to meet the requirements of the market.

2. Special Considerations not applicable

3. Background and Justification

The biggest and most comprehensive unit engaged in the production of plastic products in the P.D.R. Yemen is a public sector company Algundi Plastic Factory. It is controlled and operated by the Ministry of Industry and equipped with injection moulding machines, extruders, bag making machines, welding and printing units including auxiliary equipment.

The factory faces certain difficulties due to the shortage of trained personnel, the lack of mould making and maintenance facilities, the lack of quality control, and an efficient application of technology and equipment.

A programme of technical assistance to the factory has been undertaken by UNIDO in 1975/76. An expert was fielded for 3m/m to resolve problems in production efficiency in both the film extrusion and injection moulding sections. The report with a number of recommendations, including establishing of quality control unit, mould repair facilities, training etc. has been prepared by the UNIDO expert.

In June 1982 UNIDO submitted the project proposal for consideration by the Government of the P.D.R. Yemen. The Government examined the proposal and found it quite appropriate and essential for implementation, in order to solve urgent technical problems at the Algundi Plastic Factory, and, therefore, requested UNIDO assistance in this regard.

UNIDO fielded four experts from May 1984 to July 1984 for 6 m/m to resolve actual problems and to advise and assist in setting up of a quality control laboratory, in improvement of the processing techniques and in new techniques of mould making and mould design. The UNIDO experts recommended the development of a Plastic Processing and Application Centre (PPAC) Ader, P.D.R. Yemen, in Algundi Plastic Factory, including training, mould making facilities, quality control laboratory, experimental stations, documentation, and standardization.

4. Proposed Output

The outputs of the project in verifiable terms will be:

- National staff trained in the fields related to maintenance, mould repair, mould making, mould design, quality control, processing, and administration.
- A workshop for mould making, mould repair, and maintenance established.
- A laboratory for quality control and testing of plastic products established.
- A design of local vocational training programmes in maintenance, mould repair, quality control, and plastics processing worked out.
- One simple experimental station for the demonstration of plastics in agriculture and for plastics in fishery established.
- Documentation and standardization unit established.
- Improved capability of AGPF staff for marketing and feasibility estimations.
- Improved efficiency in processing and application of plastics at the AGPF.
- Improved capability of AGPF staff in resolving administrative problems.
- Improved capability of AGPF staff in technical assistance to industry, agriculture, and fishery.

5. Proposed UNIDO Activities

- a) The provision of study tours for management and senior staff (1 to 4 weeks each) (10 weeks)
- b) The provision of fellowships
 - three in maintenance, mould repair, mould making, mould design (12 m/m each) (36 m/m)
 - two in quality control (6 m/m each) (12 m/m)
 - two in administration and accountancy (3 m/m each) (6 m/m)
- c) The provision of short term international specialist consultants
 - expert in practical work of mould making, die making, with experience in maintenance and design; training experience appreciated (2 m/m)
 - expert in practical work of injection moulding, blown film extrusion, weaving, blow moulding, welding, printing; training experience appreciated (2 m/m)
 - expert in practical work of test methods, sample preparation, test operation and evaluation; training experience appreciated (2 m/m)
 - expert in practical training assistance for vocational training and on-the-job training in plastics technology; training experience required (2 m/m)
 - expert for plastics in agriculture (2 m/m)

- d) The provision of equipment, tools and materials for set up a workshop for mould making and mould design, mould repair, and maintenance:
9 machines, 18 tools and devices according to M.REUSS, UNIDO expert (see Ref 5)(Annex V)
- e) The provision of equipment for set up a quality control laboratory:
30 machines and devices according to K. RAMAMURTHY, UNIDO expert (see Ref 3) (Annex VI)
- f) Preparation of a list of local training proposals
- g) Selection and scheduling of appropriate activities for setting up an experimental station
- h) Additional selection and scheduling of appropriate activities for documentation and standardization
- i) Initiation of discussion group meetings involving international consultants and counterparts
- j) Training of personnel counterpart.

6. Proposed Project Input

a) Self Contribution

For 1985 AGPF has planned the investment of a blow moulding unit including moulds and dies with a total of US \$ 250 000, in 1986 the investment of a woven bag unit and of two injection moulding machines including moulds is planned for US \$ 350 000 totaling US \$ 600 000. The expansion of materials is expected to be US \$ 350 000. The grand total of expansion of US \$ 950 000 in two years shows the prosperity and the importance of the existing AGPF.

b) UNIDO Contribution (Proposal) in US \$

The project phase II might be subdivided in the following steps by turns of priorities and financial possibilities:

1. Study tours 1985	10 000
2. Fellowships 1985	48 000
3. Consultants 1985	14 700
4. Mould making basic equipment	60 000
5. Mould making first supplement 1985	30 000
6. Quality control basic equipment	50 000
7. Quality control first suppl. 1985	30 000
8. Study tours 1986	5 000
9. Fellowships 1986	60 000
10. Consultants 1986	58 800
11. Mould making first supplement 1986	20 000
12. Mould making second supplement 1986	60 000
13. Quality control first supplement 1986	60 000
14. Quality control second suppl. 1986	160 000
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Total	666 500
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A complete survey is shown in the following table:

		1985	1986	Total
Study tours				
2 persons	1 week	5 000	-	5 000
1 person	4 weeks	5 000	5 000	10 000
	Subtotal	10 000	5 000	15 000
Fellowships (2 000 p. m/m in India) x)				
3 persons in				
mould making	3 x 12 m/m	48 000	24 000	72 000
2 persons in				
quality control	2 x 6 m/m	-	24 000	24 000
2 persons in				
administration	2 x 3 m/m	-	12 000	12 000
	Subtotal	48 000	60 000	108 000
Consultants (7 350 p. m/m in PDR Yemen) x)				
mould making	1 x 2 m/m	-	14 700	14 700
processing	2 x 1 m/m	7 350	7 350	14 700
test methods	1 x 2 m/m	-	14 700	14 700
training ass.	2 x 1 m/m	7 350	7 350	14 700
agriculture	1 x 2 m/m	-	14 700	14 700
	Subtotal	14 700	58 800	73 500
Non-expendable equipment				
mould making				
basic equipment		60 000	-	60 000
first supplement		30 000	20 000	50 000
second supplement		-	60 000	60 000
quality control				
basic equipment		50 000	-	50 000
first supplement		30 000	60 000	90 000
second supplement		-	160 000	160 000
	Subtotal	170 000	300 000	470 000
UNIDO Contribution	Total	242 700	423 800	666 500

x) figures from UNIDO Headquarter in July 1984

