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MASTER PLAN FOR THE DEVELOPMENT OF NATIONAL RESEARCH INSTITUTIONS
AND THEIR CONTRIBUTION TO THE DEVELOPMENT
OF THE INDUSTRY

UC/IRA/93/032

ISLAMIC REPUBLIC OF IRAN

Technical report: Research, development and production
of plastics and resins*

Prepared for the Government of the Islamic Republic of Iran
by the United Nations Industrial Development Organization

Based on the work of B. W. Misterek,
expert in plastics and resins

Backstopping Officer: M. Sanchez
Chemical Industries Branch

* This document has not been edited.

V.94 27338

Explanatory notes

US\$	exchange rate: 1US\$ = 1750 Rials
MOI-	Ministry of Industry of the Islamic Republic of Iran.
N.P.C.-	National Petrochemical Company of Iran.
R&D-	research & development
AUT-	Amirkabir University of Technology, Tehran
PRCI-	Polymer Research Center of Iran, Tehran
ISIRI-	Institute of Standards and Industrial Research of Iran
PVAc-	polivinyl acetate
PVC-	polyvinyl chloride
PP-	polipropylene
LDPE-	low density polyethylene
HDPE-	high density polyethylene
LLDPE-	linear low density polyethylene
PET-	polyethylene terephthalate
PC-	polycarbonate
PF-	phenol-formaldehyde

ABSTRACT

In the frame of the project "Master Plan for the development of National Research Institutions and their contribution to the development of the industry" (UC/IRA/93/032) a 30-day mission of an expert in research, development and production of plastics and resins has been organized from 17 May to 15 June 1994 for the purpose of providing advice and assistance to the government of the Islamic Republic of Iran in assessing the present conditions of existing research institutions working in plastics development to contribute to the modernization of the related national industry. During the mission 2 research /development centres and 7 producers have been visited. In the expert's opinion Polymer Research Center of Iran is not able to supply local plastics industry with necessary technical development assistance because of prevailing orientation on basic scientific research. The expert suggests the factories to develop their own research units and to establish jointly an industrial development centre. The expert is suggesting, that the relations between the industry and research institutions should relay on commercial basis (payment for services).

The government is suggested to create economic conditions increasing industrial interest in development activities. Every purchase of technology or manufacturing installation should be accompanied by the appropriate transfer of "know-how" at research level and by the licensor's obligation of updating of technology.

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INTRODUCTION

The report has been written by Boguslaw W. Misterek, expert in research, development and production of plastics and resins, as a result of 1 month mission to Tehran, Islamic Republic of Iran, in the frame of the project UC/IRA/93/039 "Master plan for the development of national research institutions and their contribution to the development of the industry". The mission (originally planned for 1.5 months) was intended for "providing advice and assistance to the government of the Islamic Republic of Iran in assessing the present conditions of the existing research institutions working in plastics development to contribute to the modernization of the related national industry" (Job Description, Annex 1). The government authorities formulated additionally 4 questions (applicable to the whole project consisting of several sectorial missions) " to be answered and necessary advices to be given, to achieve the objectives of the project:

1. What mechanisms could be recommended to link the research and development centres with the Iranian industries and vice versa?
2. How can the findings and results of the research work be commercialized?
3. What are the present capabilities of research centres? What new research can be performed?
4. How can the MOI involve the national researchers in definition of the development strategy of the country (not just to do research)?"

The mission started on 17. May 1994 and should be completed until 15. June 1994, without any extension possibility. Due to improper ticket purchase the intended stop-over for briefing in UNIDO, Vienna has been replaced by a strange "briefing" in airport hall between the arrival and departure. After the arrival to Tehran it was realized, that due to unusual concentration of government and religious holidays and 5 working days/week system, only 15 working days could be utilized for the mission implementation. In such a situation the working days have been spent on visits, meetings etc. and holidays mostly used for preparing necessary documents.

I. ACTIVITIES

A. Work plan (intended)

Not knowing the situation at the duty station, I prepared in advance the following work plan:

- 17.5. Official introduction, meeting the professional counterpart, collecting background information (list of research institutions and factories, figures regarding production, import, export etc)
- 18.-19.5. Preparation of list of units to be visited, preparation of questionnaire for collecting statistical data.
- 20.5. Translation of the questionnaire into Farsi. Typing the questionnaire both in English and in Farsi. Multiplication of questionnaire in Farsi.
- 21.5. Distribution of questionnaires acc. to the list.
- 22.5.-5.6. Time for answering and returning questionnaires. In the meantime -visits to selected factories and R&D centres.
- 6.-8.6. Analytical study of answered questionnaires and confrontation with the information collected during visits.
- 9.-13.6. Preparing report and typing it.
- 14.6. Final visits and night departure.

After arriving to Tehran I found my intended work plan not realistic for the following reasons:

1. Unusual accumulation of government and religious holidays limiting my effective working time to 15 days only.
2. Lacking availability of any background information regarding operations of plastics industry (i.e. list of major factories and research centres, capacity of the industry, list of polymers-manufactured and processed, export/import balance of plastics raw materials).
4. Poor infrastructure of the project and insufficient logistic support of experts' operations (lacking typist in English, lacking translating capacity, computer without operator, 1 car with driver for 4 experts working independently, often outside Tehran).
5. Complete surprise of MOI authorities with my mission and lacking ability of sufficient support to it.

In front of above obstructions and limitations I had to resign of my intended work plan and due to promised, but hardly available support (permanent counterpart, typist in English, background information visiting program etc). I couldn't work in planned systematic way.

B.Utilization of mission time

In my activities I had to adjust myself to the government working system (5 working days a week, less holidays and semi-holidays) observed by the project (Annex 2). I prepared a questionnaire for collecting statistical data regarding relations R&D - industry during first 3 days of extended weekend, but had to wait 2 weeks for it being typed (and not translated into Farsi at all), so I had to resign of using it in my operations. Nevertheless, this questionnaire (Annex 3) may be used by the government in the future for collecting data regarding development in plastics industry. The same questionnaire may be also used by the factories for selfassessment purposes. The visits to 6 factories and industrial organization (NPC), as well as to 2 R&D units were organized by MOI (Annex 5-13), without any my possibility of influence on the visited place selection; despite the promise I didn't get any permanent counterpart, being only sometimes accompanied in my visits by project officer or MOI officer (almost each time a different one). As a result of my visits I got some impression on the situation in visited companies and R&D units, but I am not sure, how far representative they are to the plastics industry and R&D in Iran.

The free days (with the exception of 2-used for private excursion) I spent on preparation of report of my mission.

C.Fulfilment of mission objective

Due to limitations in mission implementation described above I was not able to fulfil in details the duties described in Job Description, but I tried to fulfil the objective of the mission (described in Job Description as "Purpose of mission") in general and to find answers to 4 questions asked by Dr.A.A.Toigh, Project Director in the name of government (listed in introduction).

II.FINDINGS

Due to circumstances of mission implementation (described in "Activities"), the following statements should be rather considered as the effect of intuitional impressions than of a deep analitic study.

A.Situation in Industry

The modern plastics industry (mostly processing) was established in Iran in 60-ies and 70-ies. In these years new, big factories have been constructed (usually in new industrial zones) and equipped with perfect (or good), costly equipment from Western Europe and Japan. Together with the modern equipment also new technologies have been introduced to the country, without any links to former traditional manufacturing systems. Industrial staff has been trained (not always properly) in the operation of delivered equipment for the manufacture of products of the range and quality applicable to the time of machinery installation. The experienced industrial staff is usually well performing routine manufacturing operations at the same technical level, but the machines are deteriorating (slower or faster) with running time and the technical progress in plastics processing technology (especially in injection moulding, the most common moulding method) is very brisk. Technical staff of the factories is usually not used to participate in development of products, technology and machinery construction, connecting mentally the technical progress rather with the delivery of new equipment only. In the present situation of the country there are little chances of technical development in this way. As the result, plastics processing in Iran is left behind the level applicable to the developed countries. Technical staff in plastics industry seems to be conservative, not participating in technical development and sometimes even not wanting it at all. The same applies to the industry management, usually not interested in technical progress, technology updating, product modernization or diversification, quality improving, development of testing and research activities. This situation continues -the recent evidence of it are the polymer manufacturing installations in Arak Petrochemical Complex and Bandar Imam Petrochemical Complex -purchased for billions of US\$, without any licenser's obligations of technology updating period, without any know-how on technology R&D and without any customer technical service facilities. Now they deliver their polymers to customers -without any catalogues or technical data (even NPC doesn't have them!), without UV-stabilizers and antioxidants and without proper labeling (lacking grade indication).

In the open economy the market itself is usually the best agent stimulating the technical development of the industry. This doesn't however apply to Iran: due to high depreciation rate of Rial to US\$ the importers have no chance of competing with local manufacturers on domestic market; on the other hand local producers reportedly don't develop their capacities deliberately, converting the economy into suppliers' market instead of commonly applicable customers' one. Not being affraid of excessive supply and of competitive activities, the manufacturers are not interested in production rationalization and modernization, in product diversification and quality improvement or in price reduction. In such a situation the usual commercial aspect of industrial development doesn't play any important function.

I have the impression, that the biggest opponent to the transfer of technical development to the industry is the industry itself.

There remains however the question: why so many intelligent and well educated people employed in the

industry do not participate vigorously in technical development of their companies? Not being a psychologist I would like however to draw the attention to the general frustration among the technical staff. I heard rumours about the incompetence of management, about excessive concentration of power on high level without proper delegation of decision (and responsibility) to lower levels, about overcrowded offices without proper work organization and I have to confess, that I experienced personally these all during my short mission here. These conditions are surely not encouraging the people to the active participation in technical development of their companies.

There are no chances of increasing the industrial interest in technical development in administrative way, using instructions, regulations, orders etc. The only effective way of encouraging the industry to develop technically would be the use of economic instruments, combining the industrial progress with financial motivation of the companies and of the individuals. Some suggestions in this respect will be given in Recommendations.

B. Situation in R&D

Considering the 3 levels of R&D activities: basic research, applied research and development projects it is necessary to mention, that only the latter are of direct industrial interest; in the results of applied research the industry may be interested directly or indirectly (or not at all), dependent on professional level on both sides. There are reportedly many research centres active in polymer field; I've got the chance to visit 2 of them, as well as some of R&D units in the industry. Let's start with the latter.

Industrial R&D units

Some companies have already their own research laboratories (unfortunately some of them only on paper). Such laboratories, usually not very strong, work in close collaboration with the manufacturing units. They know each other well, speak the same language (in the technical sense) and understand mutually their problems and capabilities. Research units are used for trouble shooting and for product development within existing technologies (new material formulations, new shape or structure of the products), but –if properly rich in staff and equipment– they can also work on new technologies for the future development of the company. If properly collaborating with the marketing sections, the research units might be able to assist the management in assessment and determination of development and expansion directions of the company. They have also an additional, very important function: in contacts with any external sources of technical information, with any raw material, machinery or technology suppliers and with external scientific and R&D units they play the unavoidable role of a link and transmitter, because they can "speak the both languages", being understandable to internal and external partners and understanding the problems of the both sides. The research units should be also used for dissemination of technical knowledge to the technical staff of the factory (lectures, internal training, excursions, demonstrations etc.)

I assess the function of internal research units as the most important factor in proper operation and development of the company. Each bigger factory should have such an unit; if it is operating properly, the future of the company is safe.

Industrial development centres

I had the chance to visit one of such centres (annex 10), organized as a joint venture of tyre factories. I am very impressed with the bright idea of joint efforts of companies of the same branch for creating a development centre being able to solve the technical development problems of common interest, exceeding the capability of individual internal research units. The staff of such centres should consist (as it is in the case of "Rubber Industries Engineering & Research") of experienced industrial staff and specialists with scientific (but not too "abstract") ambitions. The centres should be well equipped with testing, laboratory and pilot plant experimental facilities, should have good access to international sources of information, collaborate with research units of the interested factories as well as with other R&D institutions. The self-financing system and operation on commercial basis seems to be very healthy, developing the motivation to efficient activities and not charging the country budget with the means of subsistence of the centre. The only doubtfulness to the universal applicability of this system may arise from the question, if every branch of the industry is so conscious of the necessity of industrial R&D as the tyre industry is, and if it is able to cover its costs.

The industrial development centres should be organized by every industrial branch wanting to develop properly. If properly organized and equipped, such centres would create a network playing the main function in future industrial development of the country.

As a professional, I'm very sorry, that such an industrial development centre has not yet been created in the plastics branch of national economy.

Research centres and institutes

Research institutions have been established by the government (under Ministry of Higher Education); they are subsidized by central budget. PRCI visited by me was born and grown in the separation from the industry; the mutual links and understanding are very limited, and the usefulness of present operations of the Centre to industrial needs can not be considered very seriously. PRCI is oriented on scientific development (higher education, dissertations, publications, conferences, international collaboration, etc.) and is successful in this respect. The declared reorientation on industrial needs would be not easy, consuming time and money (additional facilities, staff expansion and training etc.)

It is a matter of political decision on highest level, if the country of 60 million people likes and can maintain a scientific institution concentrated on basic research (many other countries do it). If not, the field of operations, the working system, research program, the staff qualifications, the equipment etc. should be reoriented on the needs of polymer industry - it cannot be done within 1 or 2 years. If yes, the centre may be still useful to the industry in indirect way - assisting the establishment of industrial development centres and companies' research units by training their staff, dissimulation of technical knowledge, assistance in purchase of equipment etc. But even if the centre continues its orientation on basic research, the research program should be more concise, concentrated on selected problems of polymer science. Now they try to cover all the subjects, but there are no chances of being successful in everything.

RECOMMENDATIONS

1. The development of the factories should rely on the operations of their own research units and on the results of development projects executed by industrial development centres connected with individual industrial branches. For that purpose research laboratories should be organized in every bigger factory; the already existing, but hardly surviving research units should be strengthened in staff and in equipment. The plastics industry should be backed by 2 development centres: for polymer manufacture development (to be financed by NPC) and for plastics processing development (as a joint venture of plastics processing factories, with the participation of NPC, as the major raw material supplier). **The most urgent are: the organization and immediately commenced operations of research units at Arak Petrochemical Complex and Bandar Imam Petrochemical Complex** for stopping the wastage of polymers due to incompetent compounding procedures in polyolefine manufacture and for starting the customer technical service operations.
2. PRCI is not able to be used as a source of new technologies for industry during coming few years. It could however assist the industry in establishment of research units and industrial development centres (acc. to p.1). If the decision of reorientation of PRCI profile (please refer to Findings) was taken, it could start within a few years to play a function of plastics processing development centre or polymer manufacture development centre mentioned above.
3. The links between the R&D institutions and manufacturing units should be based on commercial relations. The industrial units should sign agreements of continuous collaboration or individual project execution or just order assistance in trouble shooting and pay for any R&D services.
4. For encouraging the industry interest in own development, the government should establish economic conditions favourable to all activities connected with R&D, product development and modernization. In particular all the R&D expenditures (for staff, equipment and other investment, R&D services and project execution etc.) should be exempted from taxes, if any; the manufacture of new and modernized products should be privileged for the introduction period (lower taxes, easier access to imported components, if any). The manufacture of high quality products (with the mark of quality) should be privileged as well. There should be also established a system (at least in government and public sector industry) of rewarding and distinguishing the people well-merited in introduction of new technology, development of new products, modernization of production machinery etc.
5. R&D centres and Institutes should establish internal units for strategic studies in their fields of operation. Such units should continuously analyse the internal and international market situation, the availability of raw materials, development of technology etc. On the request of the government they should submit regularly the reports on present situation and development trends in their field of operation with the suggestions regarding development strategy. On the other hand the R&D institutions should participate as advisors in the contracting procedure for importing technology or installations from the early negotiation stage for avoiding any mistakes in purchasing program.
6. The industry should exhaust all the foreign resources of know-how in R&D:
 - a. When purchasing a new technology, the contract should always contain the licensor's obligation of continuous updating of the process technology for the period of (at least) 5 years.
 - b. When purchasing a new technology, the contract should cover the necessary know-how in R&D

regarding the process, for enabling further development based on local research; in the frame of technology transfer not only the manufacturing staff, but also the R&D staff should be properly trained, for being able to carry on further development on its own.

- c. The factories should utilize to the highest extent the technical assistance of foreign suppliers of raw materials and machinery, offered in the frame of free customer service.
7. Whatever will be the decision regarding the future of PRCI (please refer to Findings), the centre should orient its research program on the needs of national economy. Its field of operation should be more concise and consequent and its communication means more oriented on Iranian readers (it is nice to edit a scientific journal in English, but would be more useful to edit the easily understandable information on polymer technology development in Farsi). After several years of operation directed towards selfdevelopment now is the time for convincing the community about the usefulness of existence of the centre.

In conclusion of my considerations I would like to express my opinion, that the technical progress in every country depends on many factors: political, economical, technical, social, traditional, psychological etc. The natural rate of this progress may be accelerated to some extent at increased cost; there are however limits of acceleration, which cannot be exceeded even at highest cost.



M. Sanchez/epg
2 March 1993

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

DP/IRA/87/013/11-53

Post title	Expert in research, development and production of plastics and resins
Duration	1.0 month
Date required	as soon as possible
Duty station	Teheran, Iran
Purpose of mission	To provide advice and assistance to the government of the Islamic Republic of Iran in assessing the present conditions of the existing research institutions working in plastic development to contribute to the modernization of the related national industry.
Duties	<p>The expert is expected to perform the following activities in cooperation with the national counterpart:</p> <ol style="list-style-type: none"> 1. Evaluation of present capabilities and future possibilities of the national research institutions which are working in the field of plastics and resins materials to contribute to the development of the industrial producers, both in public and private sectors, indicating those activities in which it will be possible to cooperate. 2. Concrete possibilities of research institutions to contribute to the development of the plastic and resins industries and indication of the specific activities to be performed. Advice on the procedures to be followed. Estimated costs and contributions of the parties involved. Personnel requirements, equipment and infrastructure for the implementation of the recommendations.

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Branch, Department of Industrial Operations
UNIDO, Vienna International Centre, P.O. Box 300, A-1400, Vienna, Austria

3. To investigate the development of aspects related to the treatment of effluent and environmental protection. Specific recommendations for the improvement of the existing technologies.
4. To indicate the possible interrelations of the mentioned sector with other industrial activities in the country and the interconnection of joint research and development projects. Possibilities for utilization of locally available indigenous raw materials.
5. Requirements and availability of qualified personnel.
6. The expert should present the typed mission report including findings, conclusions and recommendations.

Qualifications Chemical Engineer with experience in the production of plastics and resins
Language English

Background information:

The MOI intends to implement a national plan within the overall gamut of the first five-year Plan to establish a linkage between the programmes of the research institutions and the existing industries to upgrade ageing technology and ensure improved production and commercialization of the research findings. This, it is envisaged, will also increase export and encourage the private sector entrepreneurs to invest in industries.

Through the project, the Ministry of Industry of Iran will receive concrete advise on the utilization of existing research and development institutions in the field of chemical research in order to orient these institutions to the planning, organization and execution of their plan of activities addressing them to the development of the chemical industrial sector and improvement of its efficiency. Fulfillment of the project objective will entail an investigation of the means and ways for stronger direct working contacts as well as active promotion of closer working association among different institutions and industry.

The project will allow to define the surplus capacities of the research institutions, high level educational centres, engineering designs and development organization which could be made available for the development of the industrial potential in the country.

Utilization of mission time

Annex : 2

Date	Day	Morning	Afternoon
17.5	TUE	Departure from Warsaw	"Briefing" in airport hall, departure
18.5	WED	Night arrival General briefing by CTA	introduction to project Director, Dr.A.A.Tofigh and international expert team
19.5	THU	government	Preparation of a questionnaire regarding development in plastics industry and related research organizations
20.5	FRI	weekend	
21.5	SAT	Religious holiday	
22.5	SUN	Submitting the questionnaire for prompt typing, translation & multiplication	introduction to Mr.Edalatian, Dir.Gen. of Chemical & Cellulose Ind,MCI
23.5	MON	visit to paint factory "Pars Alvan", Tehran	
24.5	TUE	Visit to NPC, Tehran	Internal project meeting on report of petrochemical industry expert.
25.5	WED	Visit to PRCI, Tehran	
26.5	THU	government	preparation of report
27.5	FRI	weekend	
28.5	SAT	government half-holiday	
29.5	SUN	Religious holiday	
30.5	MON	Visit to Towlidi Tehran Factories, Tehran	
31.5	TUE	Visit to Plastiran, Tehran	
1.6	WED	Visit to Rubber Industries Engineering & Research, Tehran	
2.6	THU	government	Preparation of report private excursion
3.6	FRI	weekend	
4.6	SAT	government holiday	
5.6	SUN	Religious holiday	Preparation of report
6.6	MON	Visit to Ghods Plastic Co., Alborz	Visit to Auand Plastics, Alborz
7.6	TUE	Visit to Resitan Co., Takestan	
8.6	WED	Visit to NPC, Tehran	Preparation of report
9.6	THU	government	preparation of findings and recommendations
10.6	FRI	weekend	
11.6	SAT	Arrangments for urgent report typing and correction	
12.6	SUN	work on report	Meeting in MOI
13.6	MON	Internal project meeting for discussing Findings and Recommendations	work on report
14.6	TUE	Final work on report	
15.6	WED	Departure	Debriefing in Vienna Arrival in Warsaw

**UNIDO/Iranian Government
Project UC/IRA/93/032
Ministry of Industry**

Date :

**Questionnaire
Regarding the development of Plastics Industry
in Islamic Republic of Iran**

(The data of this document will be used only in the best interest of the interviewed parties).

A. The interviewed institution (Company)

1. Name:
2. Full address:
3. The name and title of the person in charge:
4. The name, position and signature of the person interviewed:

5. Kind of activities:

Plastics Manufacturer 1

(Please cross the applicable)

Development in plastics industry 2

B. Plastics manufacture (to be answered by plastics manufacturers only)

1. Your company is a:

Polymer Producer 3

(You may cross more than 1 box if applicable)

Compounder 4

2. Your principle plastics products are:

final product manufacturer 5

If you manufacture more than one product, you may like to answer the following questions separately for each product (or group) on additional sheets, following the box numbers.

3. Your assessment of the technical level of your manufacture compared to world standards, in respect of:

	outdated	average	leading
Technology	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8
product quality & range	<input type="checkbox"/> 9	<input type="checkbox"/> 10	<input type="checkbox"/> 11
manufacturing facilities	<input type="checkbox"/> 12	<input type="checkbox"/> 13	<input type="checkbox"/> 14
manufacturing costs	<input type="checkbox"/> 15	<input type="checkbox"/> 16	<input type="checkbox"/> 17
sewage administration and environment protection	<input type="checkbox"/> 18	<input type="checkbox"/> 19	<input type="checkbox"/> 20

		own develop- ment	Iranian* origin	imported
4. Origin :	of your manufacturing technology	<input type="checkbox"/> 21	<input type="checkbox"/> 22	<input type="checkbox"/> 23
	of manufacturing facilities	<input type="checkbox"/> 24	<input type="checkbox"/> 25	<input type="checkbox"/> 26

* Please name the supplier

		Yes	No
5.	Is your manufacture based on any licence or "know-how"?	<input type="checkbox"/> 27	<input type="checkbox"/> 28
	If yes - do you still pay any royalties or licence fees?	<input type="checkbox"/> 29	<input type="checkbox"/> 30
	If yes - is the licensor obliged to support your keeping your technology updated?	<input type="checkbox"/> 31	<input type="checkbox"/> 32
	If yes - do you utilize his assistance?	<input type="checkbox"/> 33	<input type="checkbox"/> 34

		Yes	No
6.	Do you support your manufacture with any development activities (including customer service)?	<input type="checkbox"/> 35	<input type="checkbox"/> 36
	If yes - are these your own activities?	<input type="checkbox"/> 37	<input type="checkbox"/> 38
	If yes - do you collaborate with any research/development unit?	<input type="checkbox"/> 39	<input type="checkbox"/> 40
	If yes - is this collaboration systematic?	<input type="checkbox"/> 41	<input type="checkbox"/> 42

If you crossed box 39, please name the partner

Do you pay him for collaboration services?

Yes	No
<input type="checkbox"/> 43	<input type="checkbox"/> 44

7. If you crossed box 38 - are the development activities of local origin (Iranian)?

Yes	No
<input type="checkbox"/> 45	<input type="checkbox"/> 46

if yes - please name the institution.

if no - please name the foreign country.

Do you pay him for activities?

Yes	No
<input type="checkbox"/> 47	<input type="checkbox"/> 48

8. Are you satisfied with the development activities or collaboration of partners named in question 6 or 7 (if any)?

Yes	No	not applic.
<input type="checkbox"/> 49	<input type="checkbox"/> 50	<input type="checkbox"/> 51

9. Do you feel the usefulness of arranging new development assistance services (or expanding the already existing ones)?	Yes	No
	<input type="checkbox"/> 52	<input type="checkbox"/> 53
If yes - would you be able to cover their costs?	<input type="checkbox"/> 54	<input type="checkbox"/> 55
Do you have any specified institution in mind?	<input type="checkbox"/> 56	<input type="checkbox"/> 57

If yes - please name it

10. Do you employ any locally educated engineers?	Yes	No
	<input type="checkbox"/> 58	<input type="checkbox"/> 59
If yes - are you satisfied with their professional qualifications?	<input type="checkbox"/> 60	<input type="checkbox"/> 61

If no - please list your objections :

Do you intend to employ any new engineers in near future?	Yes	No
If yes, please give their number.	<input type="checkbox"/> 62	<input type="checkbox"/> 63

11. How do you assess the utilization of your manufacturing capacity?	underutilized	fully utilized	overloaded
	<input type="checkbox"/> 64	<input type="checkbox"/> 65	<input type="checkbox"/> 66

If you didn't cross box 65 - what is the reason?

installation condition	market situation	other*
<input type="checkbox"/> 67	<input type="checkbox"/> 68	<input type="checkbox"/> 69

* name the other reason

Please explain the reasons (boxes 67-69)

If you crossed the box 37, please answer the questions of part C.

C. Development activities in plastics industry (to be answered also by plastics producers who crossed box 37)

1. Your company is active in following field(s):

- | | | |
|---|--|--------------------------------|
| (you may cross more than one box if applicable) | a) development of polymer manufacturing methods | <input type="checkbox"/>
70 |
| | b) development in plastics processing, testing & application | <input type="checkbox"/>
71 |
| | c) development in design & manufacture of industrial installations | <input type="checkbox"/>
72 |
| | d) development in sewage administration and environment protection | <input type="checkbox"/>
73 |
| | e) education in any field listed above | <input type="checkbox"/>
74 |

The above specification will be used in some of next questions.

2. Staff involved in development activities, related to specification a) - e) listed above (please write no. of persons in appropriate box (es)):

	a)	b)	c)	d)	e)
Ph.D and higher*	<input type="text"/> 75	<input type="text"/> 76	<input type="text"/> 77	<input type="text"/> 78	<input type="text"/> 79
other graduated	<input type="text"/> 80	<input type="text"/> 81	<input type="text"/> 82	<input type="text"/> 83	<input type="text"/> 84
assisting staff (technical only)	<input type="text"/> 85	<input type="text"/> 86	<input type="text"/> 87	<input type="text"/> 88	<input type="text"/> 89

* Please list the names on the separate sheet, referring to box No.

3. Experience in development activities of the staff listed above, related to specification a) - e) - (please write No. of persons in appropriate boxes):

	a)	b)	c)	d)	e)
Less than 3 years	<input type="text"/> 90	<input type="text"/> 91	<input type="text"/> 92	<input type="text"/> 93	<input type="text"/> 94
3 to 8 years	<input type="text"/> 95	<input type="text"/> 96	<input type="text"/> 97	<input type="text"/> 98	<input type="text"/> 99
more than 8 years	<input type="text"/> 100	<input type="text"/> 101	<input type="text"/> 102	<input type="text"/> 103	<input type="text"/> 104

4. Facilities and equipment for development activities related to specification a) - e) - please cross only in the case of sufficiency the appropriate boxes:

	a)	b)	c)	d)	e)
Laboratory equipment	<input type="checkbox"/> 105	<input type="checkbox"/> 106	<input type="checkbox"/> 107	<input type="checkbox"/> 108	<input type="checkbox"/> 109
Large scale laboratory equipment	<input type="checkbox"/> 110	<input type="checkbox"/> 111	<input type="checkbox"/> 112	<input type="checkbox"/> 113	<input type="checkbox"/> 114
Pilot plant(s)	<input type="checkbox"/> 115	<input type="checkbox"/> 116	<input type="checkbox"/> 117	<input type="checkbox"/> 118	<input type="checkbox"/> 119
Semicommercial manufacturing plant(s):	<input type="checkbox"/> 120	<input type="checkbox"/> 121	<input type="checkbox"/> 122	<input type="checkbox"/> 123	<input type="checkbox"/> 124

5. (please refer to specification)

	a)	b)	c)	d)	e)
How many development projects have you already completed? (Please write the numbers in the appropriate boxes)	<input type="text"/> 125	<input type="text"/> 126	<input type="text"/> 127	<input type="text"/> 128	<input type="text"/> 129
How many development projects are being executed at present?	<input type="text"/> 130	<input type="text"/> 131	<input type="text"/> 132	<input type="text"/> 133	<input type="text"/> 134
How many of completed projects are successfully utilized in production?*	<input type="text"/> 135	<input type="text"/> 136	<input type="text"/> 137	<input type="text"/> 138	<input type="text"/> 139

*Please list the subject(s) and utilizing factory(ies) referring to box No. (on the additional sheet)

6. Do you collaborate with any other development unit related to plastics industry?

YES, systematically

140

YES, occasionally

141

NO

142

In the case of box 140 being crossed please give the No. of units, related to specification

a)	b)	c)	d)	e)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
142	143	144	145	146

Please list their names on additional sheet referring to box No.

7. Do you have any technical library?

YES

147

NO

148

If yes - how many plastics journals do you subscribe?

149

How many visitors use the library services (average, during 1 month)?

total

150

external

151

8. For how many years have you been already active (as the institution) in plastics development? Please put the number of years in the box.

152

Do you intend to develop these activities?

YES

153

NO

154

9. Is your staff participating in any training courses, seminars, exhibitions etc?

YES in Iran

155

YES abroad

156

NO

157

10. How do you finance your development activities?

from central budget

158

by donations

159

selling projects

160

from profits

161

other

162

(you may cross more than one box if applicable.) If your crossing box 162, please explain

11. How do you select the topics of your development projects?

According to: own market studies instructions of authorities

163

164

orders of customers inventions of staff other

165

166

167

(you may cross more than one box, if applicable). If you crossed box 167, please explain

Memo of 22.5.1994
regarding the introduction to MOI

Annex : 4

accompanying person: Mr.Nader Niktabe, Project Officer
person met: Mr.M.Edalatian, Director Gen., Chemical & Cellulose Industries, MOI.

The intention of the visit was the introduction to MOI authorities on plastics industry, establishing procedures of mission implementation (selection of counterpart, information on plastics factories and plastics R&D institutions under MOI, selection of places to be visited etc.)

The visit was a complete surprise to Mr.Edalatian and for that reason he was not able to arrange the expected assistance on spot. He promised however to select the professional counterpart as soon as possible and after some ad hoc suggestions regarding the visits to industry he promised to arrange a meeting (on 1 June, 3 P.M. *) with his plastics industry specialists for discussing the plastics industry problems and to prepare a list of major plastics factories (there are more than thousand small units) and R&D units for the selection for next visits. He also suggested another meeting at the end of mission (not specifying the date) for discussion on findings and recommendations.

*. This meeting time has been postponed in the last moment until 8 June because of some urgent duties of Mr.Edalatian. Unfortunately also this new meeting time has been postponed in the last moment.

Memo of 23.5.1994
regarding the visit to Pars Alvan paint factory, Tehran

Annex : 5

Accompanying person: Mr.N.Niktabe, Project Officer
 interviewed persons: Mr.Tabatabai, Deputy manager
 Mr.Haghi, Deputy Chairman at administration
 Mr.Farahani, Deputy at product and development
 Mr.Khoyasteh, Private Consultant

The factory is a major manufacturer of alkyd resin based industrial paints and PVAc based emulsion paints for wall painting (totalling 2000 t/y). The factory is constructing a resin manufacturing unit intended mostly to be used for the manufacture of alkyd resin for the replacement of present import. This construction is being executed by a local private company Disal Co., reportedly well used to construction of chemical installations.

The paint manufacturing sector of the factory is well equipped for the present manufacturing program, but unfortunately is underutilized (10000 t/y capacity) because of reportedly limited domestic market and lacking chances of any export of manufactured paints. This is also the reason for marginal only profit of the production.

The factory is well developed in testing laboratories -separate for raw material testing and for product testing and standardization. There is also a small research laboratory (2 persons only), equipped with basic installations for laboratory scale and large laboratory scale research operations (also in the resin manufacturing sector).

The factory would be eager to accept any foreign technical assistance, but due to difficult economic situation would not be able to finance it.

The factory has no links neither to the Paint Research Institute nor to PRCI but is reportedly utilizing the technical assistance of foreign raw material suppliers. I suggested the factory to get in touch with the both institutions in the regard of upgrading and diversification of products and manufacturing technology. For improving economic effects of paint manufacture I suggested the factory to identify the kinds of imported paints and to try to develop new paint grade manufacture (i.e. marine paints) for replacing import and better utilization of existing manufacturing facilities.

As far as future development is concerned, I suggested the interest in the modern paint types, like water dilutable industrial paints and powder paints (although manufacture of the latter would require some investment in production facilities). These new types are more environment friendly (less or none of evaporating solvents) but they are not yet known on the local market; therefore the development of market for new paints should be stimulated by the factory.

There is also another possibility of better utilization of existing manufacturing facilities (not yet suggested to the factory): to start the commercial manufacture of PVC paste for the use of paste processors. It might be however obstructed by the limited stability of PVC paste at elevated temperature, common to the local climate.

Memo of 24.5.1994
regarding the visit to N.P.C. Tehran

Annex : 6

interviewed persons: Dr.M.S.Parvisi, Head of R&D
Dr.M.Saberian Broujeni, Tech. Consultant to Operations Director
Dr.B.Rajabalitabar, Techn. Consultant of R&D Coordinating Affairs
Dr.M.Shatiee, AUT, Chancellors Advisor

The aim of the preliminary visit to the company was the assessment of applicability of a visit to any petrochemical unit from the point of view of interest of the project.

In fact the large scale polymer manufacture (PVC, PP, LDPE, HDPE, LLDPE) is concentrated in 3 petrochemical complexes (Abadan, Arak and Bandar Imam)

Reportedly very modern technologies and processes are utilized there on the licence/know-how basis, but they are not accompanied by any research, development or even customer technical service unit. Only recently the decision has been taken to create a R&D unit located at Arak petrochemical complex with the aim of it to serve all the polymer manufacturing units. Unfortunately no one of licensed installations was supported with any licensor's obligation of upgrading the technology, so the company is lacking any development support. The company would be able to pay for the R&D projects executed according to its requirements.

In the existing situation it has been agreed to resign of the visit to any of the complexes but to meet again for discussing some problems of mutual interest.

There was also some advice given by me on spot to the company officials:

1. When purchasing any new technology, the contract should always contain obligation of the licensor of continuous updating of the process in question for the period of (at least) 5 years.
2. When purchasing any new technology, the contract should cover the necessary know-how in R&D in the regard of the technology in question; in the frame of technology transfer not only the manufacturing staff, but also the R&D staff should be trained to such an extent, that it could carry on further development of the given technology on its own.
3. The polymer manufacturing units (as well as the company officials) should get informed about the ISO 9000-9004 complex certification system (without introduction of this system to company's operation, there wouldn't be any possibility of the company to get any position on the international polymer market in near future). For that purpose the assistance of ISIRI should be requested.

Memo of 25.5, 19944
Regarding the visit to PRCI, Tehran

Annex : 7

The interviewed persons : Dr. S.A. Hashemi, Dep. Director in Research
Dr. M. Nekoomanesh, Deputy of Planning & Designing

PRCI has been established by the government in 1986. It is located in an adapted administrative building in the centre of Tehran, but new facilities are already under construction in Chitgar near Tehran and the centre will be moved to the new location soon. The present location of PRCI is limiting its operations because of deficiency of space and urban conditions not allowing pilot plant and semicommercial manufacture. Thus PRCI oriented itself on development of staff, laboratory research and testing, as well as provision of advanced laboratory equipment. These excellent, sophisticated and well operated laboratory instruments as well as the research program are concentrated on basic research, prevailing over applied research and development activities oriented on industry needs. PRCI has the intention of reversing the proportions when moving to new facilities, but it would require additional investment in laboratory and pilot plant equipment, as well as employment of experienced industrial staff.

The team of PRCI is young and very ambitious, but apparently overestimating own possibilities in backing the industrial development in plastics field. In their present operations oriented on basic research they try to cover a broad, very diversified range of problems, not always well understood and requested by the industry.

Reportedly PRCI is fully subsidized by the government budget; if they earn any money for their services to industry, they have to return it to the budget without any possibility of using it.

The library is very rich in books, journals (more than 100) mostly from the field of polymer science. More practical, closer to industrial needs, journals are disregarded as "too much commercial". The library is open to external visitors 2 days a week only.

Reportedly PRCI is working for the industry (research projects, trouble shooting etc.) but is complaining about very long procedure of decision taking in the industry in regard of signing any research agreements and orders.

Memo of 30.5.1994
regarding the visit to Towli Tehran Factories, Tehran

Annex : 8

accompanying person: Miss Simin Kimiaji, MOI
interviewed persons: Mr. Izadi, Factory Manager and his staff

This public sector factory is located on the western outskirts of Tehran. It is highly dependent on international market, importing raw materials for $\text{c}\acute{\text{a}}$ 8000000 US \$ (mainly from reputable european suppliers) and exporting market products for $\text{c}\acute{\text{a}}$ 1000000 US \$ (mainly to Central Asia). Although having negative foreign exchange balance, the company is in good financial condition with the profit reaching 20% of turnover. It is possible thanks to the good quality products, reaching higher prices on domestic market than the ones of the competition. All the products are market oriented; the product range consists of: calandered PVC films and sheets, PVC-coated wallpaper, textile backed PVC sheet, PVC leathercloth, artificial leather (with foamed layer), melamine-formaldehyde tableware, polyethylene film and polyurethane flexible foam. For all the PVC products the consumption of polymer is 9000t/yr. Factory was established in early 60-ies and well equipped at that time by reputable machinery manufacturers. The most of equipment is in good technical condition and the processes are on average technical level (presses, calanders and coating installations are not being changed very frequently in their construction and technology). Only the polyethylene film extrusion units are evidently outdated, but they seem to play a marginal function in total manufacturing program of the factory. The staff of the factory is well experienced and effective in routine operations and in technology modifications. The only laboratory (employing 2 graduates) is covering all the testing and technology problems; it seems to be a bit underdeveloped in staff, in equipment and in services provided. The factory used high frequency ovens for preheating thermosetting moulding powder in the past, when using it in precompressed tablet form. Since the compression moulding of melamine tableware from granular raw material has been started, the factory resigned of the use of raw material preheating, with some disadvantageous effect to the product quality and manufacturing output.

In the frame of ad hoc advice I suggested the return to preheating operation in the modified version: the individual portions of granular raw material should be first put in PP containers of proper volume, then heated in high frequency oven during proper time (PP containers wouldn't be heated in such conditions, but their content would) and immediately transferred to the press for moulding.

Memo of 31.5.1994
regarding the visit to Plastiran Co., Tehran

Annex : 9

interviewed persons: Mr.A.A.Sharafeldini, Managing Director
Dr.M.Ghasemi, Technical Director
Mr.Tabrizi, Quality Control

The factory (established in 1968) is a custom moulder, manufacturing injection moulded products (upto 7000 g) and extrusion/blow moulded products (upto 220 l) for industrial customers.

The injection moulding shop is equipped with more than 40 italian and japanese machines (upto 1300t clamping force) and about 3000 moulds -mostly the property of customers. The machines are already more than 25 years old; they are operable, but not always in good condition and sometimes not properly maintained (especially control & hydraulic systems). The most of the products are being used as components for the complex and advanced products (cars, refrigerators, sewing machines), some other (mostly transport crates and boxes) have responsible application function as well. It is surprising, that in such a situation the factory management (consisting of bright, well educated and experienced people) doesn't see any necessity of establishing technical control laboratories, neither for their raw materials nor products. They rely on their manufacturing experience and routine (and on foreign suppliers' assistance), limiting the quality assessment to visual inspection only. Although making a good profit they don't like to invest any money in quality control (not speaking about development) laboratory, preferring to spend it for new machine purchase. In fact they are contracting a new Reifenhäuser sheet extrusion line. Their argumentation, that there is no competitor on the market better to them and for that reason there is no fear of losing the customers, is not convincing very much.

The factory is also making blown containers upto 220 l capacity, used as packaging. Beside some old, outdated (and not very well maintained) italian extrusion blow moulding machines there are also many small, not very efficient, but simple and inventive, locally made extrusion blow moulders.

The factory complains, that the polyolefines of domestic origin (from the new Arak Petrochemical Complex) are virgin polymers, not containing any UV-stabilizers nor antioxidants. If it was true (to be proved on the other end), the use of such polimers would be just waste of money.

The company is thinking about the purchase of equipment for the manufacture of biaxially oriented PP as a flat film. I have drawn their attention to the possibility of the manufacture of such film in tubular form with the use of equipment and method invented by Prandi (Italy). This technology seems to be simpler and cheaper (and also scrapless), than the flat orientation method.

Memo of 1.6.1994

Annex : 10

regarding the visit to Rubber Industries Engineering & Research, Tehran

accompanying person: Miss Simin Kimiaji, MOI
interviewed persons: Mr.A.Ghannad-Rezaii, Managaing Director
Mr.Mehrdad Samadi, Head, Development Div.

This new development unit has been established jointly by tyre manufacturing companies (being the shareholders of the unit). The staff of the unit (ca 50 qualified people) has been recruited among the staff of tyre factories or fresh degree holders (being trained at the beginning for 6 months in tyre manufacture). The unit constructed a new building for its operation, but unfortunately, due to rapid depreciation of local currency against US \$, was not able to import any R&D equipment with the exception of hard-and software for tyre construction and behaviour simulation, and rubber compound formulation optimization. The possibility of utilization of mentioned software seems to be very attractive to the tyre manufacturers. There is also a good rubber library in the unit; it is unfortunately not yet very popular in the industry and external visitors don't use it very much. Reportedly the unit is not subsidized and lives of the resources it earns on the base of R&D agreements with factories and in technical service operations. These resources are sufficient for running the unit, but not high enough to use them for importing testing & development equipment. Because of lacking such an equipment the unit is not able to conduct any "in house" experimental activities; for making any testing or experiments it has to use facilities available in factories or in PRCI. Nevertheless the system of establishing development units by the industry with the participation of people from the industry and financing the activities on commercial basis (by selling the results of R&D projects to the industry) seems to me to be very healthy and well promising to the future; in such a system the R&D program is oriented on the industry needs, the unit as a whole (and also individuals) are motivated to efficient operation, the financing system offers the possibility of selfsufficiency of the unit; it is also some means of objective selfassessment of unit operation program. The only difficulty in introduction of this system might arise on the industry side -if it is lacking understanding of technical development importance, or if it is short of money (for paying R&D costs). In the case of visited unit, hopefully the present problems with equipment deficiency will be gradually solved (not everything has to be purchased immediatelly)- the shareholders should also be helpful. I wish the unit fruitful operations and a good future.

As a personal request, the unit asked me to arrange contact with polish tyre development laboratory - it would be interested in some assistance in the problem of practical approach to the design of a new tire, and would be able to cover the costs.

Memo of 6,6,1994
Regarding the visit to Auand Plastic Co., Alborz I.C.

Annex : 11

Accompanying person : Mr. M.N. Fallah, Head Expert, Chem. & Cellul. - MOI

Interviewed person : Mr. Majeed Abbasi, Factory Manager

The government-owned company, located in Alborz Industrial City (ca' 160km to the west of Tehran), was established in late 70-ies and equipped at that time with ca'30 extrusion-blowing units of the leading european manufacturers (Bekum and Kautex) for the mass scale manufacture of bottles and containers upto 60l. Recently the factory was additionally supplied with modern AOKI injection moulding-bottle blowing unit for PET and PC bottle manufacture.

Such a high concentration of bottle & container manufacture doesn't seem to be rational because of remoted customers (bottle filling companies i.e. Pepsi Cola in Tehran) and voluminous production (in the case of PET bottles more than 97%-air). The manufacturing machinery is deteriorating quickly because of insufficient maintenance (it applies especially to the moulds); it is operated in primitive way, consuming very much manpower. The manufacture is backed with very small laboratory for product testing (1 technician; drop testing, compression test and leakage testing methods available, but apparently not much used). No mould maintainance & repair shop is available. The company makes only marginal profit - it is not surprising, if taking into account little interest in the technical level of manufacturing condition. The company is not interested in any technology or production development, but reportedly is thinking about employment rationalization.

Memo of 6,6,1994
Regarding the visit to Ghods Plastic Co., Alborz I.C.

Annex : 12

Accompanying person : Mr. M.N. Fallah, Head Expert, Chem. & Cellul, MOI

Interviewed persons : Mr. M. Gharibnavaz - Managing Director's advisor

Mr. K. Amiri - Factory Manager

Mr. Y. Taghipoor - Production Manager

Present manufacturing facilities of the company have been established in late 70-ies in Alborz Industrial City. The company is specialized in manufacture of ball and fibre pens, (ca'100mln/yr) brushes and tooth brushes (ca' 20mln/yr). Some of manufacturing facilities are on high technical level (ball pen tip manufacture); the hygienic conditions of tooth brush manufacture are also noticeable. Unfortunately this doesn't apply to the plastics moulding shop, supplying all the above final products with plastics components. Injection moulding machines (ca' 60) have been delivered to the factory (in 70-ies) without proper staff training in machine operation and maintenance; as the result the machines are not in perfect condition and the costly Netstal machine has not been put into operation at all. Also the technical knowledge in regard of injection moulding technology is not sufficient, which is reflecting badly on proper machinery utilization and on product quality. During the visit some ad hoc advice has been given (the proper application of reduced holding pressure, the origins of internal stresses causing stress-cracking, the disadvantages of using silicone release agent spray, the foam injection moulding technology etc.), including the indication of available technical literature sources.

The company uses specialized equipment for final product quality control, but does not have any unit for product/technology development. New products are just following some imported samples, and the moulds are purchased from local market. The company makes a good profit and would be able to pay for development services, if required.

Memo of 7,6,1994
Regarding the visit to Resitan Co., Takestan

Annex : 13

Accompanying person : Mr. Shirazi - MOI

Interviewed persons : Mr. A. Pourheidari, Managing Director
and his staff.

The completely new factory is intended to be used for the manufacture of ca' 13000/yr various resins for the in house manufacture of PF moulding powder and for the use in many branches of the industry (brake lining manufacture, paint manufacture, foundries etc.). The installation has been imported from Germany, the technology (know-how backed by 8 year updating period obligation) originated also from this country. The factory is supported by water treatment, sewage incineration system, closed water circulation system etc. All these systems will be proved when full manufacture commences. The separate building (under construction) will house the research unit equipped with laboratory and pilot plant scale instruments and installations (already purchased and delivered.). The approach to R&D (research laboratory, technology updating agreement) is unique among all factories visited.

I suggested the management to take special care to health hazard problems (connected with toxic raw materials) and to request a MD specialized in industrial medicine to prepare necessary instructions, provide necessary staff training etc. in this respect.

Memo of 8,6,1994
Regarding the short visit to NPC, Tehran

Annex : 14

Interviewed person : Dr. M.S. Parvizi, Head, R&D

I informed Dr. Parvizi about the complains of plastics processing factories regarding the manufacture of polyolefines without UV stablizers and antioxidants by Alak Petrochemical Complex. After a few telephone calls he almost confirmed the information, telling that "with the high probability" my information is correct. I informed him about disadvantageous consequences to end users of ready products, if manufacturing them of such material.