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JAPANESE CO-OPERATION WITH DEVELOPING COUNTRIES FOR ESTABLISHING PETROCHEMICAL INDUSTRIES *

by

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Appendix

1. Petrochemical Industries Established with Co-operation of Japanese Enterprises in Developing Countries.

Japan's petrochemical industry started production on a small scale in 1957 using catalytically cracked gases from refineries, but the next year a full-scale petrochemical industry commenced by naphtha cracking for ethylene production. Thereafter, it has grown rapidly supported by the following factors: (1) Naphtha supply as raw material was easy at that time in view of Japan's oil products pattern, (2) condensed population of Japan, i.e. 100 million, formed a stable market for petrochemicals stimulated by the economic growth policy of the government, and (3) such rapid growth allowed the construction of relatively large scale plants and it made possible to export the products at internationally competitive prices.

At the beginning of Japan's petrochemical industry, almost all the technologies were imported mainly by licencing or turn-key basis and they were easily absorbed by Japanese because of their high level of education. As early as a few years later, some Japanese technologies were exported.

As export of petrochemicals from Japan increased, voices wishing to implement petrochemical industries arose in import countries. Responding to such voices, Japanese enterprises established affiliates as wholly-owned or joint ventures in these markets in place of export of petrochemicals, at first processing of plastics and synthetic fibers or formulating of surface active agents or paints and secondly polymerising of monomers for plastics and synthetic fibers.

Apart from such cases, recently full-scale petrochemical complexes have been planned in developing countries and some of them have been implemented by joint ventures between Japanese consortiums allied by many enterprises and respective country's enterprise or the government.

Details of these three types of technology transfer are listed in Appendix 1 for licencing or turn-key basis plant export, Appendix 2 for joint venture establishments for local market in place of import from Japan, and Appendix 3 for joint venture establishments for full scale complexes and corresponding projects not only for local market but also for export to Japan and Japan's established market anywhere.

In the future, cases such as the last one in which significant volumes of products are exported will be most important both for Japan and developing countries. In addition, some ventures have been planned, but not implemented so far.

Following is a detailed explanation of the joint ventures in the last cases mentioned above under implementation, under consideration but not implemented, and ever planned but not materialised.

1-1. <u>Iranian Petrochemical Complex (Iran Japan Petrochemical Co.)</u>

(Refer to Case No.4 of Appendix 3)

The Mitsui group of Japan formed a consortium of enterprises which were responsible for participating in the project, offering necessary technology, and/or taking over products to be produced. Then, the Mitsui group negotiated with the National Iranian Oil Co. (NIOC) to establish a joint venture for implementation of a full-scale petrochemical industry in Iran. Final settled organization of participation is as follows:

Mitsui & Co.	45%			
Mitsui Toatsu Chemicals	22%	Iran Chemical		
Toyo Soda Mfg.	15%	Development Co.		
Mitsui Petrochemical	13%	(ICDC)	50%	
Japan Synthetic Rubber	5%			Iran Japan
National Petrochemical Co. (NPC), wholly owned affiliate of NIOC			50%	Petrochemical Co. (IJPC)

Original plan was agreed in 1972 with expected investment of ¥550 billion for products centering on 300,000 MTA of ethylene production by using natural gas and naphtha as raw materials. But so many problems had to be solved.

1). Oil crisis and price increases in every field thereafter elevated the cost of the project to such high a level that the project would be thought not to be implemented. As a result of negotiations between the parties for compressing the total capital investment in the venture, it was decided that the Iranian side would be in charge of the raw material supply systems including gas separation facilities.

2). As a rule, the Export-Import Bank of Japan requires the guarantee of the recipient Government for her financing, but Iranian Government rejected it. After negotiation between the financial authorities of both governments, it was understood that the guarantee is to be made by NIOC.

3). For still more expanding estimation of investment cost, bold compression of budget could not but be made.

4). For solving poor communication system of the plant site, a photo-facsimile system, among others, was set up, which is the first in Iran, between Tokyo and Bandar Shahpur. It will be connected to Teheran after the administration body starts business in Tehera

5). For further more expanding estimation of investment cost, some projects could be transferred to other enterprise or be postponed, as mentioned in Case No.4 of Appendix 3.

While these difficulties were overcome, preparation of salt field to feed electrolysis plant, reclaiming and preparation of land, and port facilities were completed, and some fractionating towers for production facilities have been received and installed, expecting the completion in 1980.

Regarding the marketing of products, at the beginning of start-up only half amount of each product will be consumed in domestic markets. Then, the following measures have been and will be taken.

1). For fostering the downstream industries, Japan International Cooperation Agency (JICA), a governmental body, dispatched a survey team to Iran in autumn of 1977 to prepare the master plan for processing industries of plastics, synthetic rubber, and synthetic fiber, responding to the request by NPC.

2). For half or more of each product exceeding domestic consumption, the Japanese group will export the products with their responsibility to Japan as well as Southeast Asian and other markets which Japan has developed.

3). Among such anticipated export procedures, Toyo Soda Manufacturing Co. will take a skillful measure. The company will export to Singapore a considerable amount of ethylene dichloride (EDC) to be produced here. In Singapore, as a member of newly established intermediate producers in the Singapore petrochemical complex, the company will produce vinyl chloride monomer (VCM) by using imported EDC from Iran and ethylene supplied by Petrochemical Corp. of Singapore which will be a building block producer. That means one mole of EDC and one mole of ethylene react each other to produce two moles of VCM without local supply of chlorine. And thus the VCM to be produced will be sold to Toyo Soda's affiliates not only in Singapore but also in Indonesia and other users.

Iranian people are said to be hard-working and of high efficiency. High class engineers have been transferred from NPC, but number of middle class engineers are limited, then they have been trained in respective Japanese enterprise's plant in Japan for which mutual language training for both parties' engineers started in 1973.

1-2. <u>South Korean Petrochemical Complex (Yochon Petrochemical Complex)</u>

(Refer to Case No.1 of Appendix 3)

Originally the project had been started by Japan's Mitsui and Mitsubishi groups under co-operation of products allotment. Just after the oil crisis happened, the Mitsubishi group gave up the project due to the difficulty of prediction. After then, Dow Chemical Co. of the U.S.A. and her affiliate, Korea Pacific Chemical Co. have taken

the project for the Mitsubishi group, though some modification was made. Final organization of the Yochon petrochemical complex is as follows:

Honam Ethylene Co., a national company in charge of building block production.

Mitsui & Co.	31%		
Mitsui Petr chemical	31%	Daiichi Chemical Industries	
Mitsui Toatsu Chemicals	31%		
Nippon Petrochemicals	7%	50%	Honam Petrochemical Co.
Yosu Petrochemical Co., a national company		50%	

Honam Petrochemical Co. is in charge of production of downstream, namely, high density polyethylene (HDPE), polypropylene (PP) and ethylene glycol (EG).

Dow Chemical Co. and Korea Pacific Chemical Co. are in charge of production of caustic soda, EDC, VCM and low density polyehtylene (LDPE).

At first, butadiene extraction from cracked C_4 fraction co-produced in the course of ethylene production by naphtha cracking had been considered to be undertaken by Nippon Petrochemicals Co. In August of 1977, however, the butadiene project was transferred to Korea Synthetic Rubber Co. because of the delay of decision by Nippon Petrochemicals, since the Korean side hastened the finalization of the project.

Due to rapid growth of the Korean economy, considerably large volumes of petrochemicals have been imported. For example, in 1975, all of styrene monomer, EDC, dimethyl terephthalate (DMT) and terephthalic acid (TPA), and EG were imported, and moreover a half of propylene, one-fifth of LDPE, 90% of HDPE, 60% of acrylonitrile, 55% of caprolactam, etc. were also imported. Then, almost all products from the complex will be consumed in domestic market, except at the beginning of start-up.

Under such conditions, piling work at the plant site started in October, followed by start of receiving of main equipment by the end of 1977, with expected completion in January of 1979 and commercial production by March, 1979.

In spite of the later start of planning than the Iranian case, the factors contributing such quick completion are rather good conditions of infrastructure, employee's training level and reduction of anticipated construction cost from original ¥120 billion to around ¥92 billion by using local fabrication instead of Japan.

1-3. Singapore Petrochemical Complex

(Refer to Case No.3 of Appendix 3)

Singapore Government has long desired to establish a petrochemical complex there, since Asian Industrial Development Council (AIDC) of ECAFE (now, ESCAP) concluded at the meeting held at Bangkok in 1969 that it would be desirable to establish a petrochemical complex in the Philippines or Singapore. Also considered was installation of production facilities for some downstream products in the Philippines, Singapore and Indonesia. Thailand declared in the meeting that she would proceed with a petrochemical complex project without assistance of ECAFE, though it is not materialised as mentioned later.

Meanwhile, Sumitomo Chemical Co. has intended to establish a petrochemical complex in Singapore, because her complexes in Japan have used naphtha supplied by Singapore Petroleum Co. (SPC) through a Japanese trading firm. Oil crisis and following price increases in every field seemed to cause heavy damage on her project.

Since then, Prime Minister Lee Kuan-yew of Singapore requested, every time he visited Japan, that the Japanese Government urge early materialization of the petrochemical complex project. On the other hand, Sumitomo Chemical Co. has endeavored to set up a Japanese consortium to get support of the Japanese Government.

Finally, the Japanese Government promised Prime Minister Lee in May, 1977 that it would render support to the project. It was realized by ¥3 billion participation of Overseas Economic Co-operation Fund (OECF), a governmental body, to establish Singapore Petrochemical Co. (SPCC) as a Japanese juridical person. Finally, in addition to OECF, 11 ethylene producers including Sumitomo Chemical Co. in condition of parity participation, 3 engineering companies, 3 trading firms and 4 banks participated in SPCC. Then, SPCC and the Singapore Government established Petrochemical Corp. of Singapore (PSC) in August with detailed conditions described in Case No.3 of Appendix 3.

PCS is the center company of the Singapore petrochemical complex in charge of building block production and utilities supply.

Several downstream joint ventures have been discussed but not yet officially published in detail. Among them, Shell's EG project supplied ethylene from PCS in exchange of naphtha supply and Toyo Soda's VCM project using EDC from Iran and ethylene from PCS as mentioned in Iranian petrochemical complex (1-1) may surely be included.

Regarding marketing, surplus of products over the Singapore market will be taken over by respective Japanese enterprise to export to other Southeast Asian market which developed by them.

In plant site at Plau Ayer Merubau (Merubau Is.) in front of Jurong Industrial Estate of Singapore, land reclaiming has almost been completed. Industrial water will be supplied from the main island by sub-marine pipeline. Comparatively good conditions of infrastructure and employee's training level will contribute to smooth construction work and start-up of operation.

1-4. Saudi Arabian Petrochemical Complex Project

Mitsubishi Shoji and Mitsubishi Petrochemical Co., as the Mitsubishi group, has long planned a petrochemical complex project in full scale, using mainly associated gas which has been burnt wastefully, including at first 500,000 MTA and later on changed to 300,000 MTA of ethylene plant.

Then, the Mitsubishi group and Saudi Arabian side in joint charge requested the feasibility study of the project to Lummus Company of the U.S.A. The study was concluded in 1975 that (1) the realizability of oil refining was considerable, but the petrochemical complex project had many difficulties, (2) if the construction of petrochemical complex could be performed, many difficulties such as operating efficiency and securing operating personnel would remain, and (3) the construction of 300,000 MTA ethylene plant based on natural gas cracking and derivatives plants would require at least $2.4 billion in 1975 price. Accordingly, the Mitsubishi group suggested the postponement of the project to Saudi Arabian party (Petromin, national oil company, at that time), but Petromin adhered to practice the project. After then, the Japanese Government who has been anxious

for the course of matter, has indicated its intention to support the project.

Considering every condition, the Mitsubishi group, not only the members mentioned at first but also including other members of the same family, has been anew endeavoring to materialise the project under close relation with the government. In December of 1977, the Ministry of International Trade and Industry (MITI) disclosed the result of discussion with Saudi Arabian Basic Industry Corp. (SABIC, Present Saudi Arabian party) that SABIC recognised the suggestion of the Japanese Government to postpone the feasibility study of the project again until after coming summer.

As the result of it, the realisation of the project will be delayed considerably. Until next summer, however, in-house study, namely preliminary study, will be done by the Japan side, and after then, a new feasibility study will be done in more detail.

Accordingly, the course of the event is difficult to foresee at present, in spite of both parties' enthusiasm. It could be safe to say that the project would be materialised after solving the following problems: (1) Chaotic condition of the worldwide economy causing the difficulty of future demand estimation is cleared and stable growth of the world economy is expected, and (2) to rise anticipated low level of operating factor as pointed out by the Lummus' report whatever measure should be taken, for example, practice of operation by the foreign legion.

1-5. Saudi Arabian Methanol Project

To realize early utilization of associated gas which has been burnt wastefully, SABIC designated Mitsubishi Gas-Chemical Co. to establish a joint venture for large methenol plant, say 2,000 short tons per day.

As one of the largest methanol producers in Japan, Mitsubishi Gas-Chemical Co. has invited Sumitomo Chemical Co. and Mitsui Toatsu Chemicals to be participants to give the project a national status and get the understanding of these companies. Mitsubishi Gas-Chemical has also invited Kyowa Gas Chemical Co. for the same purpose, but not yet get the understanding, because the latter company just gave up an another methanol project in Iran which had long embraced.

In such conditions and considering the difficulty of the Saudi Arabian petrochemical project of the same family, Mitsubishi Gas-Chemical has met passively the project and both parties have been doing the feasibility study expecting completion in coming March. At present, it is thought that it would be feasible and completion of the project is expected in 1982.

Regarding marketing, in principle, about 90% of methanol to be produced will be exported to Japan and other market which has been developed by Japan.

It is not to say there are no problems. At present, operating rate of Japan's methanol makers is as low as 60 to 70% of the capacities on average. This is due to scheduled imports under long term contracts. Among them, 150,000 MTA import contracts from Tae-Sung Methanol Co. in South Korea jointly established by Japanese and local parties (refer to

No. 2 case of Appendix 3) and 80,000 MTA import contract from Alberta Gas Chemical Co. of Canada for which the Mitsui group has financed the construction cost. Some portions of these contracted imports have been re-exported to overseas markets. On the other hand, another imports by another groups are also existed. Demand and supply balance over past three years in Japan is as follows: (1,000 MTA)

(Fiscal year)	1974	1975	1976
Domestic production	929.0	841.0	946.6
Domestic recovery*	63.0	59.7	54.1
Import	95.0	44.5	116.3
Supply total	1,087.0	945.2	1,117.0
Domestic demand	954.0	939.6	1,056.2
Export	50.0	14.3	24.6
Demand total	1,004.0	953.9	1,080.8
Balance	+27.0	-8.7	+36.2

(Note, * mainly from polyester fiber production using dimethyl terephthalate; short of balance in 1975 might be filled by running stock adjustment)

Under such circumstances, Higashi-Nihon Methanol Co. having 264,000 MTA of production capacity has only operated 16 months during the past 2 years and Nishi Nihon Methanol Co. having 330,000 MTA of capacity only 14 months for the same period of time. In contrast to such dark situation, production scheme of the Saudi Arabian methanol project is very simple compared with the complicated full scale petrochemical project, and it might develop the market not only for chemical use but also energy substitute and/or raw material for fermentation which have been prosperous in focusing topics.

1-6. Un-Materialized Thailand Petrochemical Project

This was the first project ever planned by Japanese enterprises for overseas petrochemical complex. From the early days, the Shell group had planned a petrochemical complex project in the Southeast Asian market. As the most potential market, the Shell group and a local partner in Thailand considered establishing the complex by welcoming Japanese partners to be in charge of necessary technologies and marketing of products.

Based on such thinking, it was decided that (1) production of building block such as ethylene would be handled by an affiliate to be established by the Shell group and a local partner by supplying naphtha from a Shell refinery there and (2) derivatives production would be done by respective joint venture of Japanese enterprise and separate local partner. Then, several paper companies were formed to study. However, the Japanese Government at that time requested the Japanese partners not to import the products to be produced there to the Japanese market, in order that Japan's market would not be confused.

By the way, Prime Minister of Thailand declared in the meeting of AISC of ECAFE at Bangkok in 1969 that Thailand would not need assistance of ECAFE for proceeding her petrochemical project. Regarding ethylene price the first suggestion by Shell group was so high. In order to reduce the ethylene price, several discussion meetings were held in Bangkok and Tokyo. Before finalized the ethylene price at mutually acceptable level, sudden increase of crude oil price happened and made the project impossible to materialize. Then, the Japanese side proposed to postpone the project until economic conditions would be stabilized. Thailand side sentenced the proposal not to have an intention

to materialize.

That was an unhappy affair for both parties. There are some precepts for future international projects.

1). That was the first case for a Japanese enterprise to establish a full scale petrochemical complex overseas.

2). In spite of it, the decision right of price for building block was held by a major oil company as a private deal without any intervention by relating governments.

3). Regarding marketing, MITI of Japan approved the planning of Japanese enterprises provided that products to be produced overseas would not be imported into Japan.

4). In addition to these difficult condiditions, the oil crisis gave a decisive blow to knock down the project.

As a conclusion, the circumstances were too premature for early realisation of the project.

I-7. Discontinued Indonesian Petrochemical Projects

Based on the result of feasibility study of the petrochemical industry in Indonesia prepared by Japan Gasoline Co. (now, JGC Corp.) under the contract with UNIDO in 1973, Pertamina, a national oil company, asked a Japanese trade firm to plan a petrochemical project using natural gas condensate. Accordingly, two petrochemical companies and two trading firms in Japan formed and dispatched a survey team in order to establish a joint venture with Pertamina for using gas condensate to produce olefins and their downstream products in North Sumatra.

In addition, two synthetic fiber enterprises in Japan separately approached Pertamina to set up a joint venture for production of aromatics and raw materials for synthetic fiber using catalytic reformate of naphtha being supplied by the refinery, for supplying products to the respective joint venture of synthetic fiber in Indonesia.

The former petrochemical team prepared the detailed feasibility study for the project and submitted it to President (at that time) Sutowo of Pertamina on his visit to Tokyo. But Mr. Sutowo disclosed that the right of using natural gas condensate and catalytic reformate for petrochemical production had already been sold to an American enterprise. At the moment, Indonesian petrochemical projects by Japanese groups disappeared. After then, we have not heard any news that the petrochemical industry in the country is in the course of materialization.

2. Possibilities of Future Projects

2-1. Co-operation of Japanese enterprises with developing countries in the future.

In Japan, 18 ethylene plants belonging to 14 petrochemical enterprises are operating at 5,313,800 MTA of nameplate capacity including a just completed 300,000 MTA plant and a 400,000 MTA plant. In addition, two enterprises have obtained governmental approval to construct two ethylene plants 400,000 MTA each. But they have postponed their construction, because of low operating rate at present, as low as 70% of nameplate capacity on average. The two construction plans may appropriate for demand a few years later, considering shutdown or dismantlement of old facilities.

In future, the difficulty in obtaining land for new plant site in Japan would allow to construct only from 1.5 to 2.0 million MTA additional capacity and downstream facilities in total. Therefore, Japanese enterprises have likely taken the following two policies.

1). Japanese exports of petrochemicals to developing countries have been and will be replaced by local production in the form of licensing or turn-key base export of technology, such as shown in Appendix 1, or joint venture establishment, such as shown in Appendix 2.

2). Japan has been and will be interested in establishing joint venture project with an agreement to buy back a large part of output for the Japanese domestic market or any market where has been or will be developed by Japanese enterprises, such as shown in previous Chapter and Appendix 3.

2-2. Petrochemical projects in developing countries which could help satisfy the growth in Japan's requirements after 1985.

An authorized committee of MITI of Japan published anticipated long term ethylene demands until 1985 as follows:

	(1,000 MTA)			Ann. growth rate	
	1976	1980	1985	'80/'76	'85/'80
Domestic ethylene demand	3,070	4,140	5,650		
Export demand equivalent to ethylene	710	600	600		
Total ethylene demand	3,780	4,740	6,250	6.3%	5.7%

After 1985, if demands would grow by 5% per annum over 1985-1990 and 3% per annum during 1990-2000, then ethylene requirements, even only for the domestic market, will increase from 5,650 thousand tons in 1985 to 7,211 thousand tons in 1990 and 9,691 thousand tons in 2000.

One may also assume that requirements for propylene, butadiene, and aromatics will grow at the same rate as that of ethylene mentioned above. In which case, future demands for these building blocks are as follows: (1,000 MTA)

	1976	1980	1985	1990	2000
Ethylene	3,040	4,140	5,650	7,211	9,691
Propylene	2,635	3,364	4,436	5,664	7,612
Butadiene	601	767	1,012	1,292	1,736
Benzene	1,843	2,353	3,105	3,963	5,326
Toluene	803	1,025	1,352	1,726	2,061
Xylenes	1,313	1,676	1,772	2,262	2,701

Such balanced requirements of building blocks could be supplied by naphtha cracking. Recent developments of cracking technology allow to use gas oil in place of naphtha, though the yield pattern changes somewhat. Naphtha and supplemental gas oil supplies will become available when some developing countries establish export-oriented refineries.

Ethylene, propylene, and small quantities of butadiene can be derived from natural gas or associated gas. When these raw materials are used, methane must be removed first; this can be used for the production of either methanol or ammonia, or LNG. In this case, aromatics which would be in short supply could be provided by catalytic reforming of naphtha.

Regarding the form of co-operation with developing countries, Japanese enterprises would like to have joint venture (i.e. joint ownership) implying joint management responsibility. In such case, Japan would contribute the market; developing countries contribute the raw materials. Financing would be done jointly or if necessary from Japan. Training of operating staff would be done by Japanese experts in Japan and/or at the new plant site.

2-3. <u>Project that can be established in developing countries by use flared gas.</u>

There are a number of alternatives:

1). Use all gas to produce methanol or ammonia, or LNG,

2). extract methane to produce methanol or ammonia, or LNG,
extract ethane to produce ethylene, and
export remaining propane and butane as LPG,

3). extract methane to produce methanol or ammonia, or LNG and use remaining ethane, propane, butane and heavier fractions to produce ethylene, propylene and small quantity of butadiene.

As regards alternative 1), demand and supply of methanol in Japan would be estimated as follows, if annual growth rates were the same as that of ethylene mentioned above. (1,000 MTA)

	1976	1980	1985	1990	2000
Methanol demand	1056.2	1346.8	1779.3	2384.4	3388.6
Required capacity*	--	1496.4	1977.0	2649.3	3687.3
Existing capacity	1426.5	1756.5**	1756.5	1756.5	1756.5
Short of capacity	--	--	220.5	892.8	1910.8

(Note: * Assuming operating rate is 0.9;
** The figure is expected to attain in 1978)

In fact, the existing capacity after 1980 would be shut-down or dismantled due to obsolescence, but it might be replaced by scrap-and-build.

By the way, there could be no prospective market in Japan for ammonia, because surplus capacity already exists and export in the form of nitrogenous fertilizers which occupies about half the amount of present capacity in Japan will be seen to diminish due to construction of ammonia plants in export markets.

As regards alternative 2), Japan uses propane for household fuel and butane either for industrial fuel or for methanol or ammonia production. According to an authorized estimate of LPG demand and supply by MITI, 11,231 thousand tons of demand in 1976 will increase to 16,036 thousand tons in 1980, that means average annual growth rate is about 9.3%, but the rate

for 1981-1990 is 6.3%. Then assuming that the rates in future are 6% for 1980-1985, 5% for 1985-1990 and 3% for 1990-2000. Moreover, import ratio in total supply was about 60% in 1976 and it will be 67.7% in 1980, then assuming the ratios in future are 70% in 1985, 75% in 1990 and 80% in 2000, in consideration of gradually approaching the maximum supply of domestic production. The results are as follows:

(1,000 MTA)

	1976	1980	1985	1990	2000
LPG demand	11,251	16,036	22,747	29,032	39,017
Domestic supply	4,500	5,169	6,828	7,258	7,803
Import required	6,571	10,867	15,923	21,774	31,214

As regards alternative 3) prospects were discussed in Chapter 2-2. Japan is therefore interested in one of these alternatives; the choice would depend on the preference of the oil or natural gas producing country.

3. Other Ways of Japanese Co-operation

3-1. Training course on the petrochemical industry for developing countries organized by Japan.

The petrochemical industry is a complicated and elaborated industry concentrating every field of technology, not only chemical, but also mechanical, electrical and in civil engineering, etc. To plan, to construct, to operate, and to maintain the petrochemical plant in proper condition, and to sale the petrochemicals, so many kinds of knowledge are required.

For training personnel of developing countries in such necessary knowledge, Japan has endeavored by following measures:

1). For Middle East and North African participants, Japan International Co-operation Agency (JICA), a governmental body, has organized since 1975 with assistance of MITI about 40 days' course of lectures on desk by every field's business experts and inspection of petrochemical complexes and related factories. Lecture on desk contains general features of the petrochemical industry, planning schedule, the importance of infrastructure, individual production process of petrochemicals, consideration of environmental problems, etc. In past twice training, 12 persons consisted of the following members graduated the course. (In parenthesis means number of female participants).

Egypt	2	(1)	Kuwait	3
Iran	3		Libya	2
Iraq	1	(1)	Saudi Arabia	1

And a third course of this training will be held from March 20 to April 29, 1978.

2). For ESCAP region's participants, Asian Productivity Organization (APO) has organized the training course for industrialisation every year since 1972 in co-operation with Japanese productivity Organization (JPO). The participants meet in Manila every February or March. After collective training for industrialization by Asian Development Bank in Manila, the participants arrive in Tokyo and receive respective training course separately in which the petrochemical course has been trained by JCC Corporation. The lecture and exercise contain general features of the petrochemical industry, special features of catalytic reactions, environmental consideration, and planning of a model petrochemical complex. Inspection of the petrochemical complex has also been scheduled. Every year, of about 40 participants in total, 3 to 7 members graduate the petrochemical course. Past participants in the course were counted 25 as follows: (in parentheses means women).

Bangladesh	1		Singapore	1
Hongkong	1		South Korea	2
India	2		Sri Lanka	2
Indonesia	2		Taiwan	5 (1)
Nepal	1		Thailand	3 (1)
Philippines	5 (2)			

From February 13, this year's training course is to be opened.

3). Japanese Government has made available a portion of its technical co-operation fund for training of operating and maintenance personnel at the plants designed and built by Japanese enterprises in developing countries.
The course differs from enterprise to enterprise and from plant site to site for training employees to give knowledge and practice for design, welding, construction, test operation, chemical analysis, maintenance, plant management, etc.

4). Japanese engineering firms have established affiliates in developing countries in either wholly owned or joint venture for smooth execution of business there by training local engineers and laborers, as follows:

4-1). Chiyoda Chemical Engineering & Construction Co.

Singapore:	Chiyoda Singapore (Pte) Est.	1971
Iran:	Chiyoda Iran Co. (Pte)	1974
"	Payeam Co. (Pte), Participation	1974
Saudi Arabia:	Chiyoda Petroster Ltd.	1975
Brasil:	Chiyoda International S.A.	1975

4-2). JGC Corporation

Indonesia:	P.T. Pertafenikki, Joint venture	1974
Brasil:	A. Araujo S/A Engenharia e Montagem, Participation	1974
Malaysia:	PERMAS Engineering	1975

4-3). Niigata Engineering Co.

Brasil:	Niigatabras Engenharia S.A.	1959
Hongkong:	Niigata Engineering (HK) Ltd.	1974
Ajman:	Arab Heavy Industries, Ltd.	1976

4-4). Toyo Engineering Corp. (TEC)

India:	Toyo Engineering Corp., India	1966
S. Korea:	Kankoku Toyokako	1968
Brasil:	Toyo Engenharia e Construtora Ltda.	1967
Iran:	Toyo Engineering Corp., Iran	1974

3-2 Fostering processing industries for petrochemicals.

Petrochemicals in the category discussed here are those just before being supplied to processing industries. The processing industries for petrochemicals include the industries making them for plastic goods, synthetic rubber goods, textiles, detergents, paints, printing inks, dyestuffs, pharmaceuticals, etc.

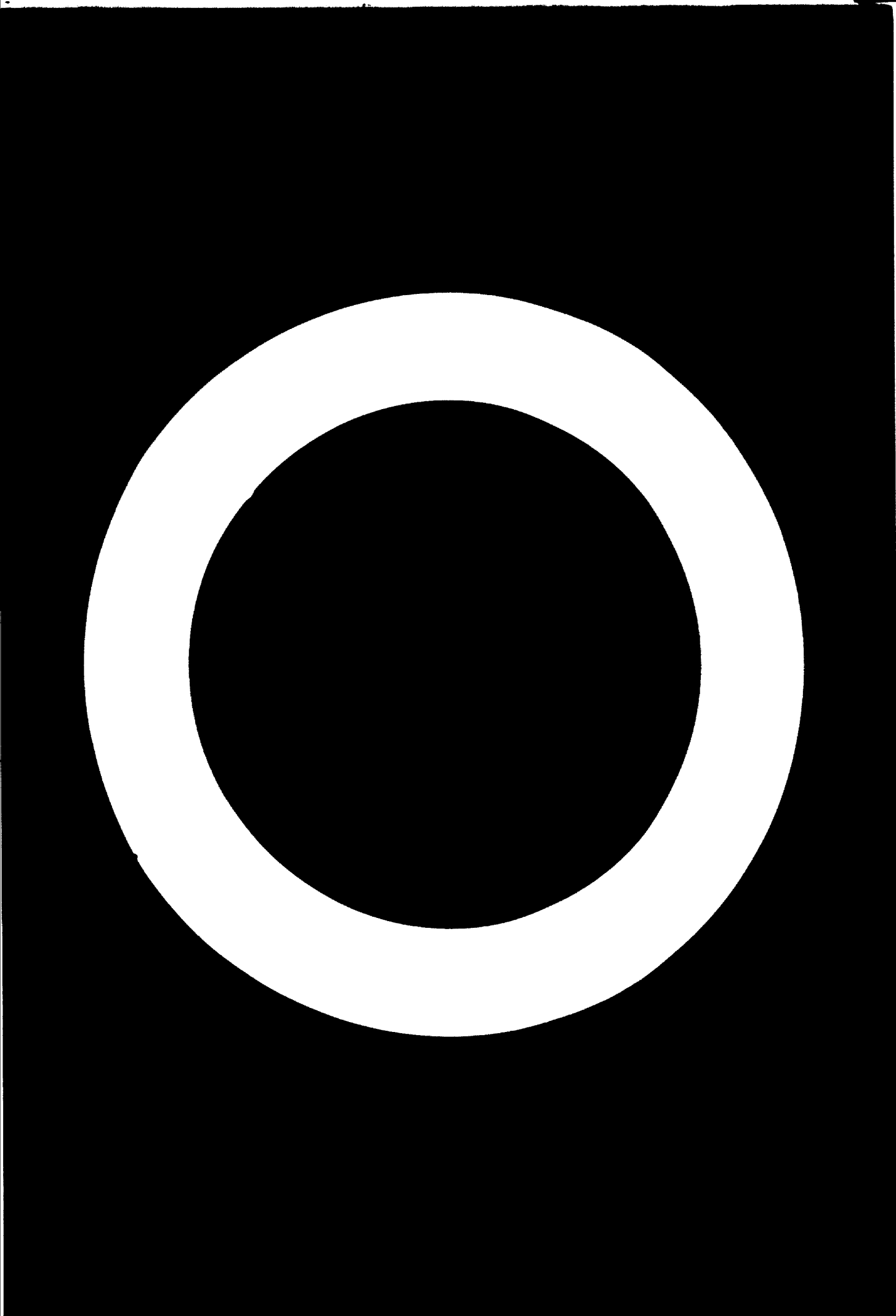
In Japan, the petrochemical industry is supported by these industries as shown in numbers of plants and employees here. (Number of employees in 1,000).

	1974		1975		1976	
	Plant	Empl.	Plant	Empl.	Plant	Empl.
Chemical industry, total	2,225	189.4	2,239	185.2	2,231	181.0
Petrochemical industry	181	38.2	183	39.3	186	38.2
Synthetic organics*	337	38.9	335	38.7	342	37.6
Plastic industry*	309	43.6	319	43.2	317	42.2
Synthetic rubber*	24	5.3	24	5.4	24	5.4
Detergent industry	158	14.6	154	13.4	159	13.3
Paint industry	189	12.6	191	12.0	201	12.2
Printing ink industry	71	3.7	72	3.6	72	3.6
Synthetic fiber industry	--	85.8	--	91.3	--	--

(Note: * Some figures overlap those of petrochemical industry).

According to these data, the petrochemical industry occupies about 8.3% of the total number of plants of the chemical industry and about 21% of total employees; if the synthetic fiber industry is included, the ratio of total employees would be around 14%. That means the petrochemical industry is supported by about 6 times the plants of downstream industries and 3 times the employees of other chemical industries or 5.3 times the employees if synthetic fiber industry is included.

Therefore, to attempt reliable growth of the petrochemical industry, these downstream industries should be fostered to grow in local and overseas markets. For which case, Japanese enterprises have fully endeavored as shown in Appendix 4.



Appendix 1. Licensing or Turn-key Basis Export of Japanese Technologies in the Field of Petrochemical Industry to Developing Countries

Supplier	Country	Client		Year
Asahi Chemical	Mexico	PEMEX	LDPE	1973
" "	"	"	HDPE	1973
Chisso Corp.	S. Korea	Korea Petrochemical	PP	1971
Chiyoda Chemical Engineering & Construction	S. Korea	Korea Caprolactam	Caprolactam	1972
Japan Synthetic Alcohol	S. Korea	Chungju Fertiliser	Synthetic Ethanol	1973
Japan Synthetic Rubber	Brasil	Petroquisa	ABS resin	1972
" " "	S. Korea	Lucky Chemical	" "	1976
Kanegafuchi Chemical	S. Korea	Yu Ho Chemical	PVC	1967
Kureha Chemical	India	Plastic Legin	"	1970
Mitsubishi Gas-Chemical	India	Assam State	Me. Methacrylate	1973
Mitsubishi Metal	Brazil	Methanol ASA	Methanol	1972
Mitsubishi Monsanto Chemical	Iran	IRNIP (See App.3)	DOP	1973
Mitsubishi Rayon	India	Polymer Corp.	MMA & PMMA	1975
Mitsui Petrochmical	Argentine	Tachmetos Petro.	PP	1975
Niigata Engineering	Colombia	Empr. Colombipetro.	Deterg. Alkylate	1970
Nippon Zeon	Brazil	Copene	Butadine Extraction	1974
" "	S. Korea	Lucky Chemical	PVC	1975
" "	Brazil	Cosper (III)	Butadiene Extraction	1977
Shin-etsu Chemical	Philippines	Mabuhay Vinyl	PVC	1961
" "	Pakistan	Arokey Chemical	"	1964
" "	S. Korea	Lucky Chemical	DOP	1968
Toyo Engineering	Algeria	SONATRACH	Ethylene, VCM & PVC	1971

Appendix 2. Petrochemical Joint Ventures of Japanese Enterprises in Developing Countries for Local Market in Place of Export from Japan.

REPUBLIC OF KOREA

1. [redacted], established in 1972.

Japanese partner: Ube-Nitto Kasei Co. (50%) and Mitsui & Co. (25.0%)
Local partner:
Capital fund: Won 207 million
Product: Polypropylene

2. [redacted], established in 1972.

Japanese partner: Toray Industries (40%)
Local partner:
Capital fund: Won 5.6 million
Product: Polyester fiber

3. [redacted], established in 1973.

Japanese partner: Toyo Menka Kaisha (45.0%) and Sanyo Chemical Co. (4.0%)
Local partner: Jin-Yang Chemical Co. (50%)
Capital fund: US$ 2 million
Product: Polyether for polyurethane
Raw material supply: Propylene oxide imported from Japan

4. [redacted], established in 1976.

Japanese partner: Nippon Petrochemicals Co. (50%)
Local partner: Korea Polyester Inc. (5%) and Private Investment Corp. of Asia (Singapore) (PICA) (10%)
Capital fund: Won 300 million
Product: Petroleum resin 5,000 MTA

5. [redacted], established in 1971.

Japanese partner: Toray Industries (40%)
Local partner:
Capital fund: Won 2.4 billion
Product: Polyester fiber

6. KUKKA SYNTHETIC RUBBER CO., established in 1971.

Japanese partner: Japan Synthetic Rubber Co. (37.5%) and Mitsui & Co. (12.5%)
Local partner: Sanyang Tire Co. (50%)
Capital fund: Won 1.57 billion
Product: SBR 25,000 MTA
Butadiene will be produced in Yochon Petrochemical Complex

7. SUNKYONG-TEIJIN CO., established in 1969.

Japanese partner: Teijin Ltd. (50%)
Local partner:
Capital fund: Won 4.53 billion
Product: Polyester fiber

8. TAE-NONG PETROCHEMICAL CO., established in 1974.

Japanese partner: Mitsui Toatsu Chemicals Inc. (30%) and
Toyo Menka Kaisha (20%)
Local partner: Tae Nong (50%)
Capital fund: US$3.6 million
Product: Maleic anhydride 10,000 MTA
Marketing: Due to small demand in local market, 60% of product is taken over by Mitsui Toatsu for which Mitsui Toatsu stopped the operation of her plant in Japan. Moreover, about 20% of product is taken over by Toyo Menka for third country market.

9. TONG-SUH PETROCHEMICAL CO., established in 1974.

Japanese partner: Asahi Chemical Industry (50%)
Local partner: Han-Il Synthetic Fiber CO. (50%)
Capital fund: US$14 million
Product: Acrylonitrile 27,000 MTA and construction works for 77,000 MTA has been done.
Raw material: Korea Oil Co. (KOCO) has supplied propylene, but chronically short supply has been supplemented by import propylene from Japan or even from Western Europe.

THE PHILIPPINES

10. PHILIPPINES PETROCHEMICAL PRODUCTS INC., established in 1974.

Japanese partner: Mitsui & Co. (18%) and Sumitomo Chemical Co. (8%)
Local Partner: Litwin, french engineering company (9%), Bunjeta, licensee of the U.S.A. (4%) and others
Capital fund: Peso 10 million
Product: Polystyrene 80,000 MTA
Raw material: Styrene monomer has been supplied from Japan

11. PHILIPPINE SYNTHETIC FIBER CO., established in 1971.

Japanese partner: Teijin Ltd. (34.1%) and Toyo Rayon Kaisha (4.9%)
Local partner: General Fiber Co. (61%)
Capital fund: Peso 86.64 million
Product: Polyester fiber
Raw material: Dimethyl terephthalate (DMT) and ethylene glycol (EG) supplied from Japan

12. PHILIPPINE POLYAMIDE INDUSTRIAL CO., established in 1973.

Japanese partner: Toray Industries (26%) and Atcha & Co. (15%), may-be transferred to C. Itoh & Co.
Local partner: ITT group (65%)
Capital fund: Peso 55 million
Product: Nylon fiber

13. POLYSTYRENE MANUFACTURING CO., established in 1974.

Japanese partner: Mitsubishi Shoji (15%)
Local partner:
Capital fund: Peso 4 million
Product: Polystyrene

THAILAND

14. TEIJIN POLYESTER (THAILAND), established in 1970.

Japanese partner: Teijin Ltd. (50%)
Local Partner:
Capital fund: Baht 218 million
Product: Polyester fiber
Raw materials: DMT and EG from Japan in principle.

15. THAI PLASTIC & CHEMICAL CO., established in 1971.

Japanese partner: Mitsui & Co. (66.7%) and Mitsui Toatsu Chemicals Inc. (10%)
Local partner: Tablace
Capital fund: Baht 50 million
Product: PVC 18,000 MTA
Raw material: Vinyl chloride monomer (VCM) from Japan

MALAYSIA

16. MALAYAN ELECTRO CHEMICAL INC., established in 1972.

Japanese partner: Nippon Zeon Co. (27.78%) and Nichimen Co. (11%)
Local partner:
Capital fund: M$4.46 million
Product: PVC 12,000 MTA
Raw material: VCM from Japan

17. PERWIRER SEMBIRIAN BERHAD, established in 1974

Japanese partner: Toray Industries (62.5%)
Local partner:
Capital fund: M$30 million
Product: Polyester fiber

18. PETROCHEMICALS SEMBIRIAN BERHAD, established in 1973.

Japanese partner: Idemitsu Petrochemical Co. (20%) and Sumitomo Shoji (14%)
Local partner:
Capital fund: M$2 million
Product: Polystyrene

SINGAPORE

19. SINGAPORE POLYMER CORP., established in 1972.

Japanese partner: Sumitomo Shoji (42.86%), Idemitsu Petrochemical Co. (22.16%), Toyo Soda Manufacturing Co. (11.76%) and Sumitomo Chemical Co. (8.4%)

Local partner:

Capital fund: S$5 million

Product: PVC

Raw material: VCM from Japan

20. MAZDA PLASTIC FACTORY, established in 1972.

Japanese partner: Mitsui Co. (23%)

Local partner:

Capital fund: S$1.3 million

Product: PVC

Raw material: VCM from Japan

INDONESIA

21. P.T. EASTERN POLYMER CO., established in

Japanese partner: Tokuyama Soda Manufacturing Co. and Mitsubishi Shoji

Local partner:

Capital fund:

Product: PVC 15,000 MTA

Raw material: VCM from Japan

22. P.T. FINNFICO JAYA, established in 1974.

Japanese partner: Teikoku Kako Co. (25%) and Toyo Menka Kaisha (25%)

Local partner: P.T. Lautan Luas (sulfuric acid maker), P.T. Sinar Antjur and P.T. Wings, (both detergent makers)

Capital fund: US$1.6 million

Product: Alkylbenzene sulfonate (ABS) 20,000 MTA

Raw material: Detergent alkylate from Japan

23. P.T. INDONESIA TORAY SYNTHETICS, established in 1971.

Japanese partner: Toray Industries (58.7%) and Mitsui & Co. (25.15%)

Local partner: Polaco (16.15%)

Capital fund: US$13 million

Product: Nylon and Polyester fibers

Raw Material: Imported from Japan

24. P.T. KURARAY MANUNGALI FIBER INDUSTRIES, established in 1975.

Japanese partner: Kuraray Co. (40%) and Maruboni Corp. (30%)
Local partner:
Capital fund: US$12,000
Product: Polyester fiber
Raw material: Imported from Japan

25. P.T. STANDARD TOYO POLYMER, established

Japanese partner: Toyo Soda Manufacturing Co. (30%) and Mitsui & Co. (30%)
Local partner:
Capital fund: US$4 million
Product: PVC
Raw Material: VCM from Japan & Singapore, after completion of Singapore Petrochemical complex in which Toyo Soda will produce VCM by reaction of EDC to be supplied from Iranian petrochemail complex and ethylene there.

26. P.T. TEIJIN INDONESIA FIBER CORP. (TIFICO), established in 1973.

Japanese partner: Teijin Ltd. (80%) and Toyo Menka Kaisha (20%)
Capital fund: US$15 million
Product: Polyester fiber
Raw material: DMT and EG from Japan

MEXICO

27. FIBRAS ACRYLICAS S.A., established in 1969.

Japanese partner: Asahi Chemical Industry Co. (6.25%)
Local Partner:
Capital fund: US$4 million
Product: Acrylic fiber

NICARAGUA

28. POLIMEROS CENTRO-AMERICANOS, established in 1968.

Japanese partner: Shin-etsu Chemical Co. (30%) and Mitsui Co. (10%)
Local partner:

Capital fund: Cordoba 1.5 million

Product: PVC 12,000 MTA

Marketing: Not only domestic but also other Latin American market.

VENEZUELA

29. PETROSOL CA. established in 1977.

Japanese partner: Tokuyama Soda Manufacturing Co. (13.4%) and Nissho-Iwai Co. (6.6%)

Local partner: Instituto Venezueiano Petroquim (IVP) (40%) and Interquim (40%)

Capital fund: ¥2.1 billion

Product: Isopropyl alcohol and acetone

Raw material: Propylene supplied by local source.

BRAZIL

30. NOBACRYL S.A., established in 1975.

Japanese partner: Asahi Chemical Industry Co.

Local partner:

Capital fund: Cr.740 million

Product: Acrylic fiber

31. SAFRAN-TEIJIN INDUSTRIAL BRASILEIRAS, established in 1972.

Japanese partner: Teijin Ltd. (37.5%)

Local partner:

Capital fund:

Product: Polyester fiber.

Appendix 3. Export-oriented Petrochemical Joint Ventures in Developing Countries by Japanese Enterprises

REPUBLIC OF KOREA

1. HONAM PETROCHEMICAL CO., established in 1975
   (in Yeochon Petrochemical Complex)

Japanese Partner	: Daiichi Chemical Industries (50%) established by Mitsui & Co. (31%), Mitsui Petrochemical Co. (31%), Mitsui Toatsu Chemicals Inc. (31%), and Nippon Petrochemicals Co. (7%)
Local Partner	: Yosu Petrochemical Co. (50%) a national company
Capital Fund	: ₩36 billion
Total Investment	: ₩118.2 billion may be reduced to around ₩92 billion by using local fabrication instead of Japan
Financing by Japan	: 78.2 billion which consists of ₩18 billion of financing by Japanese partner and ₩60.2 billion of deferred payment for construction cost.
Products Pattern	: High Density Polyethylen (HDPE) 70,000 MTA Polypropylene (PP) 80,000 MTA Ethylene Glycol (EG) 80,000 MTA
Raw Material	: Ethylene and Propylene will be supplied by Honam Ethylene Co., another national company, with 350,000 MTA ethylene production unit by naphtha cracking, for which Japanese contractor provides ₩29.8 billion of defferred payment. Naphtha for ethylene unit will be supplied by Honam Oil Refinery Co., a joint venture of Lucky Chemical Co. and Caltex of the U.S.A.

Plant Site	: Yosu, Yochon county, South Central of Republic of Korea
Marketing	: Mainly for domestic market, but for a few years after completion surplus will be exported by Japanese partner.
Completion	: January 1979 and start-up is expected in March 1979.
Remarks	: Dow Chemical Co. and her affiliate, Korea Pacific Chemical Co., will participate in the complex.

2. TAE-SUNG METHANOL CO., established in 1973.

Japanese Partner	: Mitsubishi Shoji (37.5%) and Shinetsu Chemical Industry Co. (12.5%)
Local Partner	: Tae-Sung Lumber (50%)
Capital Fund	: Won 6 billion
Product	: Methanol 300,000 MTA
Raw Material	: Supplied by Korea Oil Co.
Plant Site	: Ulsan.
Marketing	: A half of production, i.e. 150,000 MTA has been exported to Japanese market and third countries.
Completion	: 1977.

SINGAPORE

3. PETROCHEMICAL CORP. OF SINGAPORE, established in 1977

Japanese Partner : Singapore Petrochemical Co. (SPCC) (50%) established by Overseas Economic Cooperation Fund (OECF) of Japan (30%), 11 ehtylene producers (4% each by Sumitomo Chemical Co., Mitsui Petrochemical Co., Mitsubishi Petrochemical Co., Showa Yuka K.K., Idemitsu Sekiyu Kagaku K.K., Asahi Chemical Industry Co., Shin-Daikyowa Petrochemical Co. Asahi-Dow Ltd., Nippon Petrochemicals Co., Maruzen Petrochemical Co., and Tonen Sekiyu Kagaku K.K.), 5 engineering

companies (4% each by Ishikawajima-Harima Heavy Industries Co., Kajima Corp., and JGC Corp. and 2% each by Hitachi Ltd. and Hitachi Shipbuilding & Engineering Co.) 3 trading firms (2% each by Sumitomo Shoji, C. Itoh & Co., and Marubeni Corp.) and 4 banks (1% each by The Industrial Bank of Japan, The Long-Term Credit Bank of Japan, and The Nippin Credit Bank)

Local Partner : Singapore Government 50%

Capital Fund : S$3 million

Investment : ¥185.2 billion
of which ¥106.8 billion for building block and utilities section and ¥78.4 billion for derivatives section

Financing : A portion excluding that provided by credit of Nippon Export & Import Bank will be raised by both partners on halves.

Products Pattern : (Building Block)

Ethylene	300,000 MTA
Benzene	60,000 MTA
Toluene	38,000 MTA
Xylenes	27,000 MTA

(whether SPCC or Singapore Petroleum Co. take charge of BTX project is still pending)

(Derivatives)

LDPE	120,000 MTA
PP	100,000 MTA

(by a joint venture of Sumitomo Chemical Co. and local interest).

HDPE	50,000 MTA

(by a joint venture of Asahi Chemical Industry and local interest)

Ethylene Oxide	100,000 MTA
Ethylene Glycol	120,000 MTA

(by a joint venture of Mitsubishi Petrochemical Co. and local interest.

Shell group may be involved as a shareholder of Mitsubishi Petrochemical)

(Later Projects)

VC Monomer	150,000 MTA
(being negotiated with Dow Chemical Co.)	
2-Ethyl Hexanol	34,000 MTA
(being negotiated with Kyowa Yuka Co.)	

Other projects are also considered.

Raw Material : 658,000 MTA of naphtha and 436,000 MTA of gas oil for cracking will be supplied by Singapore Petroleum Co. (C. Itoh's affiliate), Shell Eastern Petroleum and Esso Singapore in equal amounts by submarine pipelines.

Utilities : Electricity and industrial water will be provided by Singapore Government. For industrial water, which will be supplied by submarine pipeline, the Government signed a contract to get 30,000 ton/day of water from Johor State Government of Malaysia.

Plant Site : Pulau Ayer Merbau (Merbau Is.) in front of Jurong Industrial Estate of Singapore

Marketing : Mainly for export to South-East Asian countries where Japanese enterprises have developed the market over long years

Completion : 1981 - 1982

Remarks : The information referred here does not contain the project in which Toyo Soda Manufacturing Co. will bring EDC from Iranian petrochemical complex to react it with ethylene to make VCM as mentioned in Chapter 1. This would mean that condition in Iranian project has changed or that some adjustment is being made on VCM project in this complex between Toyo Soda and Dow.

IRAN

4. IRAN JAPAN PETROCHEMICAL CO. (IJPC), established in 1974.

Japanese Partner : Iran Chemical Development Co. (ICDC) (50%)
established by Mitsui & Co. (45%), Mitsui Toatsu Chemical Inc. (22%), Toyo Soda Manufacturing Co. (15%), Mitsui Petrochemical Co. (13%) and Japan Synthetic Rubber (5%)

Local Partner : National Petrochemical Co. (NPC) (50%)
a wholly owned affiliate of the National Iranian Oil Co. (NIOC)

Capital Fund : ¥100 billion

Total Investment : ¥550 billion

Financing by Japan: ¥300 billion
consists of ¥28.8 billion of Yen credit guaranteed by Japanese Government, ¥60 billion of direct loan by Nippon Export & Import Bank, ¥50 billion by Japanese partner, ¥125 billion of bank loans and ¥36.2 billion of deferred payment of construction cost.

Products Pattern :		
	Ethylene	300,000 MTA
	Propylene	120,000 MTA
	Butadiene	25,000 MTA
	Caustic soda (solid)	50,000 MTA
	" " (liquid)	190,000 MTA
	EDC	300,000 MTA
	(VCM	150,000 MTA)*
	LDPE	100,000 MTA
	HDPE	60,000 MTA
	PP	50,000 MTA
	SBR	40,000 MTA
	Benzene	330,000 MTA
	(Para-xylene	100,000 MTA)**
	(Ortho-xylene	20,000 MTA)**

Styrene monomer	100,000 MTA
(Cumene	150,000 MTA)**
Ethylene glycol	50,000 MTA

(Note: * Originally planned, but recently the project would be transferred to Abadan Petrochemical Co., an affiliate of NPC;
** Originally planned, but recently the projects would be postponed due to the market situation and the reduction policy of the total investment).

Raw Material : Natural gas from National Gas Co. (NGC), another affiliate of NIOC, and Naphtha from Abadan Refinery of NIOC.

Plant Site : Bandar Shahpur, east of Abadan.

Marketing : At the beginning of operation, half amount of each product will be taken over by Japanese enterprises for sale to mainly Japan and Southeast Asian and other markets.

Completion : 1980

Remarks : Raw material prices are not yet decided by NIOC and NGC.

5. IRAN NIPPON PETROCHEMICAL CO. (INPIP), established in 1973.

Japanese Partner : Mitsubishi Chemical Industries (24%) and Nissho-Iwai Co. (24%)

Local Partner : NPC

Capital Fund : Rial 4.56 million

Products Pattern : [Octanol (2-ethyl hexanol) 28,000 MTA]*
Phthalic anhydride 20,000 MTA
Dioctyl phthalate (DOP) 40,000 MTA

(Note: * For the time being, it has been imported from Japan)

Raw material : After completion of IJPC's complex, propylene will be supplied for the production of octanol;

ortho-xylene as a raw material for the production of phthalic anhydride has been and will be imported from Japan until IJPC will produce it.

Plant Site : Bandar Shahpur.

Marketing : DOP as a plasticizer mainly for PVC resin has been solely for domestic market.

Completion : 1976.

SAUDI ARABIA

6. MITSUBISHI GROUP'S PETROCHEMICAL COMPLEX PROJECT.

Japanese Partner : Originally Mitsubishi Shoji and Mitsubishi Petrochemical Co., but recently an effort has been made to materialize the project by whole Mitsubishi family or by larger group in order to get governmental support.

Local Partner : Formerly Petromin, but now Saudi Arabian Basic Industry Corp. (SABIC)

Plant Site : Al-Jubail

Raw Material : Associated gas which has been burnt wastefully.

Progress of the Project : See 1-4 (page 9).

7. MITSUBISHI GAS-CHEMICAL'S METHANOL PROJECT.

Japanese Partner : Mitsubishi Gas-Chemical Co. and by her invitation, Sumitomo Chemical Co. and Mitsui Toatsu Chemicals Inc., and may-be Kyowa Gas-Chemical Co.

Local Partner : SABIC

Plant Capacity : 2,000 short tons per day

Raw Material : Associated gas.

Marketing : More than 90% of production will be exported to Japan and other market where Japanese enterprises has been developed.

Present Status : Under proceeding the feasibility study with expectation of completion in coming March. See 1-5 (page 11).

BRAZIL

8. CIQUINE COMPANHIA PETROQUIMICA (CCP), established in 1973.

Japanese Partner	: Mitsubishi Chemical Industries (16.67%), Mitsubishi Heavy Industries (16.66%) and Nissho-Iwai Co. (16.66%)		
Local Partner	: Petroquisa (Petrobras Quimica S.A.) (1/3) and Camalgo (civil engineering company) and others		
Capital fund	: Cr.142 million		
Products Pattern	: Phthalic anhydride	10,000 MTA	operation
	" "	13,000 MTA	civil engineering
	Octanol (2-Ethyl hexanol)	20,000 MTA	operation
	" " "	44,000 MTA	Engineering
	n-Butanol	3,000 MTA	operation
	Iso-butanol	15,000 MTA	planned
	DOP	20,000 MTA	engineering
	Maleic anhydride	6,400 MTA	operation
Raw Material	: Propylene for octanol and butanol, and benzene for maleic anhydride are supplied by Petrobras or Petroquisa who is a wholly owned affiliate of Petrobras. Ortho-xylene for phthalic anhydride may have been imported from Japan or anywhere until Copene S.A. (Petroquimica do Nordeste Ltda.), a subsidiary of Petroquisa, will produce it in same complex.		
Plant Site	: Camaçari complex, Bahia state		
Marketing	: Mainly for domestic market.		
Completion	: The first phthalic anhydride plant was completed in 1970, and other plants now under planning, engineering, or construction will be completed by 1979.		

9. COMPANHIA PETROQUIMICA CAMAÇARI (CPC), estbuilished in 1976.

Japanese Partner	: Mitsubishi Chemical Industries (1/3)	
Local Partner	: Petroquisa (1/3) and Camargo (1/3)	
Capital Fund	: Cr.500,000	
Products Pattern	: VCM	150,000 MTA
	PVC	140,000 MTA
Raw Material	: Ethylene for VCM will be supplied by Copene S.A.	
Plant Site	: Camaçari complex, Bahia State	
Marketing	: Mainly for domestic market	
Completion	: 1978	

10. POLIALDEN PETROQUIMICA, established in 1974.

Japanese Partner	: Mitsubishi Chemical Industries (1/3)	
Local Partner	: Petroquisa (1/3)	
Capital Fund	: Cr.7.34 million	
Product	: HDPE	60,000 MTA
Raw Material	: Ethylene will be supplied by Copene S.A.	
Plant Site	: Camaçari, Bahia State	
Marketing	: Mainly for domestic market	
Completion	: First quarter of 1978.	

11. POLITENO INDUSTRIA E COMERCIO, established in 1974.

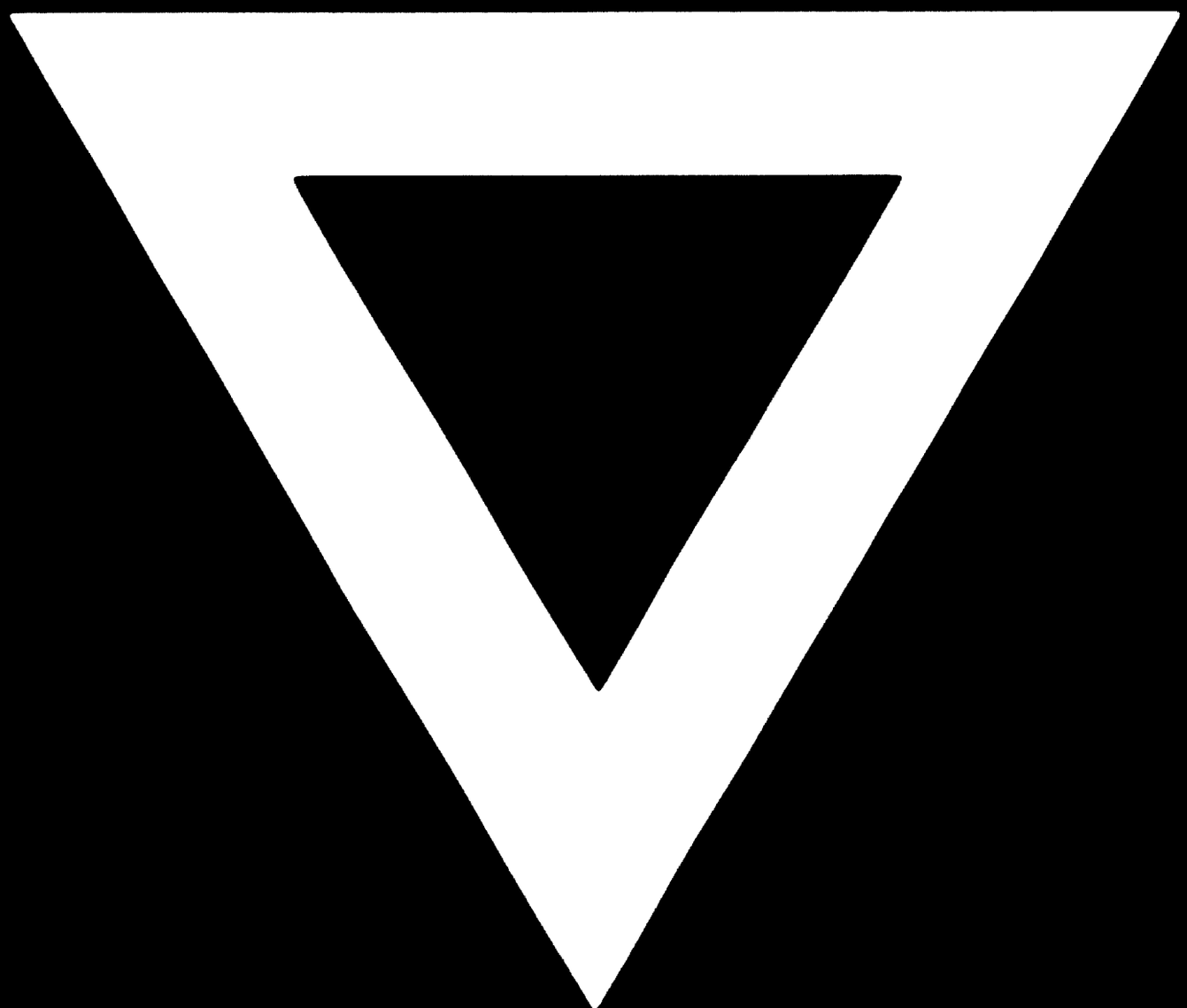
Japanese Partner	: Sumitom Chemical Co. (30%)	
Local Partner	: Petroquisa (1/3)	
Capital Fund	: Cr.6 million	
Product	: LDPE	100,000 TA
Raw Material	: Ethylene will be supplied by Copene S.A.	
Plant Site	: Camaçari, Bahia State	
Marketing	: Mainly for domestic market	
Completion	: First quarter of 1978.	

Appendix 4. Export of Technologies or Joint Venture Establishments by Japanese Enterprises in the Field of Processing Industries for Petrochemicals.

No.	Supplier	Technology
1.	Asahi Chemical	Acrylic fiber processing
2.	Asahi Denka Kogyo K.K.	Epoxy resin
3.	Briegestone Tire	Tire manufacturing
4.	Cemedine	Adhesives
5.	Daicel	AS resin
	"	Biaxial stretched PP film
6.	Dainippon Ink & Chem.	Phenolic resin
	" " "	Alkyd resin
	" " "	Amino adhesives
7.	Dainippon Toryo	Paints
8.	Denki Kagaku K.K.	Polyvinyl alcohol
9.	Fujimori Kogyo	Vinyl tile
10.	Hitachi Chemical	Cross-linked foamed PE
11.	Idemitsu Kosan K.K.	Polycarbonate
12.	Japan Synthetic Rubber	ABS resin
13.	Kanegafuchi Chemical	ABS resin
	" "	Foamed PVC leather
14.	Kansai Paint	Paints
15.	Kao Soap	Synthetic detergent
16.	Kuraray	Polyvinyl alcohol
	"	Artificial leather
17.	Kureha Chemical	Methacrylate/butadiene/styrene resin
18.	Lion Fat & Oil	Syntheric detergent
19.	Matsumoto Yushi Seiyaku	Surface active agents
20.	Mitsui Toatsu Chemical	Amino adhesives
	" " "	PP yarn
21.	Mitsubishi Chem. Ind.	Corrugated plastic board
22.	Mitsubishi Gas-Chem.	Polycarbonate sheet
23.	Mitsubishi Petrochem.	PP woven bag
	" "	Waste plastics treatment

No.	Supplier	Technology
24.	Mitsubishi Plastic	PVC products
25.	Mitsubishi Rayon	PMMA plate
26.	M.T.P. Kasei	Polyurethane
27.	Nihon Kasei Chemical	Amino adhesives
28.	Nikka Chem. Indust'l	surface active agent for fiber processing
29.	Nikki Chemical	Catalysts
30.	Nippon Paint	Paints
31.	Nippon Polyurethane	Polyurethane
32.	Nippon Zeon	PVC pipe
33.	Nitto Chemical Ind.	Dimethyl formamide
34.	San-yo Chemical	Surfactant for fiber processing
	" "	Polyether for polyurethane
35.	Sekisui Chemical	PVC pipe and fittings
	" "	Cross-linked foamed PE
	" "	Safety glass interfilm for motor car
	" "	Synthetic wood
36.	Shin-etsu Chemical	PVC compounds
37.	Shiseido	Cosmetics & Toiletries
38.	Showa Denko K.K.	Plastic cloth bag
39.	Takeda Chemical	Citric acid by fermentation of n-paraffin
40.	Teijin Ltd.	Polyester fiber processing
41.	Toray Industries	Polyester fiber processing
	" "	Nylon fiber processing
	" "	Irradiated PE or PP film
	" "	Engineering plastics molding
	" "	Carbon fiber
42.	Toto Kasei Co.	Epoxy resin
43.	Toyo Chemical Co.	Corrugated plastics board
44.	Toyo Soda Mfg.	EVA sheet
45.	Ube-Nitto Kasei Co.	PP flat yarn
46.	Yokohama Tire	Tire making

C-668



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