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ANNEX I

FIELD SURVEY REPORT
OF
THE PREFEASIBILITY STUDY FOR INDUSTRIAL DEVELOPMENT
SULTANATE OF OMAN

March, 1978

JAPANESE SURVEY TEAM
JAPAN INTERNATIONAL COOPERATION AGENCY

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

P. O. BOX 216 MITSUI BLDG
2-1, NISHI-SHINJUKU, SHINJUKU-KU TOKYO
160 JAPAN

Your Excellency
Mr. Mohammed Zubair
The Minister of Commerce and Industry
Sultanate of Oman

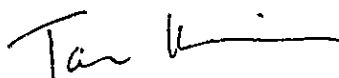
Your Excellency:

We have the pleasure of submitting our interim report at the end of our survey programme in the Sultanate of Oman.

During the limited period of our stay, we tried to do our best in looking into the socio-economy of your country in order to delineate a basis of your industrialization programme. Through analysis of information and data collected by this mission, we hope to come to a conclusion which will eventually lead to continuation of the present study, namely, a feasibility study of one or two selected industrial projects in future.

It is the sincerest hope of the Japan International Cooperation Agency as well as the Japanese Government that the technical cooperation with your Government as represented by the present study will further solidify the relationship already in existence between the two countries.

Yours faithfully,



Tan Hashida

Head of the Survey Team
for Industrial Development
in Oman

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I INTRODUCTION

During the stay of the mission in Oman, we have often been told that most development has been achieved since 1970. This is a real surprise for everyone who knows what man can achieve within a limited period of eight years.

In view of declining trend of oil production, Oman will have to exert every possible power to limit outflow of foreign currency as well as to exploit other sources of foreign currency inflow to keep the development going.

Oman, if compared with the neighbouring countries, is gifted with variety of natural resources. So we believe that it will be particularly important for Oman to achieve a balanced growth of every economic sector. Development of manufacturing industry is, by no means, to be achieved independently of development of other sectors of economy, in particular agriculture, fishery and mining.

Bearing this in mind, we tried to look into the following objectives;

1. To grasp bases of industrialization in Oman, and
2. To evaluate prerequisites for development of selected industrial projects.

The terms of reference of the present study proposal by the Japan International Cooperation Agency (JICA) are summarized in Annex 1.

On returning Japan, the mission will continue analysis of information and data collected, and hopefully come to recommendation on the next stage of this study, feasibility study, primarily according to the terms of reference mentioned before. The estimated time schedule of the remaining part of this study is as follows:

April to May, 1978	--- Analysis of information and data
June, 1978	--- Draft report preparation
July, 1978	--- Modification of the draft report and printing
August, 1978	--- Final oral presentation in Muscat.
September, 1978	--- Final report submission

The survey mission member consists of nine experts as shown below:

1. Tan Hashida, Senior Industrial Economist,
Head of the Survey Team (Administration and Industrialization Programme)
2. Hidetomi Asoh, Senior Economist,
Deputy Head of the Team (Investment Analysis)
3. Shusaku Ikeda, Senior Geologist
(Evaluation of Metallic Mineral Resources)
4. Koji Tanaka, Senior Chemical Engineer
(Industrial Project Analysis)
5. Yoshihisa Hirose, Senior Geologist
(Evaluation of Non-Metallic Mineral Resources)
6. Tetsuo Wakui, Development Economist
(Analysis of Development Plan, Infrastructure and National Economy)
7. Toshio Kurokawa, Chemical Engineer
(Industrial Project Analysis)
8. Masaki Kobayashi, Regional Planner
(Analysis of Regional and Urban Plan, and Industrial Location)
9. Eiichi Seki, Coordinator
Official of Industry Division, Mining and Industrial Planning and
Survey Department, JICA

A list of visits made by the mission during the stay in Oman is shown in Annex 2.

JAPANESE SURVEY TEAM
 FOR
 INDUSTRIAL DEVELOPMENT
 IN
 SULTANATE OF OMAN

Mr. Tan HASHIDA
 Project Manager
 [Administration and Industrialization
 Programme]



Mr. Hidetomi ASOH
 Assistant Manager
 Senior Industrial Economist
 [Industrial Project Analysis]



Dr. Shusaku IKEDA
 Senior Geologist
 [Metallic Minerals]



Mr. Koji TANAKA
 Senior Chemical Engineer
 [Industrial Project Analysis]



Mr. Yoshihisa HIROSE
 Senior Geologist
 [Non-Metallic Minerals]



Mr. Tetsuo WAKUI
 Development Economist
 [Development Plan, Infrastructure,
 National Economy]



Mr. Toshio KUROKAWA
 Chemical Engineer
 [Industrial Project Analysis]



Mr. Masaki KOBAYASHI
 Regional Planner
 [Regional and Urban Planning, Industrial
 Location]



Mr. Eiichi SEKI
 Coordinator
 Official of Industry Division, Mining &
 Industrial Planning and Survey Department,
 Japan International Cooperation Agency



Address: JAPAN INTERNATIONAL COOPERATION AGENCY
 P.O.Box 216, Mitsui Building
 2-1 Nishi Shinjuku, Shinjuku-ku
 Tokyo, JAPAN
 Telephone: 03-346-5311
 Telex: J 22271
 Cable: JICAHDQ

II GENERAL OBSERVATION ON DEVELOPMENT

1. Economy

Since 1970, the economic policy in Oman so far adopted has been oriented towards more laying foundations for economic and social development rather than embarking on large-scale economic developments from the outset. This policy has met with success as is evidently seen today.

The large revenues brought about by the rises of oil prices which took place after 1973 plus loans and grants have enabled the Government to implement large-scale national projects most of which aimed at improvement of infrastructure.

The growth of economy is well illustrated by a rapid increase in GDP which registered 107 million O.R. in 1970 and 827 million O.R. in 1976 indicating an average annual growth of 40.6 percent.

By far the most important source of revenue is export of oil. The Government revenue recorded 45.4 million O.R. in 1970 and 505.3 million O.R. in 1976 in which contribution by oil always accounted for almost 90% or above. Expenditure for defence has the largest share in the national budget and is instrumental to generate of domestic demands. At the same time a large expenditure for defence services as a constraint to increasing development expenditures.

There is uneasiness in the prospect of oil revenue which is expected to decline unless substantial discoveries of oil reserves are made. In view of the predominant portion of oil in the national revenue, this problem can very serious if means to cope with the problem are not found.

According to the statistics of Central Bank, the scale of foreign trade has boomed from the level of 56.8 million O.R. in 1970 to 836.6 million O.R. in 1976. Balance of trade has shown surplus since 1974. Regarding export, statistics show the level of 44.8 million O.R. in 1970 and 456.1 million O.R. in 1976. By commodity, oil represents over 99% every year. Japan is the biggest importer with a share of more than 50% in 1977.

In 1975, capital goods, consumers goods, and intermediate goods accounted for about 50, 30 and 20 per cent of import respectively. The United Kingdom and United Arab Emirates are the major sources of supply with about 20% and 18% of the total import respectively.

2. Development Plan

Since 1976, the Five Year Plan (FYP) has been brought into implementation. Although the progress report for the year of 1976 has been prepared, it still waits for the official approval. For this reason, the mission is not informed of achievement made in 1976 in detail. The indicated growth of GDP by 14.2% in 1976 in current price seems better than expected by some other outside experts, although no estimation of deflator value is available. The plan is based on assumptions that the contribution of the oil and construction sectors to GDP will decline, whereas agriculture, fisheries, manufacturing and other industries are expected to grow at annual rate of 10.8%. Income generating industries such as agriculture (including fisheries) and manufacturing are assumed to grow at 13.7% and 71.5% p.a. respectively. Since only three years are left for further development before 1980 and implementation of some important projects are lagging behind, it seems that achievement of the goals is not so easy. Slower growth of these income generating industries than expected may contribute negatively to the overall economic growth in the coming next three years.

As for investment plan, we foresee gradual decrease of public spending, whereas private investment will become active at the later stage of FYP period. Despite of inherent problems of setting up commercial projects, private sector is gaining confidence in dealing with these problems. Our projection of average growth of public and private investment is - 5.0% p.a. and 5.0% p.a. respectively for the plan period in contrast to - 19.0% and 14.0% projected in the FYP. We have noticed that private investment sometimes proceeds quickly, once feasibility of the project is established. So it will be desirable for the government to ensure minimum profit of industrial projects by introducing various forms of incentives to encourage private investment as much as possible.

Importance of geographically balanced growth of national economy has been emphasized in the EYP and the government investments are being distributed evenly. Since population tends to concentrate in the metropolitan area in which most industrialization has taken place, a part of the government spending is preferably directed to regional industrialization programme in line with infrastructure development.

3. Infrastructure and Manpower

Though Oman's infrastructure was extremely limited before 1970, roads, ports, power facilities and telecommunication equipment have been greatly developed by the immense efforts of the new government, and as a result, it may be considered that a minimum infrastructure required to sustain Oman's economic development is now available. This amazing speed of infrastructural development, however, caused a significant strain in Oman's financial position. From now on, it is important to carry out development projects with due consideration given to economic justification and consistency with the industrial development projects.

1) Road

Up to now, total length of asphalt surfaced road and that of gravel road reached about 1,500 km and 8,500 km respectively and the intercity highway network may be regarded as almost completed. Hereafter, feeder service, or branch roads, should be increased connecting trunk lines and scattered towns and villages. In case economic scales of local towns and villages are very small, road construction is apt to cause population outflow from villages and towns to bigger cities with substantial adverse impacts on local economy. This question deserves full attention by the planners.

The old roads in Muscat and Mutrah are mostly inadequate for transportation by vehicles and have begun to suffer from congestion and shortage of parking spaces. Roundabouts in the newly developed area as well as in the old cities function fairly well. Their capacity, however, are limited upto about 250 to 300 vehicles per hour for each one lane, so that this rotary system will cause traffic congestion and should be improved sooner or later as traffic volume increases. In case the industrial area is developed in the capital region, another access road to the Port of Mina Qaboos would be necessary and at the same time, full attention must be paid to measures to avoid congestion due to commuting.

2) Port

In Oman there are a number of natural harbours, but she has no port with deepwater berths except Port Qaboos and Raysut Port now under const-

ruction. Reflecting the general import boom in the Middle East, Port Qaboos with the capacity of 1.5 million tons was slightly congested in 1974 to 1976, but the congestion is expected to lessen as a result of levelling-off of import and of the vast investment to the port development all through the Gulf countries.

Coastal shipping had, historically, played an important role, but nowadays it has been largely replaced by land transportation. So, the present expansion of Port Raysut would provide excess capacity in the immediate future.

3) Power

Electric power supply in the capital area depends on the Riyam and Al Ghubra power stations, the capacities being 37 MW and 77 MW, respectively, and 114 MW in total. The peak load registered 65 MW in 1977. In 1978, the peak load is anticipated to reach 85 MW. The recent rapid development of the capital area has remarkably increased the demand for power and the peak load is forecast to surpass the installed capacity during 1979, though installation of gas turbine generating units is in progress.

The above projection do not take into account possible establishment of energy consuming industries in the capital area. In case these industries are set up in the capital area they will have to possess own generators; otherwise, serious shortage of power supply would result.

A recent development worthy of note is completion of a natural gas pipeline from Yibal to the capital area which will very soon make a cheap and stable supply of fuel available to power generation in the capital area.

4) Water

Consumption of water in the capital area recorded 365 million imperial gallons in 1976. In the first half of 1977, the capital area consumed 362 million imperial gallons of which about three quarters was supplied by the Al Ghubra desalination plant and the balance by underground sources of Wadi Samail and Wadi Rusayl located west of Seeb International Airport.

With the existing sources alone, shortage of supply is expected from 1979. There is a plan to add in the Al Ghubra plant two units of desalination plant each capable of producing 2.5 million imperial gallons per day. It is urgently needed to develop new sources of water supply to cope with increasing demand for household and industrial uses of water.

5) Telecommunication

The number of telephone lines has been rapidly increasing and it exceeded 7,000 lines in the beginning of 1978. However, the supply cannot catch up with the busting demand so that about 7,000 applications are waiting for installation of telephone. Communication is often difficult especially in the morning time and during the week-end because of busy lines, and also after rainfalls because the system are apt to be out of order. The Cable and Wireless Company (CWC) has no particular priority policy for installation by purpose of use, under the principle of "First come, first served". But it might be advisable that public uses and business uses should be given priority to private uses until when telephone came into wide use to some extent. Demand for telex is also very high and there are 250 applications waiting for installation, while 275 units are now in use. CWC intends to increase another 1,200 lines by introducing a new automatic exchange.

6) Manpower

The population of Oman is considered to be around one million. The rapid change in economic activity and administrative reform in recent years have required a large inflow of experienced, semi-skilled and unskilled manpower from abroad, namely, professional and qualified mainly from Europe, Egypt and Jordan and semi-skilled and unskilled from India and Pakistan.

Until the time when a sufficient number of experienced Omanis become available, this trend will continue with a significant financial burden on the economy of Oman. As a step to cope with this situation, the Government has established a vocational training center for Omanis in Muscat and is planning to establish such training centers in various parts of the country. In the private sectors of industry, efforts have been made to train the

Omanis and to transfer, though gradually, jobs of greater responsibility from the expatriates to the Omanis. In spite of these efforts, however, expansion of industrial activities are likely to rely heavily on expatriates for several years to come.

One of the statistics indicates that the total number of employees excluding those engaged in agriculture, fisheries and public sector was 53,385 of which 24 percent are Omanis and the rest expatriates.

4. Industrialization

1) Present Status of Manufacturing in Oman

According to the updated industrial project list dated January 15, 1978, issued by the Ministry of Commerce and Industry there are not many manufacturing firms in operation except for small-scale workshops. These include flour mill, asbestos-cement products, PVC pipes, furniture, aluminum products, soft drinks, date processing, paint and some other industries. Total investment cost of these projects is estimated at less than 5 million R.O.

The industrial project list includes 54 projects, out of which 19 projects are already completed or in operation, 15 projects are in the stage of feasibility study or completed, and the rest are in such preliminary stages that little information is available.

Several visits to private firms made by the mission revealed that most of them are small- to medium-sized in terms of capital, production, and sales still in an infant stage of development, with a few exceptions in which the government sector participates. This appears only natural when the short period of eight years of modernization in Oman is taken into account.

2) Advantages and Disadvantages of Industrialization in Oman

Oman, as one of late comers for industrialization, should properly recognize her advantages and disadvantages at this initial stage of industrial development. The advantages may include:

- (1) considerable potential of exploiting hydrocarbon and mineral resources
- (2) relatively high potential of exploiting water resources--potential for agricultural and agroindustrial development
- (3) high cost effectiveness of industrial development on national economy due to her small scale of economy
- (4) political stability

The disadvantages may includes;

- (1) shortage of manpower, in particular highly skilled workers and qualified people
- (2) small domestic market size
- (3) competition with industrialization of neighbouring countries
- (4) traditional inclination of Omani people to commercial activity rather than to manufacturing
- (5) hot climate in summer

While retaining her free economic activity on one side, the government is requested to assist development of certain important industries whose economic feasibility remains uncertain for the time being. Various incentives for private industrial investment including tax exemption, financing with preference and specially designed infrastructural development are needed, since protection of domestic products by means of tariff barrier is not entirely applicable to Oman. It is also important that, in some capital intensive industrial sectors the government takes the initiatives of development, typically represented by the gas pipeline, cement and copper projects currently in progress.

The government should also try to provide as much infrastructure for industrialization as possible. Stabilized supply of electricity and water to industry at reasonable cost is essential. In view of rapid industrialization in the gulf area, promotion of industrial siting by establishing the industrial areas is urgently needed. The planned Rusayl Industrial Area with proposed development area of 300 ha, though water supply seems guaranteed, may have topographical restriction for the future expansion. Flat lands are better to be allocated in Seeb district for future exploitation as industrial areas.

3) Selection of Industry

Identification of projects for industrialization of Oman is preferably to be conducted in the following manner:

- | | |
|--------|--|
| Step 1 | Preparation of list of industries possibly located in Oman |
| Step 2 | Preliminary screening based on such fundamental criteria as; |

- a) the government's priority
- b) elimination of existing and already planned projects

Step 3 Primary screening based on such criteria as;

- a) availability of natural resources
- b) marketability of products

Step 4 Secondary screening based on such criteria as

- a) technological competence
- b) price and non-price competitiveness
- c) industrial linkage

Industries selected through this process may be regarded as "appropriate industries" for location in Oman, and the list will form a basis of acceleration of licensing industrial projects and/or future invitation of investment.

III COMMENTS ON MAJOR INDUSTRIAL SECTORS

I. Petroleum and Natural Gas

1) Overview on Reserves and Development

The proven recoverable oil reserves of the Sultanate of Oman were estimated at 5.8 billion barrels as of the end of 1976. This figure takes into account the recovery by secondary and tertiary recovery methods.

Except for Dhofar area, the oil being produced and found in Oman is light in API gravity, around 35, and low in sulfur content, approximately 1% by weight. In the Dhofar area a heavy oil of about 20° API gravity has been found.

Commercial production of oil started in August 1967 by Petroleum Development (Oman) Ltd. (PDO) which is now owned 60% by the Government and 40% by private companies with Shell as the largest shareholder. The production of oil until the end of 1977 is as shown below:

1967	20.9 Million Barrels
1968	87.9
1969	119.7
1970	121.3
1971	107.4
1972	102.8
1973	107.0
1974	105.8
1975	124.6
1976	133.8
1977	124.2

At present PDO is the sole producer of petroleum in Oman. Oman Sun Oil Company (Sunoco), Elf Aquitaine Oman/Sumitomo, and Quintana International Ltd., have been searching for oil in Oman for the past few years; however, none of them has been successful. Recently BP Petroleum Development Ltd. has signed a production sharing agreement with the Government

and BP is expected to start drilling very soon.

The five-year plan of the Government forecasts the production of oil until 1980 as given below:

1976	135.0 Million Barrels
1977	132.0
1978	128.0
1979	125.0
1980	122.0

The projection foresees decline in the production. The heavy oil found in the Dhofar area would give a production of about 10 million barrels in 1980 and onwards. As indicated by the decline in the projected production, the most experts agree that the producing fields have already passed the peak; and therefore, new discoveries of substantial size will be needed to stabilize oil production.

Natural gas in Oman exists in association with crude oil and also in the state of dry gas of which the main reservoir is located around Yibal. The reserve of gas is considered to be of such magnitude that would permit production at the rate of 140 million SCFD for a period of about 80 years.

A 20 inch pipeline has been laid from Yibal to al-Ghubra which is near commissioning at present. The pipeline is designed to deliver 140 million SCFD of gas without compression or 320 million SCFD of gas if compression is applied. Concurrently with the construction of the pipeline, a gas processing plant has been installed in Yibal to extract Liquefied Petroleum Gas (LPG) and Natural Gas Liquid (NGL) from natural gas. Productions of LPG and NGL will vary depending upon the throughput of natural gas to the plant and also on the composition of gas. Presently, the production of LPG and NGL are estimated at about 150 and 5,000 barrels per day, respectively.

2) Utilization of Petroleum and Gas

Petroleum is the mainstay of the economy of Oman. Export of petroleum generates a revenue which now accounts for more than 80% of the earnings of foreign currencies. At home there is no industry to utilize crude oil. All the petroleum products Oman needs -- aviation gasoline, premium and regular grades motor gasolines, kerosene, Jet-A-1, deisel fuel, LPG, bunker fuel and lubricating oils -- are imported. Of these products, substantial portion of Jet-A-1 and almost all bunker fuel are re-exported. Shell Markets (Middle East) Ltd. and BP Arabian Agencies Ltd. share the marketing of these products between themselves.

The demands for petroleum products in 1977 including and excluding bunker grade fuel oil were 9.4 and 25.4 thousand barrels per day (TBD), respectively. The demands are forecast to grow by 1985 to around 20 TBD or 30 TBD whether the bunker grade fuel is included or not.

The demands thus forecast do not appear large enough to justify construction of a refinery or a topping plant, the former being more sophisticated and equipped with all facilities for produce gasolines, gas oil, Jet-A-1, kerosene and fuel oil while the latter being equipped with a crude oil pipestill and a minimum number of facilities to produce gas oil, Jet-A-1, kerosene and fuel oil but not to produce gasolines.

A question of whether or not a refinery or a topping plant is justifiable should consider forecast demands for petroleum products and relevant economic and technical problems which we will look into later.

Generation of electricity presents a concrete program for utilization of natural gas. The Muscat power station (37 MW) and the Al Ghubra power station (78 MW) will use natural gas from 1978. Both power plants with a combined capacity of 115 MW will burn less than 30 million SCFD of gas, or about 21% of the 140 million SCFD pipeline capacity.

Other industries which have been considered for Oman and would consume natural gas are manufacture of ammonia/urea, manufacture of cement, smelting of copper, production of sponge iron, etc. The refinery, if installed, could burn gas instead of fuel oil. If these projects materialize before

1985, the consumption of natural gas by industries may be estimated as shown below:

Industry	Capacity	Natural Gas Demand (MMSCFD)
Refinery	30,000 BPSD	5
Ammonia (Urea)	1,000 T/D (1,700 T/D)	40
Electricity	200 MW	52
Cement	1 MMT/Y	15
Sponge Iron	400,000 T/Y	22
Copper Smelter	20,000 T/Y	5

Since the pipeline could deliver 320 million SCFD if compressors are employed, there would be a sufficient supply of gas to these industries.

We will study the adequacy of establishing an ammonia plant, a cement factory and a copper smelter. We will, however, not investigate the iron reduction project, since our expertise does not cover this field. The technology for construction and operation of a 1,000 T/D ammonia plant and a 1,700 T/D urea plant has already been established. Therefore, the study will be concentrated on the forecast of supply and demand pictures of nitrogenous fertilizers in the region surrounding Oman.

Another possibility of gas utilization which we have considered but abandoned is establishment of ethane cracking to produce ethylene and derivatives of ethylene. It is questionable whether the delivered gas will contain ethane in sufficient quantity to feed a commercial scale cracking unit. In addition, there are a number of problems before the petrochemical project can be justified; namely, a large capital outlay to be required, difficulties associated with the operation of the facilities and marketing of the products, negligible domestic demands for the intermediate and finished end products, inflexible nature of operation inherent to a highly integrated complex of a number of facilities, and so forth.

2. Agriculture & Fisheries

1) Agriculture

The cultivated land in Oman amounts roughly to 37,000 ha which is only 0.12% of the total land of 100,000 km². The agricultural areas are limited to where water supply is easily available or there are the traditional water system "falaj" through the area. Batinah coastal plain, interior of northern Oman, Musandam peninsula, Dhofar province are the major agricultural area.

Principal crops are dates, alfalfa, onions, citrus, wheat, banana, mangoes, etc. and various kinds of vegetables are harvested. Camels, sheep, cattle, goats are also abundant as livestock resources.

The Omani government has established a number of agricultural extension centres throughout the country and is giving seeds, fertilizers, insecticides, tractor services as well as technical instructions to local farmers in order to improve the agricultural activities in the country. A total of 23 such centers were in operation as of the end of 1976.

Major agriculture-related industries are yet to be developed, however, some of them are in operation on small scales. They are:

- (1) date-processing plants in two places (mostly for export),
- (2) dairy farms in Salalah and Sohar, and
- (3) a flour mill of a capacity of 4,800 tons in Muscat (wheat is imported from Australia).

The overall production capacity of agriculture in Oman is still insufficient to sustain full-scale agro-industries in the country. Effective use of water resource is the key to the agricultural development in Oman. With the severe natural environment it would be necessary to introduce large-scale mechanization to every aspect of the agricultural activities as well as to the system of irrigation. In order to realize the mechanization, the first step to be taken would be to intensify education, training and to promote organization and cooperation of farmers. In spite of the efforts of the extension centers, only a small portion of the total

farmers are now under the influence of these centers. As for the water resources, evaluation of the underground water potential and further measures to secure the reserve (reservoir dam in Dhofar) must be undertaken.

2) Fisheries

It has already been recognized that Oman is quite rich in fisheries resources. For example, the annual yield of sardines is estimated at about 1.5 million tons, and tuna 10-60,000 tons. For demersal fish, a catch of about 300,000 tons is expected.

Although the exact number of fishermen in Oman is not known, it is estimated to be several thousands. The number is supposed to be decreasing with the expansion of employment in other industries in urban areas. The majority of the Omani fishermen are still equipped with very small, one-man fishing boats, and their activities are irregular due to the change of weather. This makes the daily catch fluctuate greatly.

Fish is important food, for the Omanis, and the demand for fish is enormous. Fish is sold fresh, frozen, dried or salted. In Dhofar area, sardines are also consumed as fishmeal for feeding cattle. The prices of fresh fish are relatively high and fluctuate according to the seasons of the year. Improvement of the distribution system and the construction of cold storages throughout the country will contribute greatly to the price stabilization and therefore increase the total demand for fish.

Ice plants, cold stores are in existence in Muttrah, Salalah, Sur, Sohar, etc. and new constructions and improvements are now being undertaken in other places including the interior districts. In addition to offshore fish catching by trawlers in progress jointly with foreign firms, the government is now granting financial aids to local fishermen in purchasing modern fishing boats and outboard engines, and furthermore provides repair services for them free of charge in the established workshops. Although the government is planning to replace small wooden fishing boats with small aluminum or FRP (fibreglass-reinforced plastics) boats, the local fishermen tend to use wooden boats which they are accustomed to and are manufactured locally. The construction of aluminum or FRP fishing boats is not contemplated.

Although some canning factories of sardines are now under consideration, the operation will be difficult if the sale is confined to the limited domestic market. We foresee that overseas marketing of these products will be decisive of performance of the finalized project.

To make the best of the vast fisheries resources and to make the fish supply stable, the Omani fishermen must improve the quality of their fishing activity as well as to expand the scale of it. It will be fundamental to organize independent local fishermen since large scale fishing in which many fishermen work in cooperation is absolutely necessary for yielding a constant catch. In addition, the facilities for storage and transportation must be provided sufficiently.

3. Construction Materials

There are four major types of building materials, namely;

- (1) metallic - iron and steel, aluminium, brass
- (2) inorganic - cement, aggregates, blocks, bricks, ceramics, glass
- (3) organic - wood, plastics, paints

Except for aggregates, blocks, paints and plastics products domestic production of these are almost non-existing.

In 1980s, it is expected that production of rolled steel, cement and some other minor construction materials will start, leaving only aluminium extrusions, ceramics, glass and wood to be imported. Recent development of several projects in which manufacture of asbestos cement pipes and limestone/silica blocks will enhance self-sufficiency of construction materials in Oman.

Besides rolled steels and cement, we presume that the following projects may be worthwhile to be looked into in detail;

- (1) clay brick production
- (2) ceramic tile production
- (3) production of plasters and mortars
- (4) manufacture of marble blocks
- (5) aluminum profile extrusion
- (6) sheet glass manufacturing
- (7) FRP (Fibre Reinforced Plastics) manufacturing
- (8) manufacture of aerated lightweight concrete

Projects (1) and (2) will be feasible marketwise only if domestic clay deposits of high quality or equivalent resources are located within easy access of transportation. Project (3) will utilize either limestone or dolomite which are found abundant in most parts of Oman.

Though the existing demand for these products is limited, competitive pricing and diffusion of application technique may prove the manufacture viable even at small scale production, since it requires relatively small capital investment.

Marble quarrying to produce blocks will be one of promising projects provided sizable deposits of high quality are located in the vicinity of the trunk roads. One or two applications for quarrying marble have been reportedly submitted. Marble blocks will be exported, only if mechanized methods of quarrying and finishing are introduced to cut the high cost of labour.

Extrusion of aluminum profiles may not be a feasible proposition since demand is small and specifications are diversified. Demand for these products in 1976 is estimated as less than 2,000 tons, which will not economically justify introduction of a hydraulic extrusion press.

Demand for sheet glass has not been clearly identified by the mission. Due to its capital intensiveness, manufacture of sheet glass in Oman at this stage seems to be less economical. Moreover, sizable silica sand deposits of high quality have not yet been located and alternative use of quartzite as raw material must push up production cost considerably. Availability of soda ash at reasonable cost in Oman still remains uncertain. Thus production of sheet glass appears as one of long-term objectives of effective exploitation of minerals in Oman, provided that sizable amount of high-quality silica sand deposits be located within easy access of transportation.

FRP products are expected to substitute metals and wood only if specific applications are identified and technology of application is established. FRP has its own drawback of high cost of production.

Aerated or autoclaved lightweight concrete (ALC) can be cast into the forms of blocks and slabs. Cost of production of ALC blocks may be higher by 50% than that of conventional concrete blocks and, for this very reason, extensive substitution is not expected to occur (ref. Renardet-I.C.E. report in 1974). Increasing use of reinforced ALC slabs, on the other hand, appears possible, once standardization of building modules is carried out and technology of its application is established among contractors. The penetration process of ALC slabs, however, may take some more time than expected elsewhere.

Estimated annual investment on building in public sector gradually decline and level off at certain level, whereas private investment increases

steadily according to the Five Year Plan. Total investment in building including housing is, therefore, estimated to increase gradually. Demand for bulky construction materials will increase from the estimated current level of approximately 160,000 m³ per year by the rate of 3 to 4% p.a.

4. Mineral Resources

The territories of the Sultanate of Oman, especially the northern Oman mountains represented by Jabal Akhdar, Jabal Nakhl, Jabal Bani Jabir, etc. have ample potentiality of various mineral resources, which can be classified as follows:

- (1) Metallic minerals as represented by copper,
- (2) Non-metallic minerals as represented by asbestos,
- (3) Industrial rock as represented by limestone,
- (4) Sand and gravel as aggregate resources, and
- (5) Seawater as source of salt.

Though our itinerary was too short to make a full-scale reconnaissance survey covering all the above items, our findings or comments are summarized below.

1) Metallic Minerals

The most extensive research so far made for metallic minerals, especially for copper, would be the one by Prospection (Oman) Ltd., which confirmed presence of 3 ore bodies having 12 million tons in total of minable ore reserves with the average grade of 2.1% cu.

It should be noted that the said 3 ore bodies occur in a limited area of only 20 km² and that the similar geologic environment can be found over vast areas on both east and west flanks of the Oman mountains where over 60 occurrences of copper mineralization were reported.

It is emphasised, therefore, the Sultanate is highly potential to have new ore deposits of copper, especially, and other minerals such as zinc, silver, etc. It should be pointed out that the depths of exploration made so far still remain insufficient to cover all the potential depths of the ore bodies.

Kinds and quantities of so far confirmed or estimated reserves of the metallic minerals are summarized in the following:

Mineral	Ore reserves (1,000 T)
Copper	12,000
Chromium	abundant but of lower grade
Iron	- ditto -
Nickel	-
Gold	-
Silver	-
Manganese	-
Zinc	-
Lead	-

2) Non-metallic Minerals

As for non-metallic minerals which could be utilized on an industrial scale, asbestos and coal are to be specially mentioned. Amiantit (Oman) Ltd. was awarded a special licence to explore asbestos only, and confirmed, after 18 months of laborious research, presence of asbestos deposits worth considering a more detailed investigation anyhow, though the final decision on the next step to be undertaken has not been made yet mainly due to remoteness of the deposits. Considering many occurrences of asbestos in the Sultanate, some measures to promote further exploration and, finally, encourage industrial uses of local asbestos might be recommendable.

Meanwhile, a coal deposit with some 10 million tons of reserves reportedly occurs near Sur. It appears, however, any detailed investigation has not been undertaken so far on possibilities of industrial utilization of the deposit, which, in our opinion, would be difficult to be economically exploited considering the magnitude of the deposit.

3) Industrial Rocks

As for industrial rocks available in the Sultanate, the followings could be mentioned:

- Carbonate rocks--limestone, marble and dolomite
- Siliceous rocks--quartzite, schist and sandstone
- Argillaceous rocks--shale, phyllite and clay

a) Carbonate rocks

Carbonate rocks are very abundant in the Sultanate, and potentially, they can be utilized for varieties of industrial uses.

At present, their actual utilization is negligible as compared with their widespread distribution, but there are at least two carbonate-based projects now under investigation or in progress, namely, a cement plant project and lime-silica brick manufacturing project, both of which we expect would be worth undertaking a detailed study since they could be based entirely on the locally available resources, not only carbonates but also siliceous and argillaceous rocks as well as natural gas.

In addition to the above, however, attention should be drawn to the possibilities of further utilization of carbonate rocks such as follows:

- Marble manufacturing
- Quick lime burning and subsequent slaked (hydrated) lime production
- Dolomite burning for producing refractories and/or plasters
- Production of pulverized calcium carbonates for various industrial uses

From the geologic viewpoint, it appears that there is ample possibility to locate suitable deposits for any of the above purposes, though it would require a laborious intensive research for each specific project.

For example, a short-time survey was made by our geologists on a couple of marble occurrences, where they found marbles of acceptable or even attractive quality, though the quantities of minable reserves did not appear to be very substantial.

It should be noted that not a few occurrences of 'exotic' limestones, most of which would expectedly have been more or less metamorphosed into a kind of marble, are reported in many localities covering a considerable area of the Sultanate. Though it might not be easy to obtain slabs or blocks of larger dimensions from any of the marble deposits, production of marble chips for terrazzo manufacturing purpose or high-quality aggregate uses would be practicable in some of the favourably located deposits.

b) Siliceous rocks

It should be pointed out that no important silica sand deposit has been reported in the Sultanate and that in our geologists' opinion, such

deposit cannot be expected in such geologic environment where igneous rocks and carbonates predominate as in the case of the Sultanate.

Instead, however, siliceous rocks as represented by quartzite or quartz sandstone are considerably widespread in certain areas, especially in and around the Sayh Hatat Basin, where such rocks develop widely along the Wadis forming thick beds or masses locally intercalated with phyllite or reddish dolomite beds.

In the Sultanate, therefore, silicate industries such as sheet-glass or bottle manufacturing plants would have a disadvantage of being forced to utilize such siliceous rocks instead of silica sand, which means that processes of drilling, blasting, crushing and grinding of the hard rock are required beforehand in addition to the normal processes to follow them.

c) Argillaceous rocks

Deposits of clay to be utilized as raw materials of ceramic industries such as manufacturing of bricks, roof/wall/floor tiles etc. are limited to a few localities that have been reported to date, though further exploration efforts are strongly desired here.

As a countermeasure to cope with the rising potential demand of clays, it is recommended to investigate possibilities of utilizing argillaceous rocks such as shale, claystone, marl, shists and phyllites, etc.

It is usual in Japan to exploit weathered part of such rocks as a source of clay for cement industry as well as for brick manufacturing.

4) Sand and Gravel

Sand and gravel for road surfacing or aggregate use are obtainable from any of Wadis developing throughout the Sultanate. They are, in fact, one of the most abundant resources, but it appears that, from the very reason that they are abundant, no particular study has been made on their chemical compositions and physical properties except for limited number of geochemical sampling programmes undertaken from certain Wadi sediments.

Should such investigation be proceeded continuously, the results would be much more fruitful than one might think, in not only that it might lead to discovery of new mineral occurrences but also it would introduce proper and wider uses of each Wadi sediment.

5) Sea Water

Sea water contains approximately four percent of salt. The desalination plant at Al Ghubra discharges brine, or concentrated sea water, which contains about twice as much salt. We have briefly looked into the possibility of utilizing the brine from the Al Ghubra plant to set up salt-based industries.

Use of brine instead of sea water certainly represents an advantage when producing salt from sea water either as an end product or as a raw material for the production of caustic soda and chlorine. The brine from the Al Ghubra plant could therefore be a basis for salt related industries.

All the more important is, however, the presence of demands for these products. The domestic demand for salt is expected to be negligibly small to justify production of salt in commercial scale; and therefore, the industry would have to look for export markets.

Production of caustic soda and chlorine needs more rigid condition to be met; that is, industries to consume chlorine must exist in the vicinity of the plant since transportation by boat of chlorine is technically prohibitive at the present state of technology. In other words, the feasibility of producing caustic soda and chlorine depends to a great extent on the feasibility of other industries which consume chlorine.

We will continue to look into the utilization of brine although the study we have so far conducted indicates that the presence of brine would not necessarily constitute as favourable a condition as one might think.



ANNEX II

SUMMARY OF DISCUSSIONS
ON
DRAFT REPORT OF THE PREFEASIBILITY STUDY
FOR INDUSTRIAL DEVELOPMENT
SULTANATE OF OMAN

November, 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

I. INTRODUCTION

"The Prefeasibility Study for Industrial Development in Sultanate of Oman" has been conducted by JICA since February, 1978. JICA sent a team of nine experts to Oman from 24th February to 21st March, 1978 for gathering data and information. After returning to Japan, these experts tried to do their best to finalize a draft report. The draft report was completed by the end of August, 1978 and mailed to the Government of Oman for review in advance. The final presentation and discussion on the draft report took place in Muscat from 25th to 29th October, 1978. It was understood that the Government of Oman had thoroughly reviewed the report and prepared many questionnaires and comments. The discussion and exchange of views on the study are believed to be most fruitful for planning industrialization of Oman.

This report is designed to summarize the results of the discussions on the draft report, particularly in response to a request by His Excellency Minister of Commerce and Industry that this summary be attached to this final report for reference.

For the final presentation and discussion the following two experts were despatched by JICA:

Mr. Tan Hashida, Head of the Team

Mr. Koji Tanaka, Team Member

II. MEETING SCHEDULE

<u>Date</u>	<u>Time</u>	<u>Meeting</u>
25th Oct.	9:00	<p>Discussion with Ministry of Commerce and Industry</p> <ul style="list-style-type: none"> • Mr. Barakat Al-Lamki • Mr. Saxena • Dr. Faizal M. Elamir • Mr. Malek Adawi • Mr. Moosa Baqer • Mr. Erayet H. Mallik • Mr. Khalid Kayer
26th Oct.	9:00	<p>Discussion with the Development Council</p> <ul style="list-style-type: none"> • H.E. Dr. Sharif Lotfy
28th Oct.	9:00	<p>Discussion with Division of Petroleum and Minerals, Ministry of Agriculture, Fisheries, Petroleum and Minerals</p> <ul style="list-style-type: none"> • Mr. Ali Battasi • Mr. Ken Bodine
	10:30	<p>Discussion with Division of Petroleum and Minerals, Ministry of Agriculture, Fisheries, Petroleum and Minerals</p> <ul style="list-style-type: none"> • Mr. Mohammed Qasim • Dr. I.M. El-Boushi • Mr. Omer Al-Amin • Mr. Mohammed-Rugrehm
	11:30	<p>Discussion with Division of Fisheries, Ministry of Agriculture, Fisheries, Petroleum and Minerals</p> <ul style="list-style-type: none"> • Mr. Ahmed S.S. Al-Sharfari • Mr. Abdul G.Y. Saad
	13:30	<p>Meeting with H.E. Mohammed Zubair, Minister of Commerce and Industry</p> <ul style="list-style-type: none"> • H.E. Ali Dawood • Mr. Barakat Al-Lamki • Mr. Saxena • Dr. Faisal M. Elamir • Mr. Enayet M. Mallik • Mr. Khalid Kayer

S.P. 1175

<u>Date</u>	<u>Time</u>	<u>Meeting</u>
29th Oct.	11:00	Discussion with Oman Development Bank <ul style="list-style-type: none">• Mr. Mohammed B.B. Othman• Mr. Storch (An Expert from International Finance Corporation)
	12:30	Discussion with the Development Council <ul style="list-style-type: none">• Dr. Mohammed Shazli

III SUMMARY OF DISCUSSION

Major items of the discussions were classified into two categories as shown below:

- a. Projection of Oman's economy, industrialization and so on
- b. Evaluation of prefeasibility of selected industrial projects

The following is summary of discussions expressed in the form of question and answer, and comments.

Note: The following abbreviation is used.

- Q. : Question
- A. : Answer
- C. : Comment
- O. : Omani Government
- J. : JICA Mission

1. Projection of Oman's Economy and Industrialization

Q.O. : We are interested to know that how the JICA Mission projected GDP, Gross Industrial Output and other macro-economic indicators of Oman. We would also like to have the JICA Missions's comment on discrepancies of projected figures between the Five Year Plan and the JICA report.

A.J. : The GDP figures were estimated based on long-term trends of petroleum production and price and also past trends and present status of each economic sector other than petroleum. Industrial sector was, in particular, looked into in detail on project-by-project basis. The method of estimation used was fundamentally judgemental. The discre-

pancy may be partially explained by the difference of figures of 1976 which is the base year. Instead of low GDP for 1976 assumed in the Five Year Plan, the JICA Mission used up-to-date figures suggested by the Development Council. On the other hand, our projection of overall GDP growth rate from 1976 to 1980 was lower than that assumed in the Five Year Plan. We expected slowdown of economy in Oman after 1978.

Q.O. : There are some obviously overestimated figures projected for the year of 1980 in the JICA report. For example, Gross Industrial Output and Industrial Employment in 1980 will reach 38 million RO and 11,540 respectively according to the JICA report. We believe this is by far larger figures than we expected. We want to know the reason behind this.

A.J. : We must admit that projection for the year of 1980 may be on the optimistic side because only two and half years are left to reach that level. However, by encouraging private investment in industry, it would be possible to achieve figures close to these targets.

Q.O. : Total investment required to achieve industrialization for 15 years from 1976 to 1990 amounted to 420 million RO in 1976 price according to the report. The estimated investment in industry for 5 years from 1976 to 1980, 166 million RO, seemed considerably large in comparison with 137 million RO stated in the Five Year Plan.

A.J. : At the early stage of industrialization much investment is usually needed for construction of infrastructure and other auxiliary facilities. This could be explained in terms of large indirect investment.

Direct investment is also inefficient in view of slow startup of various industrial projects.

C.O. : Omani economy, unlike UAE's or Saudi Arabian ones, has already entered into a stabilized growth or readjustment stage, although economic growth of 1976 and 1977 exceeded our expectation. The existing recession in Oman is due to reduction of growth rate but not due to reduction of economic activity as a whole, which is easily explained by the fact that very few bankruptcies have taken place in Oman. In order to stimulate Omani economy, it is necessary to speed up the Government spending, in particular, expenditure on projects. In 1980s it will be possible to accomplish a stable and upward economic growth. Private industrial sector has been active as represented by the following investment in industry. We regard this as encouraging.

1976	10 million RO
1977	20 million RO

C.J. : We would like to emphasize importance of private sector in industrial development. The role of the Development Bank of Oman, an industrial financier, could be fully utilized to foster the private sector in industry.

C.O. : The Government of Oman is now preparing various measures to accelerate industrialization. We would welcome any advice in this regard which might be obtained in the course of the succeeding study.

Q.J. : We would like to ask about protection tariff for industrial goods manufactured in Oman.

A.O. : The system is under consideration. The proposed tariff rates, however, would be moderate only to warrant appropriate margin for domestic manufacturers. We essentially believe in free market economy to which Oman belongs.

2. Results of Evaluation of Selected Industrial Projects

1) Marble

C.O. : There are two past studies on development marble resources in Oman conducted by Arab League and a U.S. consultant. A new feasibility study is already under way and therefore this item can be excluded from further consideration.

2) Ceramic Tiles

C.O. : In connection with the preliminary study conducted by the Whitehead group, another in-depth study is now being implemented. This item could be also dismissed. According to the JICA report, commercial scale production of ceramic tiles could be started at the scale of 300,000 m² per year but we believe the production scale be better reduced to somewhat 50,000 m² per year since the preliminary study warranted production of only floor tiles due to clay quality so far examined.

C.J. : Production scale of 300,000 m² per year is large even in Japan.
We agree with your view that initial production starts at smaller capacity.

3. Glass Products

Q.O. : We would like to ask you how you evaluated possibility of establishing glass industry in Oman.

A.J. : As for sheet glass production, minimum economic size of production is a few million square metres per year depending upon various conditions. Demand for sheet glass in Oman is approximately 11,000 m² per year, which is minute compared with the minimum production scale. Capital outlay for sheet glass manufacturing will exceed ten million RO and technology required is high and sophisticated. There is also problem of packaging sheet glass for shipment, because Oman must import wood and other materials for this purpose. Demand for glass containers (bottles) is relatively large if markets in the Gulf countries are brought together. Quartzite reserves have been located in Oman and these will warrant supply of silicate raw material. We have been informed, however, that one private company is promoting this glass container project and has completed a feasibility study. For this very reason, we decided to leave the whole matter to the private sector. Manufacture of glass tableware seems also possible in Oman, since it requires less capital and raw materials supply. In this case, however, a careful marketing study should be made before selecting types of products.

A.O. : Total investment needed to produce 10,000 tons per year glass bottles is 5 million RO according to the JICA report, whereas a private source indicated that investment of 1.1 million RO is enough to start manufacturing 20,000 tons per year of glass bottles.

A.J. : The latter figure seems to be too optimistic. We would like to confirm the validity of the figure. To sum up, glass projects other than glass bottle manufacturing could be reconsidered later when markets are developed or abundant cheap raw materials becomes available.

4. Clay (Red) Bricks

Q.O. : Our questions include markets for bricks, inter-material competition in building industry and availability of clay.

A.J. : Hollow clay bricks could be extensively used if they can be made cheap and more high-rise buildings are erected. The trend is conspicuous in some parts of the Gulf area including Saudi Arabia and Iran because use of clay bricks usually reduce building cost. Clay bricks compete with concrete blocks and also some precast concrete products including ALC. The key factors which determine result of the inter-material competition will be price and quality. A big clay deposits which could be easily exploited have not been located in Oman and, until cheap clay becomes available in quantity, manufacture of clay bricks may be left untouched.

5. Secondary Concrete Products - Precast Concrete Panels and ALC Products

A.O. : We want to ask about your views on the future of building sector in Oman and also on the markets for the above two products.

A.J. : The Five Year Plan predicts gradual decrease in investment in building sector up to 1980. We think that level of the total investment in building sector will be unchanged or rather slightly increasing due to delayed public investment and also need for new investment in housing by the Government. The two secondary concrete products are suited for constructing standardized houses and buildings which are easily incorporated into Government-sponsored housing development schemes. If this takes place, either precast concrete or ALC products must be selected since markets for these products are limited. It is recommended that initial scale of production of these materials be well below the levels indicated in the report.

C.O. : There exists oversupply of high-cost housing in Oman, whereas shortage of low-cost housing is expected in future. In planning construction of low-cost housing in Oman, such local factors as traditional design, climate and life pattern must be taken into consideration.

6. Nitrogenous Fertilizers

Q.O. : We come across two conflicting views as to prefeasibility of the fertilizer project. We want clarification about marketability of the fertilizer.

A.J. : The fertilizer project will become feasible only if market is secured. In other words, domestic market for the fertilizer is so small that most must be exported to countries which could easily absorb 600 to 1,500 tons per day of the product. In order to stabilize exportation conclusion of a long-term Government-to-Government agreement on purchase is strongly recommended. Projection of regional demand and supply balance in the Middle East and the South West Asia (Pakistan, India and so forth) indicates that in 1980s shortage of supply in the South West Asia could be offset by the excess supply of the Middle East. One typical example is a G-G agreement between Oman and India.

C.O. : Exploitation of natural gas is one of key long-term objectives of industrialization and there is some time left before we reach final decision on this matter. There are two feasibility studies on the gas-fertilizer project already available and we can make full use of the existing studies when Oman wants to arrange the G-G agreement.

Q.O. : We would like to ask you some technical advice to make this project competitive.

A.J. : The minimum production scale of ammonia plant is 600 tons per day and below this level unit cost rises sharply because expensive reciprocating compressors must be employed. A fertilizer plant mounted on a barge could be recommended for gas feed obtained from offshore gas fields.

7. Copper Products

Q.O. : According to your recommendation, the copper projects is preferably modified to include electrolysis and copper wire manufacturing. Then what is technological and economical indication of this modification?

A.J. : The reasons why we recommend the project to go further downstream are as follows:

- a. Markets for the fire refined copper is small--only 10% of total copper market.
- b. Higher value added in Oman could be achieved.
- c. There exist markets for wire bars and wire rods in the Gulf countries--several factories for manufacturing electric wire and cable are under construction.

Technological and economic impacts of the process modification is expected to be small. Smelting is simplified by removing reduction process and electrolysis and SCR process are added. And, if domestic market justifies, insulated electric wire manufacturing could be added. We foresee little difficulty in introducing these technologies into Oman. The additional investment is estimated at about 20 million U.S. dollars, which is small compared with the proposed investment of 120 to 140 million U.S. dollars to develop the copper mined and the smelter.

C.O. : Extension of the copper project toward downstream processing is now being discussed within the Government of Oman and OMCO. There remains

still uncertainty as to copper price in future and, on account of this, there is an opinion that we had better to wait and see for a while before we finally decide to proceed with the downstream processing.

C.J. : We would like to make it clear that as long as copper market remains weak development of the on-going copper project may not be viable and therefore downstream processing will not become feasible as well. Our recommendation is based on a fact that the downstream extension of the project makes marketing of copper products much easier and that it is more efficient to design the upstream and downstream processes at the same time.

Q.J. : We wonder if implementation of the copper project is slightly delayed.

A.O. : It is not true. We have already invited tenders for engineering design of copper mines, a dressing plant, smelter and related infrastructure. The project is certainly on the move.

8. Fish Meal

Q.O. : The JICA report indicates that the minimum economic scale of fish meal production is approximately 350 tons per day and there is little possibility for Oman to construct such a processing plant. On the contrary, a small-scale fish meal plant is to be built in Oman by

Korean according to a fishery agreement between the two countries. We regard the 350 tons per year plant as too large to be built in Oman.

A.J. : Fish meal plants could be enlarged to match the amount of fish catch and fish catch should be estimated prior to determining capacity of fish meal plant. It will be wiser to start with smaller capacity of production and gradually to enlarge it in accordance with increase of fish catch.

C.O. : Construction of a small fish meal plant is one of many items included in the agreement and it has not materialized yet. It is our wish to build larger plants in future, because fish meal is in big demand in the world market. There is a plan in Oman that sardine fishing be further encouraged in order to process the catch into;

- a. fish meal
- b. canned fish
- c. frozen fish

and these products be marketed.

9. Repairing Small Fishing Boats

C.O. : Ministry of Agriculture, Fisheries, Petroleum and Minerals has already started to build small workshops for repairing outboard engines and boats in Sur, Salalah, Mutrah and Sohar. And Japanese cooperation may not be needed urgently.

10. Petroleum Refinery

Q.O. : Some people have cast a doubt on the increasing trend of petroleum product demand as explained in the JICA study. In particular the total demand in Oman except for bunker fuel is sometimes projected to remain on the same level as that of the present, namely approximately 10,000 barrels per day (bpd). Refining capacity of 50,000 bpd proposed by JICA seems too large to be economically operated in view of the expected smallness of demand in Oman. To avoid risking heavy investment in large-scale refinery, there is an opinion that Oman is to construct a small- to medium-scale refinery with capacity of 10,000 to 30,000 bpd by 1985 only to meet major parts of the demand and, if necessary, the rest to be met by importation. And after 1985 refining capacity will be increased to 50,000 bpd, for example, so as to meet the incremental demand.

A.J. : We have not looked into possibility of stage construction which would optimize combination of capacity and process in terms of investment and cost. So it is not possible for us to recommend an optimized schedule of building up refining capacity. As the World Bank experts advised, construction of a topping plant with gasoline manufacturing facility could be recommendable as the first step of refining petroleum in Oman.

Q.O. : The World Bank report suggested construction of 30,000 bpd topping plant and thereafter American firms including Bechtel and Fluor have proposed construction of a topping plant. Their rough estimate

of construction cost is something like 10 million U.S. dollars for a 10,000 bpd plant, which is extremely cheap compared with construction cost of a medium-sized grassroots refinery.

A.J. : The prices the Americans are quoting seem very low in comparison with those internationally accepted. There are a few ways of saving the construction cost, including use of a skid-mounted plant or a plant-barge.

Q.O. : Residual oil from the 50,000 bpd refinery will amount to about 13,000 bpd in 1985 as explained in the JICA report. The abovementioned figure will be net excess excluding sales of bunker oil and it will have to be exported somewhere. We would like to know if you have any idea about disposal of this residual oil including exportation to Japan and also if any Japanese companies are interested in equity participation in this refinery project with the aim of marketing the excess products.

A.J. : There exists a lot of uncertainty regarding estimation of demand for bunker oil and we are not sure if 13,000 bpd residual oil will have to be exported in 1985. We foresee, at least, a stiff competition for marketing residual oil in the Gulf area in future because there will be many petroleum refineries in operation. For the time being, excess residual oil in Oman, if it occurs, will have to be marketed through distribution channels of international oil companies. Exportation of the residual oil to Japan may not be possible on the ground that residual oil is also in surplus in Japan. Construction

of a heavy oil cracking apparatus is not recommended due to higher refining cost resulting from additional investment.

C.O. : There is an optimistic view of demand for residual and bunker oils. There will be additional demand for bunker oil from Oman by VLCCs (Very Large Crude Carriers) which barely pass through the Strait of Hormuz after loading fully with crude oil in the Gulf area but not with bunker oil because of insufficient depth of the Strait. In the coming age of petroleum shortage, residual oil will certainly find large market since it will make cheapest sources of energy among hydrocarbon resources. Also it would be possible for oil producing nations to sell residual oil at relatively low price when their export-oriented refineries are competing each other.

C.O. : Decision making on construction of a petroleum refinery in Oman will be based on balancing advantages against disadvantages as shown below:

Advantages: Saving foreign currency to import petroleum products and insuring the national security in case of discontinuation of petroleum products supply through the Strait of Hormuz.

Disadvantages: Reduction in foreign currency earning due to reduced export of Omani crude oil and large investment involved.

The Government of Oman now contemplates stockpiling petroleum products but actual implementation of the plan is withheld since construction of a refinery will make an alternative for stockpiling. In view of the strategic consideration prevailing in Oman, construction of even a small-scale topping plant seems to be justified. The Gas Council composed of the Ministry of Commerce and Industry and Ministry of

Agriculture, Fisheries, Petroleum and Minerals will have the final responsibility of the refinery project. In making decision on this matter, such factors as follows will be thoroughly reviewed and examined:

- a. Future domestic demand for petroleum products
- b. Optimal combination of output products and refining capacity
- c. Estimated necessary importation of petroleum products if a proposed refinery could not meet all the domestic demand
- d. Estimation of refinery investment and operation cost
- e. Comparison refinery investment with stockpiling investment

11. Others

A.O. : Production of plastic water tanks has attracted much attention. We wonder if you examined possibility of manufacturing FRP (Fibre Reinforced Plastics) tanks.

A.J. : In the JICA report, we proposed production of polyethylene tanks with steel frame reinforcement which are inexpensive enough to be widely marketed in Oman. FRP tanks will be expensive and therefore will find small market.

Q.O. : There is a steel-rerolling project going in Oman and the project may be expanded so as to incorporate downstream processing such as wire drawing, nail and wire net manufacturing and so forth.

A.J. : We understand that initial production of rolled steels is planned to be 30,000 tons per year and most of the products are to be consumed in construction sector. Markets for other secondary products in Oman are expected to remain small and therefore production of wire rod is not strongly recommended for the time being. The JICA team did not look into these markets in detail and will not have a plan to reexamine the project in future.

12. Results of Discussion

1) The Government of Oman wishes the Japanese Government to continue its technical cooperation in the following areas of detailed industrial project study:

- a. Building materials
- b. Petroleum refinery
- c. Copper products
- d. Plastic tanks

An official request in this regard will be sent to Japan through the normal diplomatic channel. The Government of Japan, on the receipt of the request, will decide which project(s) are to be further studied, considering situations in Oman and its own conditions including budget.

2) The Government of Oman will accept the invitation by JICA that two Omani experts be sent to Japan in order to deepen understanding and exchange views about the present study. Together with the abovementioned two experts, "other two" experts will also be sent to Japan for the same purpose at the expense of the Government of Oman.

ANNEX Ⅲ. 地名対照表

日本語	英語名	日本語	英語名	日本語	英語名
アジュマン	Ajman	スマイル	Sumail	マトラー	Mutrah (Matrah)
アクダール山	Jabal Akhdar	ソハール	Sohar	マルムル	Marmul
アル・クウェイール	Al Khuwair	ダヒラ	Dhahira	ミナ・アル・ファール	Mina al Fahal
アル・グブラ	Al Ghubra	ダル・サイト	Dar Sait	ミナ・カブース	Mina Qaboos
アルジャ	Aarja	ドバイ	Dubai	ミナ・レイースト	Mina Raysut
アル・フワイサ	Al Huwaisa	ドファール	Dhofar	ムサンダム	Musandam
アル・ベイダ	Al Bayda	ナッハル	Nakhl	ラサイル	Lasail
イバル	Yibal	ニザール	Nizar	ラスアルハイマ	Ras Al-Khaimah.
イブラ	Ibra	ニズワ	Nizwa	ラスアルハッド	Ras Al Hadd
イブリ	Ibri	バハラ	Bahla	リヤム	Riyam
ガーバ	Ghaba	ハウシ	Haushi	ルウイ	Ruwi
カサブ	Khasab	ハクシ	Hajar	ルズク	Luzuq
グブラ	Ghubra	ハジャール	Batinah	ルセイム	Rusayl
クラヤット	Qurayat (Quriyat)	パティナー	Bid Bid	レイースト	Raysut
クリアムリア	Kuria Muria	ピドビド	Fahud	ロスタク	Rostaq
クルム地区	Qurum	ファワード	Buraimi	ワジ・アディ	Wadi Aday
サイ・ハタート	Sayh Hatat	ブレイミ	Huqh	ワジ・ジジ	Wadi Jizi
サマッド	Samad	フグフ	Bustan	ワジ・マブラー	Wadi Mabrah
サララー	Salalah	ブスタン	Beit	ワジ・マンザリア	Wadi Manzariah.
シーブ	Seeb	ペイト	Bayda	ワジ・ワ'アル	Wadi Wa'al
ジャブロ	Jabro	ペイダ	Hormuz	ワティア	Wattiyah
ジャルキヤ	Sharqiya	ホルムズ	Masirah	ワヒバ	Wahida
スール	Sur	マシラ	Muscat		
		マスカット			

ANNEX

IV. その他関連用語対照表

日本語	英語名	日本語	英語名
A F S E D	Arab Fund for Social and Economic Development	財務局	Directorate General of Finance
ウイラヤー	Wilayat	シェイク	Shaikh
オーマン開発銀行	Development Bank	中央銀行	The Central Bank of Oman
開発審議会	Development Council	農業普及センター (A E C)	Agriculture Extension Center
計画会議	The Development Board	水資源審議会	Water Resource Council
経済計画開発 最高会議	Supreme Council for Economic Planning and Development	ガス審議会	Gas Council
財政審議会	Financial Council		

(1978年6月現在)

日 本 語	英 語	名
國 防 省	Ministry of Defence	
外 務 省	Ministry of Foreign Affairs	
内 陸 部 担 当 省	Ministry of Interior	
司 法 省	Ministry of Justice	
郵 政 省	Ministry of Posts, Telegraphs & Telephones	
電 力 ・ 水 力 省	Ministry of Electricity & Water	
運 輸 省	Ministry of Civil Aviation, Roads & Ports	
商 工 省	Ministry of Commerce & Industry	
農 ・ 漁 ・ 石 油 ・ 鉱 物 省	Ministry of Agriculture, Fisheries, Petroleum & Minerals	
保 健 省	Ministry of Health	
教 育 省	Ministry of Education	
情 報 ・ 文 化 省	Ministry of Information & Culture	
ワ フ ・ イ ス ラ ム 問 題 省	Ministry of Awqaf & Islamic Affairs	
國 土 ・ 自 治 省	Ministry of Land Affairs & Municipalities	
青 少 年 省	Ministry of Youth Affairs	
オ マ ー ン 伝 承 省	Ministry of National Heritage	
王 室 担 当 省	Ministry of Diwan Affairs	
社 会 問 題 ・ 勞 働 省	Ministry of Social Affairs & Labour	

ANNEX VI オマーンにおける代表的企業グループ

<u>Name of Firm</u>	<u>Associates Firms</u>
1. Abdul Aziz & Bros	National Pharmacy Muscat Super Market
2. Mohsin Haider Darwish	Mazoon Dept Stores Al Darwish Gas Plant Darwish - Ast Const. Co. Darwish Caperneill Ltd Crown Darwish Eng. LLC Qurum Constructors
3. Moosa Abdulrehman Hassan	Abdulla & Sons Oman United Agencies Qurum Contractors Oman Concrete Products
4. Waleed Associates	Yusuf bin Ahmed Kanoo & Co. Qurum Contractors Oman Mechanical Services Co., Ltd. Office Supplies Kassara Crusher Co. Kassara Transport Co. Mona Noor Inc.
5. Zawawi Trading Co.	Project Services Oman Qurum Contractors Oman Mech. Services Co., Ltd. Waleed Associates Muscat Pharmacy Zubair Travel & Service Bureau Electrical Appliances Corp.
6. Zubair Enterprises	Electronic Supplies & Services Co. Zubair Travel & Services Oman Oman Air Cond. & Refrigeration Co. Oman Oil Indust. & Supply Services Co.
7. Suhail and Saud Bahwan	Amiantit Oman Bahwan Const. Co. Bahwan Travel Agency Delta Tradg Co. General Elect. & Cont. Co. Al Mutawah Trading Co. Bahwan K.M. Bros. Qurum Contractors

- | | |
|--------------------------|---|
| 8. W.J. Towell & Co. LLC | General Elect & Tradg Co.
Mutrah Cold Stores
Taylor Wooddraw Towell
International Furnishing Co.
Sultan's Travel
Oman United Agencies
Masoon Printing Press
Oman Refreshment Co.
National Dairy Products
Cold Storage & Trading Co., LLC Salalah |
| 9. General Trading Co. | Oman Aluminim Co.
National Beverages Co.
Getco Press International |
| 10 Moosa Jaffes Matwani | Sharikat Fanniya Omaniya Muscat LLC
Inter - Gulf Trading Co.
Muscat Maritime Agency |

JICA