

BASIC CONCEPT REPORT
FOR
THE STUDY RELATED TO
THE REGIONAL DEVELOPMENT PLAN
OF THE GREAT CARAJAS PROGRAM
OF THE FEDERATIVE REPUBLIC OF BRAZIL

DECEMBER 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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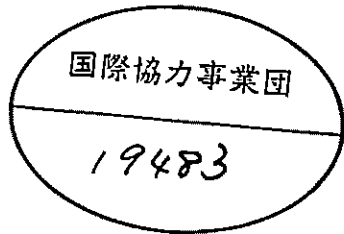


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JAPAN INTERNATIONAL COOPERATION AGENCY



国際協力事業団

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Preface

The purpose of this report is to keep the Brazilian Counterpart informed of the progress of work being made by the JICA study team in connection with the First Progressive Report of the Study Related to the Regional Development Plan of the Great Carajas Program, to be undertaken under the Scope of Work agreed upon between the Japan International Cooperation Agency (JICA) and the Executive Secretariat of the Interministerial Council for the Great Carajas Program (Brazilian Counterpart) on 4 February 1982.

The report thus attempts to describe, in respect of each commodity to be studied, (1) how far statistical data and other information have been collected, (2) how far analyses of past and present trends and long-term demand and supply projections are in progress, (3) methods or approaches likely to be employed in the projections, and (4) problems or difficulties, if any, anticipated at this stage.

Following the agreement on the Terms of Reference for the First Progressive Report between the two parties on 14 September 1982, efforts have been made by the study team to expedite the work by accelerated tempo of data collection and search for projection methods. During the period from 16 October to 6 November the study team visited various overseas organizations concerned with problems of primary products in order to strengthen their data base as well as to exchange views with experts on problems of commodity projections.

It should be noted, in this connection, that availability of statistical data on the one hand and feasibility of long-term demand and supply projections on the other vary considerably from commodity to commodity.

For instance, for some commodities like certain mineral products, necessary data are almost completely available in Japan and therefore the work has made a considerable progress while for some other commodities like certain agricultural products, data are as yet not sufficient even after the study team's visits to overseas organizations and thus the progress of the work has been necessarily slow. Again, in some cases the work has progressed to the extent that the present report may be regarded as indicative of the outline of the final report, while in some other cases it offers mostly the sources of data so far collected and the indication of the broad direction of the study. It follows that the style, depth and emphasis of the report on the progress of the work differ considerably from one commodity to another. With this qualification in mind, the progress of work so far made in respect of each commodity will be summarized below.

I. SUMMARY

I-1 Summary of Agricultural and Wood Products

I-1-1 Oilseeds

The study covers the nine oilseed crops and their products. Since the oils and fats from these crops are highly interchangeable and their prices are closely inter-related, the study is also made on the vegetable oils and fats as a whole, including other vegetable oils.

The largest factors for the growth of the production and trade of the vegetable oil in the world were the production increases of soybean in U.S. and Brazil and of oil palm in Malaysia. The production increase of soybean was induced and supported by the rapid increase in the demand for soybean meals for animal feed, while that of oil palm was due to the increased demand for oil.

The projections for vegetable oil as a whole and for major items will be tried by utilizing the time-series data. The results of projections derived from a projection model, which is now under operation, will be modified by the findings of the analytical study.

I-1-1-1 Oil palm

Since 1970, the annual growth of palm oil production has been more than 10%. The consumption also grew rapidly especially in developing countries. Malaysia and Indonesia, the most important producers, plan further increase. The lowering prices of palm oil may expand the demand at the expenses of other oils.

Since production and exports of palm oil are heavily concentrated in Malaysia and Indonesia, the study is made in detail for these two countries.

I-1-1-2 Babassu and coconuts

Although coconut trees are grown widely in tropical zone, the Philippines and Indonesia are dominant in the production of copra and coconut oil. The world trade is dominated by the Philippines, followed by Malaysia and Pacific island countries. The prospects of the future production seem to depend largely on the success/failure of the replanting progress in these countries.

The price of coconut oil correlates more closely with palm kernel oil and babassu oil both of which belong to the same category of "hard oil", being highly interchangeable. Therefore the prospects of the export markets for babassu oil will be analogized from coconuts oil.

I-1-1-3 Soybeans

Soybean oil occupies the largest portion in the world vegetable oils supply, followed by palm oil. The production of soybeans is heavily concentrated in three big countries: U.S., China and Brazil, and the major exporting countries are U.S., Brazil and Argentina.

The rapid increase in world production owes a great deal to the increased demand for soybean meals in developed countries. Thus the price of soybean has been more influenced by the demand for feed rather than for oil. The present study on soybean as an oilseed will be linked with the study on soybean meal which is dealt with under the feed crops.

I-1-1-4 Other oil seeds

Among other oilseeds, peanuts, cotton seeds, and sunflower are important. Oils from these oilseeds are interchangeable and price correlation among them is close. The study on these oil crops places emphasis on the market relationship among them.

Castorseed is produced mainly in Brazil and India. Since the castor oil is for industrial use, the study is made separately from other oilseeds.

I-1-2 Feedstuff

I-1-2-1 Maize

The collection of data on the production, import and export of maize, livestock and poultry population figures, is nearing completion, and the prevailing conditions including factors causing variations are being analyzed.

Projections of production and export of maize will be made mainly for major producing and exporting countries. Projections of import and consumption of maize will be made based on the demand for farm products in the major importing and/or consuming countries. Changes in the population and income levels as well as expected growth rates of demand for feedstuffs will be taken into consideration.

I-1-2-2 Soybean meal

Regarding the production and export of soybeans, quantities available for export from the U.S. and Brazil, and share from the EC countries which import soybeans will be the principal areas of estimation..

Concerning the import and consumption, the quantities of soybean meals will be estimated from the demand for feedstuffs, based on the projections for maize. The substitution of other seed meals will also be taken into account.

I-1-2-3 Cassava pellet

The major importing countries of cassava pellet are the EC countries, and the major exporting country is Thailand. Since the import quota has recently been in effect in the EC countries, the diversification of crops has been progressing in Thailand.

Since the future demands will depend to a great extent on the EC's import policy, projections will not be made in the same manner as the other products.

I-1-3 Ethyl Alcohol

I-1-3-1 Industrial Ethyl Alcohol

Demand in major consuming countries up to 2000 will be projected by means of the elasticity of GNP. Based on the demand/supply projections and cost competitiveness comparison in major alcohol producing countries, we will investigate the possibility of exporting industrial ethyl alcohol produced in Brazil.

I-1-3-2 Ethyl Alcohol for Energy

Demand for energy ethyl alcohol up to 2000 will be projected by comparing the prices of energy alcohol and gasoline. The future direction of technical innovation for vehicles that use energy and the prospect of oil price will influence the future demand of energy alcohol. Based on these analyses, we will investigate the possibility of exporting energy alcohol produced in Brazil.

I-1-4 Industrial Crops

I-1-4-1 Natural rubber

Demand and supply for rubber will be projected up to 2000. Demand is to be divided into two end-use groups; tire and non-tire sectors. Major explanatory variables of demand projection for tire sector are economic growth rate, growth rate of population, new car production, tire replacement ratio, radial tire ratio, etc. Regarding the demand projection of non-tire sector, we will depend upon the projections made by the research institutions and international organizations. On the other hand, supply will be projected by the production prospects of major natural rubber producing countries. Based on the above-mentioned demand/supply projections and past trends analysis of production, consumption and international trade, we will investigate the possibility of exporting natural rubber produced in Brazil.

I-1-4-2 Other industrial crops

1. Pepper

The production and exports of pepper are dominated by four big producing countries; India, Indonesia, Malaysia and Brazil. The import is heavily concentrated in the Western countries (North America and Europe), but Japan has in recent years become one of the major importers.

There are two major components of the demand for pepper; household demand as a condiment, and demand by food processing industries. In the former case, the demand for pepper should be low as pepper only accounts for a small part of household expenditure, whereas in the latter, the demand is likely to be more price responsive.

Long term projections will be tried by the method analogous to the one for oilseeds.

2. Brazil nuts

As the name indicates, Brazil is by far the largest supplier, although neighboring countries, i.e., Bolivia, Colombia and Peru produce some. Available statistics, which are very few and at best only estimate, indicate the declining trend of production.

The largest importer is the United States, which takes more than half, followed by the United Kingdom and West Germany. It seems that the price of Brazil nuts is more influenced by demand than by production.

The study on past trend and future outlook on these points are very difficult due to the dearth of statistical data and information.

3. Guarana

Necessary data have not been available as yet.

I-1-5 Raw Cotton

The harvesting area of raw cotton has not been increased since the 1930s. However yield has tended to rise, and there still exists much room for technological improvement for raw cotton production. Thus raw cotton production has the potential to meet increased demand.

The share of natural fibers in textiles consumption continued to decrease since the 1950s in contrast to the sharp increase in artificial fibers consumption. Since the first oil crisis in 1973, however, cost of natural fibers have become competitive with that of synthetic fibers.

Demand and supply projections up to 2000 will be made taking the past trends analysis into consideration. Based on these analyses, we will investigate the possibility of exporting raw cotton produced in Brazil.

I-1-6 Wood

This study is composed of analysis on production, consumption, international trade and prices, and projections of forest products; lumber, plywood, pulpwood, charcoal, sawlogs and veneerlogs, according to FAO statistical classification.

The trend of production is analyzed by FAO Yearbook of forest products divided into 13 countries and/or regions. Cutting cycles, forest resources, harvesting volume and production cost will be shown for major producing countries.

The trend of consumption is also analyzed by FAO Yearbook of forest products divided into 13 countries and regions. Calculation of consumption is made based on production, import and export.

The trend of international trade is analyzed by UN trade data and OECD trade data. The flow of international trade is figured out through trade from one block to another block, such as from Latin America to North America, etc. The assessment and study factors influencing price fluctuation of international market price are made by recent research models and others.

Demand projections of forest products will be made by 1) trend projection analyses using linear and logistic curves and 2) multiple regression analyses. Supply projections are fundamentally dependent on forest stock and forest resources in the future. Future supply conditions from quantitative, qualitative and economic points of view will be examined based on the survey of development, utilization and cultivation of forest resources in the major tropical wood producing countries.

Projections on charcoal will be difficult in view of the lack of necessary data.

I-1-7 Beef

The collection of data on production, exports, imports and trends of consumption of beef, and on factors affecting these, is almost completed. Factors causing variations in these areas are also being analyzed.

In the projections of future trends, the principal factors affecting demand, comprising growth in population, variations in per capita consumption due to changing income levels, and increase or decrease in the export levels of beef and live cattle, will be taken into account.

Most areas of South America are contaminated with foot-and-mouth disease, and non-contaminated countries prohibit the import of live cattle and raw beef from contaminated areas, boiled beef being the only category permitted for import. Therefore, unless foot-and-mouth disease is eradicated, any increase in the level of exports to non-contaminated countries will prove to be difficult.

I-1-8 Tropical Fruits

I-1-8-1 Banana

Analysis of banana has the objects of projecting world-wide demand in the year 2000, analyzing various points of view and evaluating new production and export possibilities.

Projections will be made on the basis of data such as the world total volume of imports, the volume of imports of the main importing countries, the quantity of fruit consumption per capita, banana consumption per capita, income or disposable income per capita, the population growth.

I-1-8-2 Other tropical fruits

1. Papaya

Most of the papayas produced are consumed by the producing countries themselves, and the majority of exports are to neighboring countries, with only a very small portion of these being exported to more distant locations. Accordingly, international trade data are not available, and the analysis will be made based on FAO's Production Yearbook and USDA data only.

2. Melons

Although very large quantities of melons are currently being produced, most of these are consumed by the producing countries themselves, with their export being limited to neighboring countries and not in any bulk quantities to more distant areas. Consequently, data sources are limited to Production Yearbook of FAO and USDA data only.

3. Cashew nuts and juice

The data necessary for forecasting the future demand for cashew nuts are not available in complete form, but forecasts will be tried after examination and analysis of the data obtained as far as possible.

As for cashew juice, as yet no necessary data have been available.

4. Pineapple juice

As sources of data on pineapple juice, FAO's data on import and export and data from the USDA are available, from which the analyses will be made.

5. Passion fruit juice

Regarding the product, data on the area under cultivation and output of passion fruit juice in Australia from 1973 to 1977 are the only data available.

I-2 Summary of Mining Products

I-2-1 Bauxite, Alumina and Aluminum

1. Resource

The world bauxite deposit is estimated at approximately 25 billion metric tons, including inferred deposit.

Large deposit exists in Africa, Australia and South America.

2. World total production

Bauxite in 1980	93 million metric tons
	-- Australia, Guinea, Jamaica
Alumina in 1980	35 million metric tons
	-- Australia, U.S.A., etc.
Aluminum in 1980	16 million metric tons
	-- U.S.A., etc.

3. Industrial structure

Aluminum industry has been under the strict market control by 6 "Majors" i.e., ALCOA, ALCAN, KAISER, REYNOLDS, PECHINEY, ALUSUISSE, but their share is declining.

Recently, state-owned companies are emerging mainly at the developing countries.

4. Aluminum production cost model and competitiveness

Production cost using hydro power at existing plant is regarded as overwhelmingly competitive.

Production cost using newly-installed hydro power in the developing countries could be competitive in the future so far as necessary infrastructure is provided and various incentives are extended.

5. Consumption

World total consumption of primary aluminum reached approximately 16 million metric tons in 1979. Demand has been declining and the aluminum industry is now suffering from the large excess of supply.

6. Demand structure

Every country has its own particular demand structure. Aluminum has a wide variety of market from household goods to basic industrial materials.

7. Price

Since 1978 when primary aluminum was listed in the LME market, it has become speculative commodity and its stable price formation as basic material has been damaged.

ALCAN list price	US\$1,750/MT
------------------	--------------

LME price	US\$1,050/MT
-----------	--------------

8. Trade

Present major supplying countries are Canada, Norway, U.S.A., etc. and importing countries are Japan and EC countries.

Bauxite and alumina are mainly incorporated in the integrated trade flow of "Majors" and do not form a market as trade commodity.

9. Projections

Expansion plans and new projects especially in Australia are suspended due to recent rapid drop of demand and it is now uncertain whether other projects may be materialized.

According to various supply and demand forecasts, aluminum supply and demand will be balanced in the near future to be followed by improved operation rate.

10. Conclusion

On the basis of general analysis above, a view concerning development basis, necessary considerations, timing and various measures will be summarized.

I-2-2 Nickel, Ferro-nickel and Nickel Oxide

1. Resources

Large deposits exist in Canada, New Caledonea, Australia and U.S.S.R.

Oxide shares about 70% of the resources and sulphide shares about 30%.

2. Production

Mining production of the world in 1980 amounts 755 thousand tons, Canada 195 thousand tons, New Caledonea 87 thousand tons, Australia 74 thousand tons and U.S.S.R. 143 thousand tons; these 4 major countries share nearly 70%.

Smelting capacity of the world in 1980 reaches 1 million tons including inferred capacity of Eastern block 200 thousand tons. Only INCO has 250 thousand tons of smelting capacity. Other Western majors are Falconbridge, Western Mining of Australia, SLN of France and a few Japanese producers.

3. Production cost

Production costs depend largely on the grade of ore, including that of by-products, the method of extraction and the geographical location.

4. Consumption and its patterns in sectors

Consumption of the Western world in 1979 is 584 thousand tons (while production is 774 thousand tons) and in 1981 drops sharply to the level of 450 thousand tons (while 650 thousand tons). And it will drop more in 1982.

The largest end-user of nickel is stainless steel makers which share 50% of the total consumption.

5. Price

LME price of nickel is far less than US\$2.00/lbs, whereas the most competitive production cost by sulphide reaches nearly US\$3.00/lbs.

This discrepancy is expected to exist for several years due to slow recovery of world economy and continuing inflow from the Eastern block.

6. Trade

World trade flow will be described based on reliable and available data.

7. Projections

Based on firsthand information received during our study tour in the third countries, demand forecast is now being made both on a short-term basis and on a medium term basis (up to 1990).

Future trends of production capacity, production volume and supply-demand balance will be forecasted by obtainable information and our own opinions.

8. Conclusion

Marketing of Brazilian products will be concluded in view of the results of the foregoing researches.

I-2-3 Cobalt

1. Resources

Large deposits exist in copper mines of Zaire and Zambia and nickel mines of Canada, New Caledonea and Cuba.

2. Production

World production in 1980 amounts 26 thousand tons, in which Zaire shares 15 thousand tons, Zambia 3 thousand tons, the Japanese producers 2.7 thousand tons.

World production capacity in 1980 is 31 - 32 thousand tons, in which Zaire shares 16 thousand tons.

3. Production cost

It is very difficult to figure out a production cost of cobalt independently, because cobalt is one of the by-products from copper or nickel producing process.

It is, in a sense, a simple matter of cost calculation for an integrated production process of copper or nickel.

4. Consumption and its pattern in sectors

World consumption in 1981 is 18 thousand tons, in which U.S.A. shares 6.5 thousand tons, other Western countries 8.5 thousand tons, Eastern countries 3 thousand tons.

Major consumers are the engine makers such as Rolls-Roys (U.K.), J & R (U.S.A.).

5. Price

LME price of cobalt is about US\$5/lbs, whereas production cost of Zaire is assumed to be US\$12.5/lbs.

Trends of cobalt price will be described based on a reliable data.

6. Trade

It is very hard to describe the world trade flow of cobalt due to lack of an independent item of statistical data for cobalt ore import.

7. Projections

Based on firsthand information received during our study tour in the third countries, demand forecast is now being made both on a short term basis and on a medium term basis (up to 1990).

Future trends of production capacity, production volume and supply-demand balance will be forecasted by obtainable information and our own judgment.

8. Conclusion

Marketing of Brazilian products will be concluded in view of the results of the foregoing researches.

I-2-4 Manganese

1-2-4-1 Ferro-manganese

1. World total production and industrial structure

Producing country of ferro-manganese was the consuming country until early 1970's.

The trend that the countries of ore reserves or low-energy cost become a producing country of ferro-manganese started around mid-1970.

This trend and its underlying reasons will be studied.

2. Production cost

Cost competitiveness will be examined by means of a model calculation for a certain cost composite of material ore, energy cost, depreciation, etc.

3. Consumption and its pattern in sectors

The trend of consumption, which has been closely linked to the steel production, will be studied.

The increase rate will be a little lower than that of steel production due to the technological innovation of the steel industry.

4. Price

Recently the international price is tend to be determined by a price of a country of the lowest energy cost,

while it was largely influenced by big international event, such as nationalism of mineral reserves, petroleum crisis, etc.

The trend will be studied and analyzed for the forecast of future price.

5. Trade

Major suppliers are South Africa, Norway, France, etc. and main importers are U.S.A., West Germany, etc.

International trade flow and trade practice will be studied.

6. Projection

Supply-demand projection will be made on the basis of the forecast of steel production and innovation of steel industry.

7. Conclusion

Marketing of Brazilian product will be concluded in view of the results of foregoing researches.

I-2-4-2 Manganese ore

1. Resources

World manganese ore reserves on shore amount approximately 4.1 billion tons including inferred reserves.

Five major countries share more than 80% of the reserves; these countries are U.S.S.R., South Africa, Australia, Brazil.

2. Production and industrial structure

World total production in 1980 amounts approximately 27 million tons, which is closely linked to the production of ferro-manganese.

Mining capacity of major mines has an allowance of 10 - 20% of actual production volume and also has a plan to expand its capacity in the near future.

3. Production cost

Production cost depends largely on geographical location, degree of depreciation and transportation cost to the exporting port. It means production costs vary by each mine and it is very difficult to discuss about a standard production cost.

4. Consumption and its pattern in sectors

Most of consumers are the ferro-manganese industry, which is changing in its production structure influenced by energy cost and transportation cost.

Our study will cover the trend of consumption and analysis of changes in consumption pattern influenced by ferro-manganese industry.

5. Price

Price has not been changed largely after energy crisis of 1974 under the circumstances of over-supply, excepting the effect of annual inflation.

The description of price trend and its analysis will be made.

6. Trade

Decreasing trend of international ore trade will be described comparing increasing trend of ferro-manganese trade after energy crisis in 1974.

7. Projection

Supply-demand projection will be made on the basis of forecasts of ferro-manganese.

8. Conclusion

Marketing of Brazilian products will be concluded in view of the results of foregoing researches.

I-2-5 Copper Concentrate and Refined Copper

1. Resource

The world copper reserve is estimated at 505 million tons of copper.

Large deposits exist in Chile and the U.S.A. accounting for 37% of known copper reserves.

2. World total production and industrial structure

Copper mine and refined copper production by producing countries and the analyses of the factors causing the change in production structures will be studied.

3. Production cost

The production costs depend largely on the grade of ore, including that of by-products, the method of extraction and the geographical location.

At present, Chile stands at the overwhelmingly competitive position.

4. Consumption and its patterns in sectors

The chronological data by consuming countries and the analyses of the factors influencing the consumption will be studied.

The largest end-user is the electrical equipment suppliers. The trend of the refined copper consumption and analyses of factors causing the change in the consumption patterns will be made.

5. Price

Copper prices tend to react to political uncertainty and speculative influences in addition to changes in physical supply and demand.

The trends in LME price and U.S. producers price will be described.

6. Trade

World trade flow of copper concentrate and refined copper and international transactions by copper concentrate, blister, refined copper and scrap will be studied.

7. Projections

After showing various forecasts (by World Bank, Chase Econometrics and USBM), supply and demand forecasts for short, medium and long term will be made.

8. Conclusion

Marketability of Brazilian products will be concluded in view of the results of the foregoing researches.

I-2-6 Tin

1. Resources

Total world tin resources are estimated at approximately 10 million tons.

Geographical distribution and reserves by country will be studied.

2. World total production and industrial structure

80% of tin production (concentrate or primary metal) is produced in Malaysia, Thailand, Indonesia and Bolivia.

Trends in tin production and change in the production structure will be studied.

3. Production cost

Production costs by country and by mining methods, i.e., dredges offshore, dredges onshore, gravel pump, open-cast and underground, will be studied.

4. Consumption and its patterns in sectors

Consuming countries are the U.S.A., Japan and EC countries.

Principal consuming sectors are steel industry (tin plate), electronic industry (solders), chemical industry (stabilizer for vinyl chloride).

Trends and change in the consumption pattern will be studied, putting emphasis on the effect of technological progress such as tin-free steel, LSI, aluminum can, etc.

5. Price

LME price and Penang Market price will be studied.

6. Trade

International trade flow and trade practices will be studied.

Outline of the 6th International Tin Agreement and the function of International Tin Council will be described.

7. Projection

Short term projection will be made on the basis of major sectoral demand forecast and the projected production capacities.

Medium and long term projection will be made on the basis of world steel production and electronic production taking into account of the substitution projection.

8. Conclusion

Marketability of Brazilian products will be concluded in view of the results of the foregoing researches.

I-2-7 Pig Iron and Semi-Steel

1. World total production and industrial structure

By considering characteristics of steel industry by country and by region, efforts will be made to picture a pattern by which the steel industry of Brazil is given a position in the world steel industry in future based on the structural change of the world steel industry and its future trend.

2. Production cost

It is impossible to estimate costs of pig iron and semis of individual steel mills in the world. The costs may be only guessed indirectly from published domestic selling prices in each country and other data such as foreign trade statistics.

3. Consumption and its patterns in sectors

There is a considerable difficulty in grasping consumption of pig iron and semis.

However, it may be said that iron and steel consumption is estimated basically based on the trend of steel consumption converted to crude steel base and its pattern and can be forecasted by understanding those factors. Such pattern and consideration of various technological factors will give some suggestions for forecast of consumption of pig iron and semis.

4. Trade and price

In view of the object of the project under study, this has the strategic importance, and the present condition and characteristics of the world steel trade and the direction of change in the pattern will be studied based on available trade statistics.

Export prices of iron and steel will be discussed on FOB Antwerp prices and others.

5. Projections

Medium- and long-term projections of world crude steel consumption (for 1990 and 2000) will be described by;

- 1) Some implications of projected crude steel consumption for prospective pig iron consumption.
- 2) Some implications of projected crude steel consumption for prospective semi-steel products consumption.

viz. major characteristics and backgrounds of world steel consumption.

6. Conclusion

The above studies and considerations are combined to reach a conclusion.

Positioning of Brazil's production of pig iron and semis in the world steel industry will be clarified.

**II. BASIC CONCEPT REPORT
FOR
AGRICULTURAL AND WOOD PRODUCTS**

II-1 Oilseeds

II-1-1 Analytical Study on Past and Present Situation

The study covers the nine oilseed crops and their products (fats and oils), i.e., oil palm, babassu and coconut, soybean, peanuts, cotton seed, sunflower, maize and castor, among which oil palm and coconut, soybean are studied more intensively than others because of their importance in the world oil markets.

Since the oils and fats from these crops are highly interchangeable and their prices are closely inter-related, the study is also made on the vegetable oils and fats as a whole, including other vegetable oils than the above mentioned ones.

In the last decade, the production and trade of the world of the vegetable oil grew considerably fast, in contrast to the low growth or even stagnation of animal oils. The largest factors for this growth were the production increases of soybean in U.S. and Brazil and of oil palm in Malaysia. The production increase of soybean was induced and supported by the rapid increase in the demand for soybean meals for animal feed, while that of oil palm was due to the increased demand for oil.

On the demand side of vegetable oils, increases of consumption and the resultant increase of imports were significant in developing countries, notably India, China, Mexico, Singapore and Pakistan. The increase of consumption in Indonesia, one of the largest producers of coconut and oil palm, resulted in the decrease of exports therefrom. Among developed countries, the increase of consumption during the decade was significant only in Japan.

The study is now proceeding to analyze these developments in the last decade and collect data for making the projections for future production, demand and international trades.

II-1-2 Statistical Data and Information Collected

The main sources of the statistical figures of production, import/export and prices of the individual crops are:

- FAO Production Yearbooks (FPY)
- FAO Trade Yearbooks (FTY)
- FAO Commodity Problems Committee Papers
- FAO Food Balance Sheets
- USDA Foreign Agriculture Circular, fat and oil series (FAC)
- Oil World Weekly and special issues (Published by ISTA Mielke Co. Humburg)
- UN Trade Yearbooks

In addition to these basic statistics, data from main producing and consuming countries have been collected. Information on soybean, oil palm and coconut is almost sufficient for the study, but the data on other crops are not enough for detail study. Information from centrally planned countries, e.g., U.S.S.R. and China, which are important both in production and consumption, is very limited.

Fat and oil industry of Japan consisting of oil crushers, users (chemical and food manufacturers) and importers have already accumulated a good amount of information. Fat and oil yearbook and other publications (in Japanese) are also valuable source of information for the study.

II-1-3 Projections

With a view to capturing the possible magnitude of world trade of vegetable oils, the projections for vegetable oil as a whole and for major items will be tried by utilizing the following time-series data.

	Source
Production volume	} PYB
Harvested area*	
Yield per unit area	
Export volume	} TYB
Import volume	
Export/import prices	TYB
Per capita consumption	FBS
Population	
National income	

* Figures for harvested area and yield of oil palm and coconut are not available.

The results of projections derived from a projection model, which is now under operation, will be modified by the findings of the analytical study in respect of the policies of main producing and consuming countries, emerging technological innovations, changes in consumers preferences, etc. The projections will also be compared and checked with the projections for oils and fats which have been made by World Bank, FAO and other organizations.

II-1-4 Oil Palm

During the 1960s, palm oil production grew at about 2.5% per year. Since 1970, the annual growth has been more than 10%. The consumption also grew rapidly especially in developing countries. Malaysia and Indonesia, the most important producers, plan further increase. The recent introduction into Malaysia of weevils from Africa as carriers of pollen reportedly proved very effective, and the Malaysian government envisages the production of palm oil in 1985 at 4.6 million tons as against 2.7 million tons in 1980/81.

The lowering prices of palm oil may expand the demand, at the expenses of other oils. The use of palm oil as energy source, e.g., substitution for diesel oil, is considered in Malaysia.

Since production and exports of palm oil is heavily concentrated in Malaysia and Indonesia (75% of world production and export in 1981/82), the study is made in detail for these two countries. Study on the producing countries in Africa is handicapped by the lack of detail information.

II-1-5 Babassu and Coconuts

Although coconut trees are grown widely in tropical zone, the Philippines and Indonesia are dominant in the production of copra and coconut oil. The world trade is dominated by the Philippines, accounting for more than 70% of the world export, followed by Malaysia and Pacific island countries (Papua New Guinea, Solomon, Western Samoa, Fiji). Exports from Indonesia is negligible due to the heavy domestic consumption. The world production has grown only slowly in the past decade, because most of the trees are overaged in the Philippines and Indonesia. The prospects of the future production seem to depend large on the success/failure of the replantation programs in these countries.

As the chemical and physical property of coconut oil is different from palm oil, soybean oil and many other vegetable oils, the price correlation with these other oils is not very close. It correlates more closely with palm kernel oil and Babassu oil both of which belong to the same category of "hard oil", being highly interchangeable. Therefore the prospects of the export markets for babassu oil will be analogized from coconut oil.

II-1-6 Soybeans

Soybean oil occupies the largest portion in the world vegetable oils supply, followed by palm oil. Although soybeans are planted widely both in temperate and tropical zones, the production is heavily concentrated in three big countries: U.S., China and Brazil. These three countries together supply more than 90% of the world demand. The United States, Brazil and Argentina are the major exporting countries. While Brazil exports both soybean and its products (oil and meal), Argentina's export is mostly beans.

The rapid increase in world production owes great deal to the increased demand for soybean meals in developed countries. Thus the price of soybean has been more influenced by the demand for feed rather than for oil. The demand for soybean oil increased more rapidly in developing countries. The development of intensive livestock feeding in developing countries, as taking place in Taiwan, may widen the markets of soybean meals.

The present study on soybean as an oilseed will be linked with the study on soybean meal which is dealt with under the feed crops.

II-1-7 Other Oilseeds

Among other oilseeds, peanuts, cotton seeds and sunflower are important. U.S.S.R. is the predominant producer of sunflower seeds, accounting for nearly 70%. U.S., China and India are the leading producers of both cotton seed and peanuts. U.S. production of these two crops is decreasing, however.

Oils from peanuts, cotton seeds and sunflower are interchangeable and price correlation among them is close. Hence the study on these oil crops places emphasis on the market relationship among them.

Castorseed which is also dealt with in this study is produced mainly in Brazil and India. Since the castor oil is for industrial use, the study is made separately from other oilseeds.

II-2 Feedstuff

II-2-1 Maize

1. Progress of work in hand

The collection and compilation of data on the production, import and export of maize, livestock and poultry population figures, and the production of farm products (meat, eggs, milk, and dairy products) is nearing completion, and the prevailing conditions including factors causing variations are being analyzed. Data on the consumption of maize as a feedstuff, have been obtained for the period 1973 - 1980.

2. Statistical data and information

(1) Production

- a) FAO Production Yearbook 1965-1980
- b) Foreign Agriculture Circular, Grains, USDA (1973-1980)

(2) Consumption

- a) Foreign Agriculture Circular, Grains, USDA (1973-1980)
- b) Feed Situation, USDA

(3) International Trade

- a) FAO Trade Yearbook 1965-1980

- b) Foreign Agriculture Circular, Grains, USDA (1973-1980)

(4) General

- a) FAO Agriculture Toward 2000
- b) U.S. Grain and Oilseed Export Prospects; A Group Study: Schnittker Associates Washington, D.C., July 1, 1982
- c) USDA World Agricultural Situation, WAS-21, January, 1980
- d) Econometric Model of World Agricultural Commodity Markets, F. Gerard Adams & Jere R. Behrman, Bollinger Publishing Company, U.S.A.

3. Projections

- (1) With regard to the production and export of maize, projections will be made for production and the quantity available for export for the world, with emphasis on major producing and exporting countries.

Projections of import and consumption of maize will be made based on the demand for farm products in the major importing and/or consuming countries. Changes in the population and income levels as well as expected growth rates of demand for feedstuffs will be taken into consideration.

(2) Tentative groupings of areas to be surveyed

For developed countries, the areas will be classified into North America (U.S.A.), a major producing and exporting area; Oceania (Australia and New Zealand) and South Africa (Botswana, Lesotho, Namibia, South Africa, and Swaziland), a producing area; the EC and other European countries (except countries with planned economies), a producing and importing area; and Japan, an importing area. For developing countries, Asia (Thailand), a producing area; and South America (Brazil and Argentina), producing and exporting area, will be surveyed. For countries with planned economies, the areas will be classified into Europe, the U.S.S.R., and Asia (China).

4. Problems anticipated and possible steps for solution

Since no data on production costs on international basis are available, case studies will be introduced as far as possible.

II-2-2 Soybean Meal

1. Progress of work in hand

Regarding the production and export of soybeans, quantities available for export from the U.S. and Brazil, which are soybean producing countries; and those from the EC countries, which import soybeans for processing into soybean meals for internal supply and export, will be the principal areas of estimation.

As for import and consumption, account will be taken of different patterns of demand according to stages of development.

2. Statistical data and information collected

(1) Production

Oil World	1971-1980
Soybean Blue Guide Book	1971-1980

(2) Consumption

Oil World	1971-1980
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(3) International Trade

Oil World	1971-1980
Soybean Blue Guide Book	1971-1980
FAO Trade Yearbook	1971-1980

3. Projection

Concerning the projections of import and consumption, the quantities of soybean meals will be estimated from the demand for feedstuffs based on the projections for maize. The substitution of other seed meals will also be taken into account.

Projections for soybean oil will also be taken into account in estimating the production levels for soybean meals.

II-2-3 Cassava Pellet

1. Progress of work in hand

The major importing countries of cassava pellets are the EC countries, and the major exporting country is Thailand. As a result of the import quota that has recently

been in effect in EC countries, the diversification of crops has been progressing in Thailand.

Since the future demands will depend to a great extent on the EC's import policy, projections will not be made in the same manner as the other products, but main points for consideration regarding Brazil's export of cassava pellets as an export item will be described.

2. Statistical data and information collected

(1) Production

Cassava Roots

FAO Production Yearbook	1971-1980
Thailand Agricultural Statistics	1971-1980
Indonesian Agricultural Statistics	1971-1980

Cassava Pellets and Chips

Thailand Agricultural Statistics	1971-1980
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(2) Consumption and international trade

Pellets and Chips

Thailand Tapioca Trade Association	1971-1980
Oil World	1977-1980

II-3 Ethyl Alcohol

II-3-1 Industrial Ethyl Alcohol

Specifications, applications, raw materials, major production processes of industrial ethyl alcohol and its difference from energy ethyl alcohol will be given below.

1. Specifications

Specifications in U.S.A., West Germany, and Japan as representative countries consuming large quantity of alcohol will be explained.

2. Applications

Applications of industrial ethyl alcohol will be explained by the following categories.

- o Raw material for chemical industry
- o Raw material for food and beverage industry
- o Others

3. Major production processes

Main process for production of the industrial ethyl alcohol will be described by dividing it into fermentation process and synthetic process.

4. Differences from energy ethyl alcohol

The differences between industrial and energy ethyl alcohol will be described with respect to the following:

- o Purity of ethyl alcohol
- o Scale of market
- o Raw material

A. Production

1. Trend of production

- (1) Total amount of production by fermentation and synthetic processes

Study will be made on alcohol production for the period of 1965 - 1978 by fermentation and synthetic processes from Statistics Yearbook (United Nations).

- (2) Amount of production by synthetic process

Study will be made on the production capacity of facilities for synthetic process by country.

2. Production schedule

Study will be made on main factors related to facilities to be installed in the future based on data of the trend of production for 1965 - 1978.

3. Production policy and sales policy

The production policy and sales policy of U.S.A., United Kingdom, West Germany, and France will be described, particularly taking note to their anti-monopoly policies.

4. Cost competitiveness comparison in major alcohol producing countries

The costs of production by fermentation and synthetic processes are estimated and their cost competitiveness is studied, taking in consideration the fact that raw materials for industrial ethyl alcohol are multiplex and because of its use as raw material of chemical industry, each country has a basic policy to produce the amount that is consumed in its own country and differences of production costs are not reflected in the international trade of industrial ethyl alcohol.

5. Price trend of raw material

Past price trend of raw materials that occupy 50 - 60% of the production cost of industrial ethyl alcohol will be reviewed.

6. Technical innovation in alcohol production

The latest trend of technical innovation will be described. It is to be noted that raw material cost occupies 50 - 60% of the production cost of industrial ethyl alcohol. Technical innovation in alcohol production, therefore, does not directly contribute to a large reduction of production cost.

B. Consumption

1. Trend of consumption

The amount of industrial ethyl alcohol in the international trade is as low as about 3% of the total production. Countries that consume much alcohol are countries that produce much. There is no statistics regarding

consumption. Data on the trend of production, therefore, is a proxy for the trend of consumption.

2. Consumption-influencing factors

For main items in use of the industrial ethyl alcohol as follows:

- o Raw material of chemical industry
- o Raw material of food and beverage industry
- o Others

Study will be made on the possibility of substituting industrial ethyl alcohol with methyl alcohol and isopropyl alcohol.

3. Consumption policies in major alcohol consuming countries

There are no clear consumption policies in major alcohol consuming countries except for denaturalization of alcohol which will be described here.

4. Trend of international prices

Study will be made on the trend of international prices of industrial ethyl alcohol. Industrial ethyl alcohol is not much internationally traded. But Japan is the largest importer of alcohol in the world, so Japan's import prices of industrial ethyl alcohol will be reviewed.

C. International trade

1. Trend of trade volume

Trade volume for the future is estimated based on the trade volumes in 1977-79.

D. Projections

1. Short-term projections

Demand and supply up to 1985 are projected.

2. Long-term projections

Demand in major consuming countries is projected. Demand up to 2000 is projected by the elasticity of GNP in those countries.

3. Study of possibility of exporting product of Brazil

Study will be made on the possibilities of exporting industrial ethyl alcohol produced in Brazil based on the long-term projections.

II-3-2 Ethyl Alcohol for Energy

Specifications, applications, raw materials, and major production processes of ethyl alcohol for energy and its difference from industrial ethyl alcohol will be given below.

1. Specifications

The following standards of ethyl alcohol for energy will be explained.

- o Standard of Blending in Gasoline
- o Standard for Ethyl Alcohol for Vehicle Using Only Ethyl Alcohol

2. Applications

Uses of ethyl alcohol for energy will be explained.

3. Major production processes

The major production processes of ethyl alcohol for energy will be explained.

4. Differences from industrial ethyl alcohol

The differences between ethyl alcohol for energy and industrial ethyl alcohol will be explained regarding the following:

- o Purity of ethyl alcohol
- o Scale of market
- o Raw material

A. Production

1. Trend of production

Past trend of production in two major countries that produce ethyl alcohol for energy, Brazil and U.S.A. will be studied.

2. Production schedule

Prospect for the expansion of production facilities will be studied based on the past production trend.

3. Production policy and sales policy

The production policies and sales policies of two major alcohol producing countries, U.S.A. and Brazil will be described.

4. Cost competitiveness comparison in major alcohol producing countries

The cost of ethyl alcohol and gasoline in Brazil, a major alcohol producing country, are compared.

5. Trend of raw material cost

Trend of raw material cost of ethyl alcohol for energy which occupies about 60% of the production cost, namely the cost of sugar canes will be reviewed.

6. Technical innovation in production

The trend of technical innovation in production of ethyl alcohol for energy will be reviewed. It is to be noted that, because raw material cost occupies about 60% of the production cost of ethyl alcohol for energy, technical innovation does not contribute much to the reduction of the production cost.

B. Consumption

1. Trend of consumption

As for the trend of consumption of ethyl alcohol for energy, the trend of production is substituted for it.

2. Consumption-influencing factors

The differences in physical properties of ethyl alcohol for energy and gasoline, the future direction of technical innovation for vehicles that use gasohol, and others will be described.

3. Consumption policies by major alcohol consuming countries

The policies regarding consumption of ethyl alcohol for energy such as the difference of prices for gasoline and gasohol in Brazil and U.S.A. will be described.

4. Trend of international prices

When surplus in the production of ethyl alcohol for energy occurs, it usually gets into the market of industrial ethyl alcohol, but because the prices of ethyl alcohol for energy and industrial ethyl alcohol are about the same, price of ethyl alcohol for energy in the international trade can be taken to be the same as the price of industrial ethyl alcohol in the international trade.

C. International trade

1. Trend of trade volume

The volume of fuel ethyl alcohol traded internationally will be estimated.

D. Projections

1. Short-term and long-term projections

Based on scenarios of future oil price, the demand expansion of ethyl alcohol for energy up to 2000 will be

estimated by comparing the prices of fuel alcohol and gasoline.

2. Possibilities of exporting Brazilian product

Possibilities of exporting of ethyl alcohol for energy produced in Brazil will be analyzed.

II-4 Industrial Crops

II-4-1 Natural Rubber

A. General description of natural rubber

1. Types and grades

The international standard of types and grades will be explained.

2. Production methods

Production methods for three main types (Ribbed Smoked Sheet - RSS, crepes and Technically Specified Rubber - TSR) will be explained.

3. Producers

Definition of "Estates" and "Small holders", and industry structure based on this classification will be described.

4. Relation between natural rubber and synthetic rubber

Relation between natural rubber and synthetic rubber will be explained with respect to the following:

- o Trend of consumption ratio
- o Physical properties
- o Application

B. Production

1. Production of natural rubber by producing countries

(1) The chronological data of world natural rubber production

Study will be made for the period of 1965 - 1981 on the basis of the Rubber Statistical Bulletin.

(2) Trends and outlook of major natural rubber producing countries (Malaysia, Indonesia and Thailand)

Prospect of production expansion in above three countries will be reviewed based on the projections presented at the International Rubber Study Group (IRSG) meeting and the interview with the government officials in these countries.

2. Industrial policies of major natural rubber producing countries

New-planting and re-planting policies, improvement for higher yield clones and financing policies will be described based on the interview with the government officials.

3. Production cost analysis

The costs of production between estates and small-holders are quite different. Therefore study will be done on both cases.

4. Trends and outlook of synthetic rubber production

The chronological data of world synthetic rubber production from 1965 through 1981, and future outlook of world synthetic rubber production will be described.

C. Consumption

1. Trends of new rubber consumption

The chronological data of world natural rubber, synthetic rubber and total new rubber consumption will be described together with the ration of natural rubber on the basis of the Rubber Statistical Bulletin.

2. New rubber consumption by major section in major consuming countries

Trends of new rubber consumption by major sectors, i.e. tire and non-tire products, in major consuming countries will be described.

3. The impace of innovation on rubber consumption

(1) The effect of radial tires on total new rubber consumption

The effect of radialization will be analyzed.

(2) The substitutive relationship between natural and synthetic rubber

Study will be made from the point of cost and quality.

(3) The potentiality of "Guayule"

Development works for Guayule will be described together with properties and costs of production.

4. Technically Specified Rubber (TSR) in major consuming countries

Trends of TSR consumption in major consuming countries will be explained.

5. Trade and market policies of major consuming countries

Tariff, and reserve policies of major consuming countries will be described.

D. International trade

1. Trade structure

Trade flow between major producing and consuming countries will be described on the basis of Rubber Statistical Bulletin.

2. Modes and practices of international transaction

The channels of supply and price-setting mechanism in international trade will be explained.

3. The role of International Natural Rubber Agreement (INRA) and International Natural Rubber Organization (INRO)

The outline of INRA and activities of INRO will be described.

4. Marine transportation

Trend of containerization in main producing countries will be described. Rush boat system will be explained.

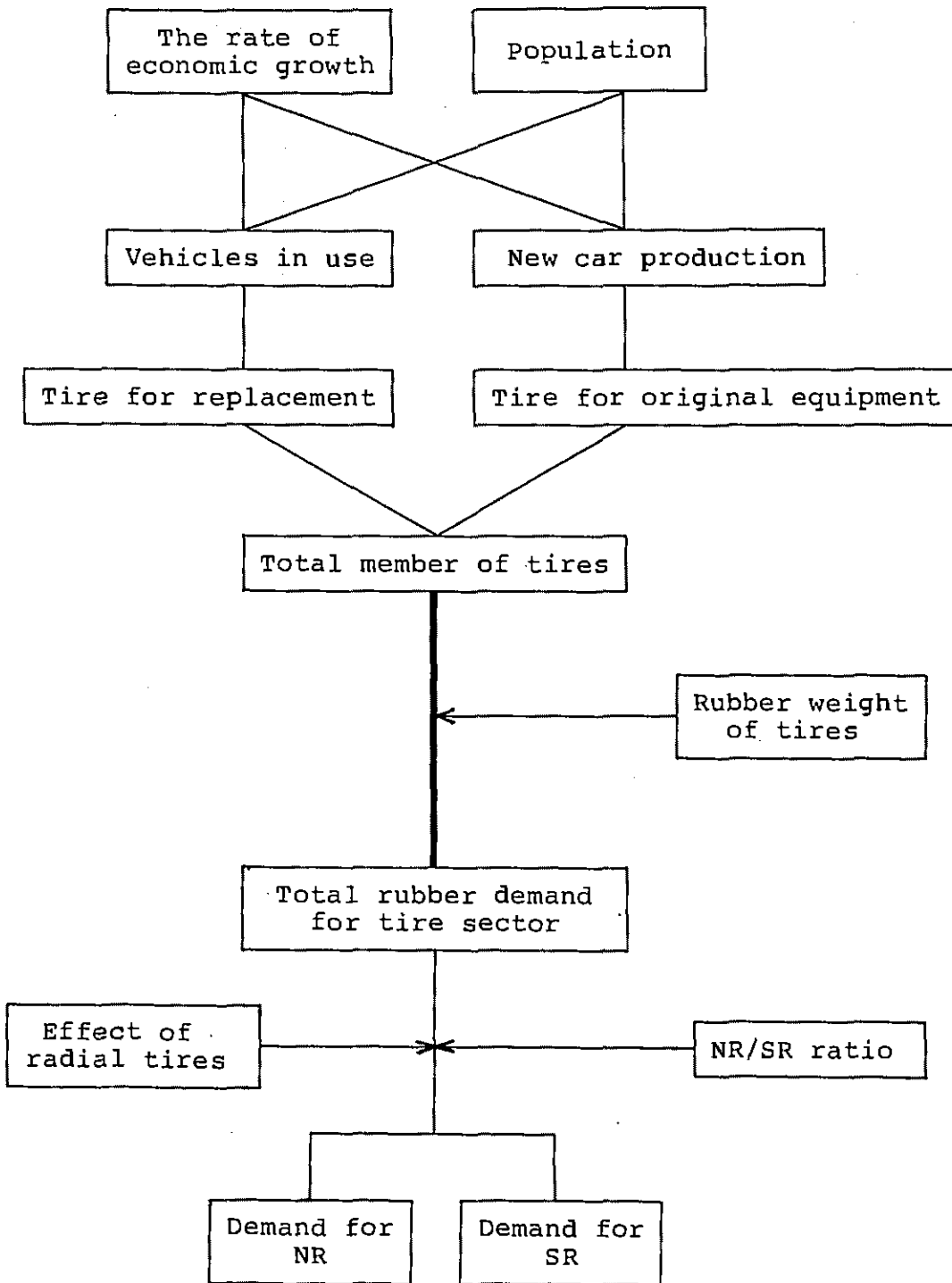
5. Price of natural rubber traded internationally

- (1) The chronological data of market prices of natural rubber in Singapore, Kuala Lumpur, London and New York will be described.
- (2) Factors of the market price fluctuation will be explained.

E. Projections

1. Demand

- (1) Demand for rubber can be divided into two groups of end-uses - the tire sector and non-tire sector.
 - (a) Regarding the tire sector, demand projections can be arrived at following stage.



(b) Regarding non-tire sector, there exist about thousand end-uses. It is very hard to obtain adequate statistical information on each end-use. Therefore we will apply several projections presented by research laboratories or international organization.

2. Supply of natural rubber

Based on the projections presented by main producing countries - Malaysia, Indonesia and Thailand - output from these three countries accounted for 80% of total output.

II-4-2 Other Industrial Crops

A. Pepper

Pepper is essentially a crop of wet tropics, requiring a heavy and well-distributed rainfall and high temperature. It is grown in many parts of the wet tropical areas, but the production and exports are dominated by four big producing countries, i.e., India, Indonesia, Malaysia and Brazil. The production of these four countries combined well exceeds 90% of the world production. As the domestic consumption in these countries is not large, except for India where about 20% is consumed within the country, most of the products are exported.

The import is heavily concentrated in the western countries (North America and Europe), but Japan has in recent years become one of the major importers.

There are two major components of the demand for pepper, i.e., household demand as a condiment and demand by food processing industries such as for meat preparation, sauces and pickles. Demand for household use has been established in Western countries for many centuries and likely to be stable. Income and price elasticities of the household demand should be low as pepper only accounts for a small part of household expenditure and it is relatively free from substitutes. On the other hand, demand derived from processed food products of which pepper is an ingredient is likely to be more price responsive, since income elasticity for processed foods is likely to be high.

The spectacular increase of pepper consumption in Japan in the last decade was due mainly to the increased demand for processed foods which associated with the rise of income level and change in food habit. The Japanese case

may merit an analytical study, as it may suggest the possibility of expanding demand for pepper in non-traditional markets where income level is rising.

Long term projections will be tried by the method analogous to the one for oilseeds.

In addition to the FAO Trade Yearbooks and USDA Foreign Agriculture Circular which are used in common with other agricultural commodities, documents of the International Pepper Community (IPC), particularly its annual pepper statistics and monthly news, are used. The IPC annual statistics for 1980 (latest) gives fairly detailed information on major producing countries except Brazil. More information is looked for from Brazilian source.

JETRO (Japan External Trade Organization) also provides useful information, though fragmented, in its monthly and weekly trade news.

B. Brazil nuts

Brazil nut is indigenous to the Amazon region, gathered from the large forests on the banks of Amazon and Rio Negro rivers. As the English name indicates, Brazil is by far the largest supplier, although other neighboring countries, i.e., Bolivia, Colombia and Peru produce some. The output in Brazil range 30,000 - 50,000 tons (in-shell basis), with yearly fluctuation; the output in 1980 was about 30,000 tons, the lowest since 1967. The harvest is mostly from natural forests, although there are some plantations.

Available statistics, which are very rough and at best only estimate, indicate the declining trend of production. The absorption of labor force to other developing job opportunities in the Amazon Basin and the formation of pastures for cattle-raising in the forest areas are said to be the main causes.

Practically all Brazil nuts collected and produced in Brazil are exported. The largest importer is the United States, which takes more than half, followed by the United Kingdom and West Germany.

Brazil nuts are exported in the form of in-shell or shelled. In-shell nuts are mainly for household demand and shelled nuts are for confectionary such as candy, baked goods and ice cream. It seems that the price of Brazil nuts is more influenced by demand than by production. And the demand may be influenced by the consumers' income and the relative prices of other nuts such as cashew nuts and almonds.

The study on past trend and future outlook on these points are very difficult due to the dearth of statistical data and information. Relevant data have been collected from FAO, USDA and Gill & Duffus group and other private sources, but the data are fragmented and inaccurate. The amounts of imports, for example, are often given in a simple combination of in-shell and shelled. Practically no data available for analysis of consumption in various forms.

C. Guarana

Necessary data have not been available as yet.

II-5 Raw Cotton

Since the main purpose of the present study is to provide information leading to a decision on whether or not the production of raw cotton should be increased up to 2000, we are endeavoring to make the demand survey as effective and realistic as possible, giving particular emphasis to the following aspects:

1. Production of raw cotton

The harvesting area has not been increased from 80 million acres, the world total in the 1930s, owing to limitations of the arable land area and to competition with other international commodities such as grains and coffee. However, the yield has tended to rise. The world average was 415 pounds per acre in 1981 though it was only 149 pounds per acre in the 1920s. There is still much room for technical improvement in the methods of raw cotton production. Raw cotton production therefore still has the potential to meet increased demand.

Accordingly, forecasts are made about groups of countries, classified into advanced countries, developing countries and countries with planned economies. We will take into account any increases or decreases of their areas and yield of those regions where raw cotton production has grown.

2. Consumption of raw cotton

This has been almost on a par with production since the 1960s. The annual average consumption of raw cotton in the world in the late 1940s, 28.5 million bales, had increased to 68 million bales by 1981, a rise of 2.4 times, and this increased demand has been the basic incentive for raising production.

3. Steady decrease in market share of natural fibers

A continuing trend in the world consumption of textiles since the 1950s has been the steady decrease of the share occupied by natural fibers, including raw cotton, in contrast to the sharp increase in that of artificial fibers, especially those produced by chemical synthesis. Since 1973, however, the cost of chemically synthesized fibers has sharply increased owing to the steep rise of oil price, and the costs of synthetic fibers have approached that of raw cotton, or even exceeded it, since the latter half of 1981.

This arouses hope for the future of raw cotton production. However, the synthetic fiber industry is sure to try to carry out rationalization in order to reduce production costs, though future movements of the oil price will affect these costs radically.

As indicated above, the competition between raw cotton and synthetic fibers has entered a new phase. Therefore, since estimates for the future based on past trends are unlikely to be appropriate, the share of raw cotton will be estimated on the basis of a hypothesis that depends on recent information about synthetic fibers.

Also, since the share of raw cotton depends on geographical conditions such as climate, these conditions will also be taken into account in discussing cotton production in the various countries.

4. World demand/supply projection for raw cotton in 1990 and 2000

It is noted that the increase of raw cotton production is caused mainly by the increased yield mentioned in 1., even without expansion of the areas under cotton.

Based on this idea, raw cotton production in 1990 and 2000 will be estimated.

On the other hand, since, as mentioned in 2. and 3., the demand for raw cotton as a proportion of the world consumption of textiles since 1980 cannot be discussed on the basis of past trends, the demand for raw cotton will be estimated on the assumption that the market share of raw cotton will not drop much further because of the leveling off of the synthetic fiber market.

Next, the feasibility of the above-mentioned potential increase of production will be investigated. According to the tentative estimates, the annual average production of raw cotton in the world in the 1980s will be 73.3 million bales (15.9 million tons) to 76.3 million bales (16.6 million tons). In comparison with this, the average estimate, made by various survey organizations, of world demand for fibers is about 35 million tons in the 1980s (U.S. Department of Agriculture); and the above estimate of raw cotton production corresponds to about 45 to 47% of the total demand. As long as the share of chemically synthesized fibers levels off, therefore, an increase in the actual production of raw cotton can be expected.

5. Data

Basic data for the analysis are Japan Cotton Statistics which compiles various cotton statistics such as Quarterly Bulletin of the International Cotton Advisory Committee.

II-6 Wood

This study is composed of analyses production, consumption, international trade and prices, and projections of forest products.

Commodities are lumber (sawnwood, non-coniferous), plywood (plywood and particle board), pulpwood (pulpwood and particles), charcoal (fuelwood and charcoal), sawlogs and veneerlogs (coniferous and non-coniferous), which are 5 commodities. Sawlogs and veneerlogs is not explicitly listed in the annex to the minutes of discussion but is additionally taken up here in order to see the world tendency in production, consumption and trade of wood products in its totality.

The above classification is based on the FAO Yearbook of Forest Products. Thus, sawnwood is included in lumber and chips are included in pulpwood and particles. It is impossible to single out chips out of the pulpwood and particles so far as FAO statistics are concerned. The same can be said about charcoal, being treated together with fuelwood.

II-6-1 Production Analysis

The trend of production is analyzed by FAO Yearbook of forest products divided into 13 countries and/or regions from 1965 - 1980.

Forest resources will be reviewed on the basis of FAO/UNEP Tropical Forest Resources Assessment Project.

Cutting cycles, harvesting volume and production cost will be shown for major producing countries in the tropics.

Production planning and policy and timber processing industry policy are exemplified in regard to major tropical hardwood producing countries, such as Southeast Asia, Tropical Oceania, Tropical Africa and Tropical Latin America.

II-6-2 Consumption Analysis

The trend of consumption is analyzed by FAO year-book of forest products divided into 13 countries and regions from 1965 - 1980. Calculation of consumption is made based on production, import and export; consumption is basically taken as production + import - export.

II-6-3 International Trade and Prices Analysis

The trend of international trade is analyzed by UN trade data and OECD trade data from 1965 - 1980. The flow of international trade is figured out through trade from one block to another block, such as from Africa to Eastern Europe Economies, from Latin America to North America, from Southeast Asia to Japan.

World wood products market and regional market structure will be reviewed from examples for North America, West Europe and Southeast Asia.

The assessment and study of factors influencing price fluctuation of international market price are made by recent research models and others. The survey of price-setting mechanism observed in international trade of timber is made by FAO reports and others.

II-6-4 Projections

Demand projections of forest products will be made by 1) trend projection analyses using linear and logistic curves, and 2) multiple regression analyses.

Supply projections are fundamentally dependent on forest stock and forest resources in the future. The tropical closed forest are expected to be reduced by about 12% between 1975 and 2000 (FAO projections), due largely to clearing for agriculture. There remains, however, considerable potential for expansion of commercial wood production in the wood-rich developing countries of Latin America and Africa, especially from presently less accessible areas. Most harvesting in tropical forests for industrial raw materials is, and has been, for only a few selected species. A major change in the species accepted by the market will enable these tropical areas to continue to supply wood in the longer term. Also, technological progress will make it possible to use a wider range of species from the tropical forest - where relatively few of the several hundred species in a forest area are utilized at present and this will have a favorable effect on the economies of pulp production in those countries. Therefore, future supply conditions from the quantitative, qualitative and economic point of views will be examined based on the survey of development, utilization and cultivation of forest resources in the major tropical wood producing countries.

Projections on charcoal will be difficult in view of the lack of necessary data.

II-6-5 Statistical Data and Information Collected

A. Production

1. Trend of production

FAO yearbook of forest products is reviewed from 1965 through 1980.

2. Trend of the regional production

The chronological production data of regional wood products are reviewed from FAO yearbook of forest products from 1965 through 1980.

3. Cutting cycle

Examples of cutting cycle classified by species group are cited from JICA (Japan International Cooperation Agency) project report in major producing countries.

4. Forest resources by region

World forest resources are assessed from FAO/UNEP Tropical Forest Resources Assessment Project report and FAO World Forest Inventory report.

5. Harvesting volume per unit area

Examples of harvesting volume per unit area are shown in major producing countries in the tropics. (Data sources are FAO forestry project reports and JICA forestry project reports.)

6. Production cost

Examples of logging/transport cost, reforestation cost and timber processing industries production cost are cited for major producing countries in the tropics. (Data sources are FAO forestry project reports and JICA forestry project reports.)

7. Production planning and policy

Examples of production planning in major tropical hardwood producing countries are shown from FAO country reports etc.

8. Production policy

Examples of forest development policy in major tropical hardwood producing countries are shown from FAO country reports etc.

9. Timber processing industry policy

Examples of timber processing industry policy in major tropical hardwood producing countries are shown from FAO country reports etc.

B. Consumption

1. Trend of consumption

FAO yearbook of forest products is reviewed from 1965 through 1980.

2. Trend of the regional consumption

The chronological consumption data of world wood products are reviewed from FAO yearbook of forest products from 1965 through 1980.

3. Trend of consumption per capita

The chronological consumption data of wood products per capita and its trend in major consuming countries are calculated from FAO yearbook of forest products and other U.N. data sources.

4. Relationship between income and consumption

Examples of correlation between income standard and consumption are shown from FAO and U.N. economic calculations.

5. Relationship between price and consumption

Examples of correlation between price level and consumption are shown from FAO and U.N. economic calculations.

6. Relationship between substitute goods and consumption levels

Examples of correlation between substitute goods and consumption levels are shown from FAO and U.S. economic calculations.

In items 4, 5 and 6, examples are shown for limited advanced countries, such as U.S.A., Canada, Japan and Western Europe Economies.

C. International trade and prices

1. Trend of trade

International trade data of world wood products are reviewed from FAO yearbook of forest products from 1965 through 1980.

2. Trend of the regional trade

The chronological trade data of regional wood products from 1965 through 1980.

3. Trends and outlook of major exporting countries

Trade and market policy of major exporting countries are reviewed from FAO, OECD and UNCTAD reports.

4. Trends and outlook of major importing countries

Trade and market policy of major importing countries are cited from UNCTAD Geneva Conference report in 1981.

5. International market structure

World wood products market and regional market structure are reviewed from various country reports for North America, West Europe and South East Asia.

6. Practice of international transaction

Timber trading enterprises, timber trading association and its structure and function in practice of international transaction are shown for North America, West Europe, Japan. (Data sources are from various country reports.)

7. Marine transportation

The overview of present transportation system of wood products, problems and its future innovation are indicated from UNCTAD report etc.

8. Ocean freight

Ocean freight for shipping and tradings in different steamer lines are shown by the table of UNCTAD report etc.

10. Mechanism of international market pricing

The assessment and study of factors influencing price fluctuation of international market price is done through various research reports of market models, such as FAO model, IIASA model, U.S.A. model, F.R. of Germany model etc.

II-7 Beef

1. Progress of work in hand

The collection of data on production, exports, imports and the trends of consumption of beef, and on factors affecting these, is almost completed. Factors causing variations in these areas are also being analyzed.

2. Tentative groupings of areas to be surveyed

For advanced countries, the areas will be classified into North America (U.S.A. and Canada) and the EC countries (Belgium, Luxemburg, Denmark, France, West Germany, Ireland, Italy, the Netherlands and the U.K.), major areas of production and consumption, Oceania (Australia and New Zealand), a major producing and exporting area; and Japan, a major importing country. For developing countries, South America (Brazil and Argentina), a major producing area, will be investigated, and for countries with planned economies, the U.S.S.R. and China, major producing and consuming areas, will be surveyed.

3. Factors related to forecasting

In the projections of future trends, the principal factors affecting demand, comprising growth in population, variations in per capita consumption due to changing income levels, and increases or decreases in the export levels of beef and live cattle, will be taken into account. In addition, increases or decreases in the number of cattle being raised, the number of cattle slaughtered and the body weight of cattle, and the import levels for beef and live cattle, constituting the main factors affecting supply, will be also taken into account.

4. Problems anticipated and possible steps for solution

Most areas of South America are contaminated with foot-and-mouth disease, and non-contaminated countries prohibit the import of live cattle and raw beef from contaminated areas, boiled beef being the only category permitted for import. Therefore, unless foot-and-mouth disease is eradicated, any increase in the level of exports to non-contaminated countries will prove to be difficult.

5. Statistical data and information collected

(1) Production

FAO Production Yearbook 1970-1980

(2) Consumption

FAO Production Yearbook 1970-1980

FAO Trade Yearbook 1970-1980

(3) International trade

FAO Trade Yearbook 1970-1980

(4) General

FAO Agriculture Toward 2000

Analytical Statistics of World Livestock Industry

Beef Policy of U.S.A.

Beef Control System of EC

II-8 Tropical Fruits

II-8-1 Bananas

Analysis of bananas has the objects of projecting world-wide demand for this product in the year 2000, analyzing various points of view and evaluating new production and export possibilities. Prior to the consideration of particulars, the key points are indicated as follows:

- (1) There are two categories of consumption; firstly, consumption by the producing countries, and secondly, consumption by importing countries. The bananas exported by the main producing and exporting countries comprise five varieties: Gros Michel, Cavendishii, Jiant Caven, Valery and Lakatan, which are the principal varieties cultivated. Bananas which have failed to pass the examination for export are for the most part disposed of. These are not therefore available for consumption within the producing countries. For consumption by the producing countries themselves, bananas of conventional varieties other than those for export are produced.
- (2) Regarding the capacity of developing countries for banana production, most of these countries possess good natural conditions and can meet the increase in world-wide demand, if they are provided with funds and technical assistance.

Accordingly, the volume of imports of both producing and non-producing countries provides important basic data for the projection of world-wide consumption of bananas.

1. Production

FAO's statistics are classified into the categories of area under cultivation, yield per unit area and output. The data for some products and countries are unknown or mere estimates in each of these categories, and serve only to indicate general trends, however, these data have been utilized in the making of forecasts. When applying these statistics for the purpose of predicting future trends, the estimates for the seventeen major exporting countries, which account for 90 - 96% of the total of the world exports, are given priority, followed by forecasts of the world total production, then forecasts for each block such as Central America, South America, Asia and Africa.

The total of crop area of the world is, at most, 3,541 thousand hectares at 1981 levels, but taking into consideration the increase in the number of countries unreported, this may gradually expand in the future.

The average yield per unit area in 1980 was 11,475 kg/ha, and the highest level of world output volume was recorded in the same year, at 39,731 million tons.

An increase in the output per hectare can be expected through progress in the development of cultivation techniques and plant breeding in the future, provided that demand increases.

On the other hand there are unstable factors, such as a fall in export volumes due to stagnation in demand from importing countries, and the destruction of or damage to banana crops caused by natural disasters; i.e., typhoons, hurricanes, floods, cold weather and drought. However, in spite of these factors, the level of output in general is expected to show a gradual increase.

(1) Productivity and production costs

Future prospects as well as problems will be thoroughly examined on the basis of data for the productivity (yield per unit area) of the main producing countries. In addition, a detailed examination and explanation of factors affecting production and delivery costs, such as increases in shipping charges, the price of agricultural chemicals, fertilizers and cartons, and in personnel costs, which have imposed a financial burden on importing countries shall be made.

2. Consumption

Consumption is classified into consumption by producing and exporting countries and that by non-producing (importing) countries. The former category as mentioned above is not related to trade, especially as regards the main exporting countries, except for some of them, e.g., Taiwan. Consequently the latter category will be closely analyzed and examined in Section 3, Trade.

3. Trade

(1) Volume of trade

Shifts in the trends for the total volume of imports of bananas by the major importing countries of the world, and that within each block, such as North America, the EEC, other European countries (developed countries), other developed countries, the developing countries and the planned economy block, will be examined on the basis of available data.

(2) International transactions

Analyses will be carried out of the transactions made by three major multinational corporations (Chiquita, Dole and Del Monte) with both the producing and importing countries in the period from 1971 to 1980, and of the influences these transactions exerted on those countries.

(3) Import policy instruments of main consuming countries

Explanations and analyses will be made concerning the present conditions of policies such as import tariffs, import regulations and distribution systems in the following six countries: the U.S.A, West Germany, France, Italy, the U.K. and Japan.

4. Projections

Projections will be made on the basis of data such as the world total volume of imports, the volume of imports of the main importing countries, the quantity of fruit consumption per capita, banana consumption per capita, income or disposable income per capita, the population growth.

5. Statistical data and information collected

[1] Production

(A1): World (incl-platin's), Area, Yield, 1965-81
Production selected countries (121 countries)

(A2): Area, Yield, Production, selected countries 1965-81
(17 countries)

Source: A1,2,1-1 Production Yearbook (FAO)

[2] International trade

- (A3): World Exports Quantity by countries 1965-81
(54 countries)
- (A4): World Exports Quantity by selected countries 1965-81
(17 countries)
- (A5): World Imports Quantity by selected countries 1965-81
(62 countries)
- (A6): World Imports Quantity by selected countries 1965-81
(25 countries)
- (A7): Quantity and Value by Exports and Imports 1965-81
countries (25 countries)
- (A8): Multinational Companies' Supply Sources 1971-80
(Percentage, 10 countries)
- (A9): Multinational Companies' of World Banana 1971-80
Market Share

Source: A3, 4, 5, 6, 7, 8
FAO Committee on Commodity Problems;
Intergovernmental Group on Bananas
A9 = Organization of American States (OAS)

[3] Consumption

- (A10): Imports Prices, Currency Prices selected 1965-81
countries (6 countries)
- (A11): Retail Prices by selected countries 1965-81
(6 countries)
- (A12): Estimated of Distribution Costs and Margin 1971-81
by selected countries
- (A13): Fruits Consumption per Head by selected 1965-78
countries

Source: O.E.C.D.-Food Consumptions Statistics

- (A14): United Kingdom- Bananas Imports, 1976, JETRO
Industry, Price, Consumption, etc.
- (A15): France- Bananas Imports, Industry, 1979, JETRO
Price, Consumption, etc.
- (A16): Italy- Bananas Imports, Industry, 1977, JETRO
Price, Consumption, etc.
- (A17): U.S.A.- Bananas Imports, Industry, 1974, JETRO
Price, Consumption, etc.
- (A18): Germany Fed Rep.- Bananas Imports, 1974, JETRO
Industry, Price, Consumption, etc.
- (A19): Saudi Arabia- Fresh Fruits Market 1974, JETRO
- (A20): Philippines- Production and Exports 1980, JETRO
- (A21): Prospect of Agricultural Products 1979, FAO
(Bananas)
- (A22): General Report of Investigation for Industrialization
in Philippines Tropics 1982
- Source: Agency of Industrial Science and Technology Inter-
national Economic Cooperation Department, Gov. of
the Philippines
- (A23): Monthly Bulletin of Banana Statistics, Annual Report
on Banana Statistics
- Source: Japan Banana Importers Association

II-8-2 Other Tropical Fruits

A. Papayas

Most of the papayas produced are consumed by the producing countries themselves, and the majority of exports are to neighboring countries, with only a very small proportion of these being exported to more distant locations. This is due to lack of plant varieties suitable for export and difficulties in the maintenance of quality. Accordingly, international trade data are not available, and the analyses will be made based on FAO's Production Yearbook and USDA data only.

1. Production

(1) Volume

According to FAO's Production Yearbook, the total output of the thirty-one producing countries was 1,894,000 tons in 1981. Considering the increased level of consumption brought about by the natural increase in population, it is certain that output as a whole will show a yearly increase.

(2) Problems

The problem is that the volume of production of such kinds as are suitable for international trade is unknown.

(3) Consumption and trade

As data on the world trade in papayas are not available, trends, in consumption will be analyzed based on data obtained from selected countries.

3. Statistical data and information collected

[1] Production, trade, consumption

(D1):	World Production by countries (31 countries)	1961/65,69/71 1974-81
(D2):	Area, Yield, Production and Values- U.S.A.	1965-80
(D3):	Papayas and Pineapples: Consumption per Capita	1965-79
(D4):	Taiwan Banana: Area, Yield, Production	1967-79
(D5):	Australia: Area, Yield, Production	1972-77
(D6):	Mexico: Area, Yield, Production, Exports and Domestic Consumption per Capita	1971-75
(D7):	Japan: Imports Quantity and Value	1974-81

Source: D1: FAO, Production Yearbook
D2,3: USDA
D4,5: Taiwan Fresh Yearbook
D6: Consumos Aparentfs Sag-Dgea
D7: Japan Exports & Imports Monthly by Ministry
of Finance

B. Melons

Although very large quantities of melons are currently being produced most of these are consumed by the producing countries themselves, with their export being limited to neighboring countries and not in any bulk quantities to more distant areas. Consequently, data sources are limited to Production Yearbook of the FAO and USDA data only.

1. Production

The statistics of FAO on area under cultivation, crop yield per unit area and output in 48 countries for the period 1965 to 1981 show that a 50% expansion of the area under cultivation took place in that period, from 321,000 hectares in 1965 to 481,000 hectares in 1981. The crop yield per unit area increased by 9%, from 12,647 kg/ha in 1965 to 13,781 kg/ha in 1981, and the output increased by 69% from 3,931,000 metric tons in 1965 to 6,625,000 metric tons in 1981.

2. Consumption and trade

Since data on trade are not available, consumption levels are analyzed on a country-by-country basis, to give an understanding of the actual conditions existing.

3. Statistical data and information collected

[1] Production, trade, consumption

(C1): Melons: World (incl-Cantalopes) Area, Yield, Production (48 countries)	1965-81
(C1): Area, Yield, Production by territories (incl-Cantalopes)	1965-81
(C2): Water Melons: Area, Yield, Production (60 countries)	1965-81
(C2): Water Melons: Area, Yield, Production (8 blocks)	1965-81
(C3): Honeydew Melons: Area, Yield, Production, Value, U.S.A.	1966-80
(C4): Honeydew Melons: Commercial Crop: Area, Yield. Production Value by Monthly U.S.A.	1978-80
(C5): Melons (Water, Cantalopes): Per Capita Civilian Consumption, U.S.A.	1966-80

(C6): Area, Yield, Production, Exports, 1971-75
per Capita and Consumption, Mexico

(C7): Imports- U.S.A. 1968-80

Source: C1,2: FAO Production Yearbook
C3,4,5: USDA
C6: Consumos Aparentfs' SAGEA
C7: U.S., Foreign Agricultural Trade Statistical
Report '80

C. Cashew nuts and juice

The data necessary for forecasting the future demand for cashew nuts are not available in complete form, but forecasts will be tried after examination and analysis of the data obtained as far as possible. As for cashew juice, as yet no necessary data have been available.

1. Production

(1) According to the Annual Report of Production of the FAO, the statistics for production in sixteen countries from 1961 to 1965 and from 1970 to 1981 indicate an average of 370,998 tons in the period 1961 to 1965, with a peak level of 648,082 tons in 1974. However, production levels tended to decline after that peak, and slumped to the lowest level of 454,340 tons in 1981. In the face of a decrease shown by other producing countries, only Brazil achieved a large increase in production levels, from an average of 11,742 tons in the period 1961 to 1965, to 85,000 tons, representing a 7.2-fold increase, in 1981.

(2) Incentive systems for production increase

Analyses will be made of incentive systems for increase in production in each of the producing countries, and of a 62,275 hectares development project in India,

which has been under way since October 1979 with assistance from the World Bank. Producing countries in Africa are becoming exporters through the expansion and new construction of processing factories. The degree of influence of these shifts in production trends will be fully examined in this analysis.

2. Consumption

Since consumption data is available only for the U.S.A., which has the highest level of imports and consumption throughout the world, the consumption levels in New York for each grade and shifts in prices related to volume of imports for the period 1975 to 1980 will be analyzed and examined. Consumption levels for other areas will be examined in the Sub-Section on Trade.

3. Trade

The following items will be examined on the basis of the data obtained, since data on imports and exports throughout the world are not available.

- (1) Exports: The shift in the volume of imports for each of the trading partners of India, which had an export volume of 145,000 tons in 1981, making it the largest producing and exporting country accounting for 42% of the world total of production, and also for each of the trading partners of Brazil, which ranks second, accounting for 18% of the world total, will be examined.
- (2) Imports: Shifts in the volume of imports, transactions with importing countries, changes and the future prospects for the U.S.A., which, at 29,730 tons in 1980, is the largest importing country, and also for

Canada (4,077 tons in 1978) and India (36,449 tons for secondary processing) will be analyzed and examined.

- (3) Prices: The relationship of export prices to volume of trade will be examined.

4. Statistical data and information collected

[1] Production

(B1): Cashew Nuts: Production in countries 1970-81
(16 countries)

(B2): Cashew Nuts (Rae Nuts Basis): Production 1965-81
in countries (5 countries)

Source: B1: FAO Production Yearbook
B2: USDA FAS Attach Report

[2] International trade and consume

(B3): Cashew Kernels: Exports from specified 1973-78
countries (5 countries)

(B4): Cashew Kernels: Exports from India 1935-78

Source: Official Trade of India, Exports Year '78

(B5): Cashew Nuts: Exports from Brazil 1977-80

Source: Bank of Brazil (CAC (CACEX))

[3] Consumption

(B6): Estimated per Capita Imports of Nuts in 1968-78
selected countries

Source: USDA, FAS Attached Report

(B7): Selected Monthly Brazil Nuts Price spot, 1975-80
New York

Source: New York Journal of Commerce (Commodity Programs,
FAS, USDA)

D. Pineapple juice

As sources of data on pineapple juice, FAO's Data on Import and Export and data from the USDA are available, from which the analyses will be made.

1. Production

According to USDA statistics from 1976 to 1980, the outputs of single (unconcentrated) strength (from six countries) and concentrate (from four countries) were 205,217 tons and 52,480 tons, respectively. Adding the output from Taiwan to these amounts, the output of these countries constitutes the mainstream of world trade in this product. Shifts in the output of these countries will be fully analyzed. The main producing and exporting countries are Australia, the Ivory Coast, Malaysia, Mexico, the Philippines, the U.S.A., South Africa and Thailand.

2. Consumption

Since statistics on consumption levels are not available, they will be approximated from the data on import volume.

3. Trade

(1) Exports

Shifts in the total volume of exports of 18 producing countries from 1970 to 1981 will be examined using data from FAO. The export volume increased from 63,443 tons in 1970 to 83,928 tons in 1981, a ratio of 100 to 132, whereas export value rose from US\$11,881,000 in 1970 to US\$34,430,000 in 1981, a ratio of 100 to 290.

(2) Imports

Regarding imports, the total volume for 18 countries increased from 82,677 tons in 1970 to 181,763 tons in 1981, a ratio of 100 to 220, whereas payments rose from US\$8,086,000 to US\$35,741,000 in the same period, a ratio of 100 to 442.

4. Projections

Demand projection for pineapple juice will be approximated on the basis of data on pineapple juice import for eleven countries, comprising the U.S.A., Japan, France, West Germany, Italy, the Netherlands, the U.K., Canada, Denmark, Belgium and Luxemburg, as mentioned above, and also using data on population, and GNP.

At present, the developed countries mentioned above constitute the mainstream of consumption in the world.

5. Statistical data and information collected

- | | |
|---------------------------------------------------------------------------|---------|
| (1) World Exports, Unit Value and Total Value by countries (18 countries) | 1970-81 |
| (2) World Imports, Unit Value and Total Value by countries | 1970-81 |

E. Passion fruit juice

The only data available now are on the area under cultivation and output of passion fruit juice in Australia from 1973 to 1977.

III. BASIC CONCEPT REPORT
FOR
MINING PRODUCTS

III-1 Bauxite, Alumina and Aluminum

A. Outline

1. Summary

Aluminum, having outstanding properties such as light-weightness, anti-corrosion and high processability, has become the most widely-used metal next to iron. Alumina, major intermediate raw material for aluminum production, is now being used for any other areas than aluminum smelting.

2. Production method

So far, only one aluminum production method is commercialized. In this method, bauxite, initial raw material for aluminum production, is firstly refined to aluminum oxide (Alumina) in the Bayer process. Then, under the Hall-Heroult process aluminum oxide so produced is electrolyzed in reduction cell where cryolite is used as electrolyte.

Other various methods have been studied, but any other method than the above has not been commercialized yet.

3. Resource

Bauxite resource is abundant in the world and in particular large deposits exist in Africa, Australia and South America. The world bauxite deposit is estimated at approximately 25 billion metric tons, including inferred deposit. Although there are many other aluminum ores than bauxite, few of them has been utilized as raw material for aluminum production because they are not suitable for the Bayer process.

B. Production

1. Movement of aluminum production

1) Bauxite production

The world total bauxite production reached about 93 million metric tons in 1980. Main bauxite-producing countries are Australia, Guinea, Jamaica and so forth. Recently, the limited number of countries with bauxite resource have come to share large portion of world production.

2) Alumina production

The world total alumina production was about 35 million metric tons in 1980. Alumina-producing countries, mainly developed countries, are dispersed in the world, major producers being Australia, U.S.A., etc.

3) Primary aluminum production

In 1980, the primary aluminum production in the world came up to approximately 16 million metric tons. The developed countries, in particular U.S.A., have been major primary aluminum-producing countries, but their weight as the aluminum producer has been decreasing recently due to the rapid growth of the developing countries.

4) Recent production trend

Since 1981, productions of primary aluminum, alumina and bauxite have fallen down drastically and production cutbacks as never seen before are continuing.

Such cutbacks are severe especially in North America, Europe and East Asia, whereas no major cutback is found in Africa, Latin America, South Asia and Oceania.

2. Aluminum industrial structure

1) World supply and demand balance

Both bauxite and alumina are at present oversupply world-widely. It is estimated that present bauxite capacity can cover the increased demand for next 5 to 6 years and alumina capacity can cover the increased demand for next 4 to 5 years. Primary aluminum is also oversupply and its capacity is estimated to cover, though dependent on future demand, increased demand for next some years.

2) "Majors" in aluminum industry

Aluminum industry has been under the strict market control by 6 "Majors" i.e., ALCOA, ALCAN, KAISER, REYNOLDS, PECHINEY, ALUSUISSE. Each "Major" is vertically-integrated from the raw materials to the finished products, which is the basis of its power. At the same time, horizontal integration is also frequently undertaken.

3) Retreat of "Majors" and nationalization

In spite of their activities as described above, the "Majors" share in the world market is declining little by little. Emerging, instead, are state-owned companies mainly at the developing countries. This situation is changing the aluminum industrial structure.

3. Aluminum production cost

1) Bauxite production cost

Bauxite production cost depends largely on natural conditions under which bauxite is mined. Fiscal regime taken by bauxite-producing countries and transportation cost are also main factors affecting competitiveness of bauxite cost.

2) Alumina production cost

Main alumina production cost components are bauxite cost, fuel cost and capital cost. In this sense, the integration with bauxite mining is desirable. At present, Australia stands at the overwhelmingly competitive position for alumina production cost.

3) Aluminum production cost

The most important factor determining aluminum production cost is power cost. In the developing countries, however, cheap power cost does not necessarily represent competitive aluminum production cost due to high capital cost and running cost requirements resulted from insufficient infrastructure, etc.

4) Aluminum production cost model and competitiveness

Classifying power sources into three cases; hydro, oil and coal, and estimating production cost in each case at existing plant and newly-installed plant, production cost using hydro power at existing plant is regarded as overwhelmingly competitive.

Production cost using newly-installed hydro power in the developing countries could be competitive in the future so far as necessary infrastructure is provided and various incentives are extended.

4. Present and future production technology

Capacity of alumina plant has been gradually increasing and there is a plant having an annual capacity of over 2 million metric tons. In addition to pursuing the economy of scale, emphasis has been placed on an energy saving technology to cope with the increasing energy cost.

Capacity of aluminum smelter has been also increasing and development has been made in large scale reduction cell and process mechanization and automation coupled with computer control. At the same time, an energy saving technology has been continuously developed in order to reduce power consumption. Extensive work has been under way to develop the aluminum chloride electrolysis process as an alternative to the Hall-Heroult process. In addition, very recently, the blast furnace process has drawn attention in which coal is used instead of electric power.

C. Consumption

1. Movement of aluminum consumption

In 1979, the world total consumption of primary aluminum reached approximately 16 million metric tons. However, the demand has been declining since 1980 and the aluminum industry is now suffering from the large excess of supply. The major developed countries share almost all of the world total demand, in which U.S.A. is the top consumer.

2. Demand structure of aluminum

1) Demand structure in main countries

Every country has their own particular demand structure. Aluminum has a wide variety of market from household goods to basic industrial materials, major markets being transportation, electricity and communication, civil construction, general usages, etc.

2) Demand structure and movement in Japan

In the past, aluminum market in Japan was limited to the light industries. However, with the industrial development, penetration into basic materials market has been proceeding and the expansion of demand structure is now under way.

3. Factors affecting aluminum demand

Aluminum has gained its share in the market under severe competition with other materials, supported by its excellent properties and price competitiveness. Development of application technologies can expand its demand suitable for its properties, while increase of recycling can result in comparative decrease in primary aluminum demand. Under any circumstances, stable cost competitiveness is the most important factor to increase aluminum demand.

D. Price

1. Movement of aluminum market price

Aluminum market price has enjoyed the comparative stable increase in proportion to the price movement of other

products, which has made possible expansion of its demand. Recently, however, the price has changed rapidly, and the uncertainty in the market is strengthening.

2. Formation of market price and factors for its fluctuation

1) ALCAN list price and LME price

In the past, list price announced by ALCAN has been dominant in forming primary aluminum price. However, since 1978 when primary aluminum was listed in the LME market, it has become speculative commodity and its stable price formation as basic material has been overshadowed.

2) Recent price movement

While ALCAN list price is US\$1,750/MT at present, the market price has been depressed due to recent drastic demand decrease and LME price stays at around US\$1,050/MT. The LME price certainly reflects some trend in international aluminum market situation, but it is one of the spot markets and does not necessarily reflect the total world supply and demand situation. In the long run, stable price as basic material will be required.

E. Trade

1. Trade structure in the world

Trade flow of primary aluminum is basically from non-consuming or producing and consuming countries to consuming countries. Present major supply countries are Japan and EC countries.

Bauxite and alumina are mainly incorporated in the integrated trade flow of "Majors", and do not form a market as trade commodity.

2. System and actual manner of international trade

International trade is classified into three types; trade with joint venture, trade on long-term contract and spot trade. For example, in Japan, trading companies play roles to coordinate these transactions.

For international trade, it is important to establish a reasonable sea transportation system required for import and export.

3. International institutions and their roles

Since 1974 when IBA was established, some member countries adopted radical fiscal regime, resulting in some problem with competitiveness. Now its activities become more modest.

There are other institutions like IPAI, but their activities are not extended to any cartel or like.

4. Import policy in major consuming countries

Major consuming countries adopt preferential tariff system to contribute to the growth of developing countries.

F. Supply and demand forecast

1. Development projects

In many countries all over the world, especially in Australia, expansion plans and new projects were announced, their total primary aluminum capacity reaching 2,900 thousand metric tons per annum. However, recent rapid drop of aluminum demand suspended some of those projects one by one and it is now uncertain whether other projects may be materialized.

2. Demand forecast

1) Previous forecasts

Supply and demand forecasts published by various sources show a variety of growth rate, but all of them forecast that aluminum supply and demand will be balanced in the near future to be followed by improved operation rate.

2) Aluminum demand in 1990 and 2000

Long term demand forecast based on GDP elasticity and Gompertz growth curve shows that aluminum demand will increase by the annual rate of a few % until 1990 and 2000.

G. Conclusion - Carajas development and possibility of entry of developed product into international market

On the basis of general analysis mentioned above, a view concerning development basis, necessary considerations, timing and various measures will be summarized for developing bauxite, alumina or aluminum in Carajas region.

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the 1980's - A Current Assessment Sept. 1982

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process of preparing this report are not included.

III-2 Nickel, Ferro-nickel and Nickel Oxide

A. Statistical data and information collected

1. Geographic distribution and mine production

- MIS (Mining Information System): Sumitomo Metal Mining
- Metallgesellschaft Aktiengesellschaft Metal Statistics
- Economic Geology (1981): J.R. Rose
- "Nickel" mineral commodity profiles (1979): USBM
- Ore Petrology (1972): R.L. Stanton
etc.

2. Major producers and consumers in the world

- Mineral Facts & Problems (1980): USBM
- The nickel industry and the developing countries (1980): UN
etc.

3. Production

1) Amounts of production

- Minerais et Metaux/Statistiques: Information Graphique
- Metal Statistics: American Metal Market
- World Bureau of Metal Statistics
etc.

2) Production capacity

- Metal Statistics: American Metal Market

- Minerais et Metaux/Statistiques: Information Graphique
 - The nickel industry and the developing countries (1980): UN
- etc.

3) Production cost (estimation)

- Reports compiled by major producers
- etc.

4) Production technology

- Winning of Nickel
 - Journal of Metals
 - E/MJ
- etc.

4. Consumption

1) Amounts of consumption

- Minerais et Metaux/Statistiques: Information Graphique
 - Metal Statistics: American Metal Market
 - Metalgesellschaft Aktiengesellschaft Metal Statistics
- etc.

2) Import policy

- World tariff: Japan Tariff Association
- etc.

5. Price in LME and producer's price

- Metal Bulletin
- Inco, Le Nickel P.P.
- etc.

6. International trade

1) Trend of trade value

- Exports & Imports Statistics
(not available except for U.S. and Japan)

2) Flow of international trade

- World Bureau of Metal Statistics
(World flow of unwrought Nickel 1979, 1980)
- Mineral Facts & Problems (1980): USBM
- etc.

B. Projections

1. Demand forecast

Due to the decline in capital investment and demand for consumer durable goods caused by the worldwide recession, nickel consumption has decreased for three consecutive years since 1980. The demand forecasts by various institutions which have been made public did not foresee this unprecedented situation.

Because of this situation expert opinions and most recent information regarding the nickel industry have been obtained from major producing companies engaging in the nickel business and of research institutions, etc.

Based on firsthand information received, demand projection is now being made both on a short-term basis and on a medium term basis (up to 1990).

While forecasting the total demand, the present situation and future trend on nickel consumption as well as movement of substitution, etc. will be closely reviewed for each of the major use sectors including stainless steel which consumes approximately half of the total nickel production. The average annual growth rate of nickel consumption will be also estimated for each use sector.

2. Supply forecast

Information on changes of the existing production capacities and new projects are obtained from articles in non-ferrous metal magazines such as "Mining Journal", "Metal Bulletin" and "Engineering & Mining Journal". By adding our own opinions to this information, future trends of production capacity and production volume will be derived.

C. Problems to be kept in mind

1. The supply and demand structure on nickel is now changing. At this point we have considerable difficulty in forecasting future trends of supply and demand.
2. Nickel inflow from the eastern block may continue to have a serious impact on the western nickel market. However, it is not possible to obtain reliable information on movements in the eastern block.

III-3 Cobalt

A. Statistical data and information collected

1. Geographic distribution and mine production

- MIS (Mining Information System):
Sumitomo Metal Mining
- Metallgesellschaft Akitengesellschaft Metal
Statistics
- Economic Mineral Geology: A.M. Bateman
- Mining Geology: H.E. McKinstry
etc.

2. Major producer and consumers in the world

- Mineral Facts & Problems: USBM
- Minerais et Metaux/Statistiques:
Information Graphique
etc.

3. Production

1) Amounts of production

- Minerais et Metaux/Statistiques:
Information Graphique
- Metal Statistics: American Metal Market
etc.

2) Production capacity

- Minerais et Metaux/Statistiques:
Information Graphique
- Chase Econometrics Report
etc.

3) Production cost (estimation)

- Reports compiled by major producers
 - Chase Econometrics Report
- etc.

4) Production technology

- Report of Laterite Symposium
- etc.

4. Consumption

1) Amounts of consumption

- Minerais et Metaux/Statistiques:
Information Graphique
- etc.

2) Import policy

- World Tariff: Japan Tariff Association
- etc.

5. Producer's price and free market price

- Metal Bulletin
- etc.

6. International trade

1) Trend of trade value

- Exports and imports statistics
(not available except for U.S. and Japan)
- etc.

2) Flow of international trade

- Mineral Facts & Problems (1980): USBM

B. Projections

1. Demand projections

The cobalt market is extremely price sensitive. Consequently, users have responded negatively to the severe increase in cobalt prices and the unreliability of supply in the late 1970s. Thus, substitution by other materials has progressed considerably, which together with the eventual slowdown in economic activities has caused a sharp decline in cobalt consumption. It is difficult to judge whether resubstitution will take place because of the present decline in price, and whether development of new applications will be possible in the near future. Therefore, we have visited major companies engaging in the cobalt business and research institutions to receive their expert opinions and to collect most recent information and data regarding the situation surrounding cobalt.

Based on firsthand information received, demand forecast is now being made both on a short-term basis and on a medium term basis (up to 1990). While forecasting the total demand, the present situation and future trend on cobalt consumption as well as movement of substitution, etc. will be closely reviewed for each of the major use sectors such as super alloy, magnet alloy, hard-facing and catalyst.

2. Supply projections

Information on changes of the existing production capacities and new projects are obtained from articles in non-ferrous metal magazines such as "Mining Journal", "Metal Bulletin" and "Engineering & Mining Journal". By adding our own opinions to this information, future trends of production capacity and production volume will be derived.

C. Problems to be kept in mind

1. Statistical data are not available with regard to production, consumption by use sector, inventories and export-import, especially those before 1970.
2. Zaire and Zambia occupy a dominant position as major supply sources. If supply disruption occurs in Central Africa, it will cause chaos in the western market. However, we are not able to include this scenario in our forecasts.
3. Exports of cobalt to the U.S.S.R. seems to have reached 3,000 tons and the U.S.S.R. is now a major outlet of the western cobalt production. However, it is difficult to foretell if this intake will continue.

III-4 Manganese

III-4-1 Ferro-manganese

A. Outline of ferro-manganese

Ferro-manganese is an indispensable secondary raw material in the process of steel production. Ferro-manganese is a general term of high-carbon ferro-manganese, silicon manganese, medium-carbon ferro-manganese, low-carbon ferro-manganese, spiegeleisen, etc. Ferro-manganese is an alloy composed mainly of manganese and iron.

As for its use, ferro-manganese is roughly classified into one as deoxidizer and desulfurizer for oxygen and sulfur which are impurities of steel in the process of steel making and one as an additive element to steel to improve steel quality.

Ferro-manganese manufacture is a process to melt and reduce metallic mineral. In almost all manufacturing process, the submerged ore-type electric furnace is now used.

B. Production

1. World's production trend

Ferro-manganese producing countries tended to be identical to producing countries through the first half of 1970, however, major producing countries have shifted to those natural resources-rich or low cost electric power generating countries such as South Africa after 1975. The recent world ferro-manganese production showed that high-carbon ferro-manganese alone reached 5MM tons.

As to production facilities, some of those in the consuming countries are now idle or have already been scrapped. In the meantime, production facilities in natural resources-rich countries had been expanded. However, it seems that this expansion trend has stopped recently.

2. Competitive production cost of principal producing countries

The ferro-manganese production costs are largely determined by the costs of electric power and ore. However, other conditions such as infrastructure, etc. cannot be overlooked. This time, 3 models of ferro-alloy plants (large, medium and small scales) will be examined and a cost structure be analyzed based on the said models.

3. Present status and future plan of principal producing countries' production capacities

The principal consuming countries used to be main producing countries. However, in and after 1975, a conspicuous expansion of the ferro-alloy production has been observed in the natural resources-rich or low-electric power cost countries. On the contrary, the levels of production in the principal consuming countries showed a marked decline. For instance, the U.S.A. once hit the peak production of 1,150,000 tons in 1965, however, the production level has been reduced to one third in these years.

Consequently, some production facilities of the principal producing countries are now idle or have already been scrapped.

4. Principal countries' policy on mining industry

As for the principal producing countries' policy on mining industry, survey will be conducted centering around information furnished by major Japanese trading firms.

5. Possible technological innovation and the impact over production

Production technologies aimed at high yield and energy saving are now being developed. In the meantime, if high-grade manganese ore becomes depleted, low-grade ferro-manganese such as Spiegeleisen would become an important alloy.

In addition, attention will be paid to ferroy-alloy manufactured from sea-bottom nodule manganese deposits.

C. Consumption

1. Trend of consumption by country

Ferro-manganese consumption is proportional to iron/steel production. Consumption of ferro-manganese, including silicon manganese, etc., now reaches 6MM tons. The consumption trend in terms of manganese purity shows that the consumption gradually increased following the introduction of higher-quality iron and steel, however part of increased consumption are offsetted due to advanced iron/steel producing technology, and the levels of consumption have been maintained at a constant level.

Consequently, it is estimated that the future ferro-manganese consumption will be maintained at a growth rate slightly lower than the production growth rate of iron and steel.

2. Sectoral consumption

Consumption levels of different kinds of ferro-manganese are being analyzed. There is a clear trend that the consumption of spiegeleisen has been relatively declining.

In the steel industry, the consumption of ferro-manganese in ordinary steel tends to decrease and that of alloy steel to increase.

3. Innovation of utilization technology and changes in consumption

Due to a progress of iron/steel producing technology, e.g., decarbonization technology for iron and steel, demand tends to shift from medium-carbon ferro-manganese to high-carbon ferro-manganese. In addition, demand for high-grade ferro-manganese is expected to increase on account of an increase of consumption for high-grade steel.

In addition to the above example, advanced vacuum metallurgy and introduced high-quality steel products may have a substantial impact on the type and quality of ferro-manganese demand.

D. International trade

Ferro-manganese trade basically flows from the non-consuming or the consuming/producing countries to the consuming countries. The principal supplying countries are South Africa, Norway, France, etc., while the principal importing countries are the U.S.A., F.R. Germany, etc.

As a peculiar country, Belgium has similar import and export volumes, although not large, seems to be acting as a distribution center.

2. International trade practice

Ferro-manganese prices are established between the main users and the smelters. International prices such as LME for copper, INCO for nickel, etc., do not exist. Accordingly, in order to grasp a substantial picture of pricing tendency, it is necessary to analyze prices by country and region such as Japan, U.S.A., U.K., etc.

3. Prices

Recently, ferro-alloy pricing was influenced by a price of the lowest electric power price country. Ferro-alloy prices have been below the producing cost for some of the producing countries.

A future tendency of prices will be studied based on the past available data.

E.

1. Projections

Demand projections (short, medium and long term) (pessimistic, standard and optimistic) on the basis of demand/supply projections of crude-steel, which is the main user of ferro-manganese, will be made by taking into account of a foreseeable change of unit consumption at steel industry.

It is estimated that demand for iron will grow by a few percents in 1985, 1990 and 2000. Therefore, demand for ferro-manganese will grow at a rate slightly lower than demand for iron.

2. Possibilities of expanding markets to which Brazilian ferro-manganese is exported

Based on the afore-mentioned general analysis, study will be made on the basis of development of ferro-manganese at Carajas as well as on various considerations necessary for the development, selection of its timing, etc.

Ferro-manganese
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III-4-2 Manganese Ore

A. Outline

The important manganese ores are found in the form of oxides, carbonates and silicates, but the oxides are the most important form.

Some of the manganese ores contain as high as 70% of manganese. However, generally the manganese content is in the range of 50% at the highest. Manganese is a secondary raw material which is indispensable for steel manufacture. It is used as a desulfurizer/deoxidizer for pig iron and steel making process and an additive element for special steel manufacture. Regardless of the form of usage (ferromanganese or the ore itself), approximately 95% of the consumption in terms of the ore form is for the iron and steel-making process. In addition, manganese is extensively used in industries such as additive element to non-ferrous metal electric battery, welding rod, zinc smelting, agricultural chemicals, etc.

B. Production

1. Distribution of ore resources and the deposits

According to the National Material Advisory Board, the estimated and confirmed onshore manganese ore deposits throughout the world total are approximately 4.1 billion tons. Manganese ore could be found in a limited place in the world like chromium ore, nickel ore, etc. Manganese ore deposits in the top five countries such as the U.S.S.R., South Africa, Australia, Brazil, India represent more than 80% of the world's onshore deposit total.

In addition, it is considered that even at the ocean bottom, large quantities of manganese resources exist. These ore deposits could be developed if coexistent element such as nickel, cobalt, copper, etc. would be collected as a main purpose.

2. Production

The world's manganese ore production is linked to the production of ferro-manganese which accounts for the majority of manganese ore consumption. In 1980, the said production reached approximately 27MM tons.

The top six manganese ore producing countries such as the U.S.S.R., South Africa, Australia, Brazil, Gabon are also rich in natural resources. Their combined production total represents approximately 90%.

3. Cost

The mine's production cost could be significantly influenced by the deposits' natural conditions, the extent of equipment cost depreciation, etc. If transport charge up to a loading port be considered additionally, production cost by mine would differ markedly. Therefore, it is difficult to figure out actual cost by mines. Instead, approximate costs involved in some of the typical mines are studied and compared herein.

4. Production capacity

The production capacity of the major mines has an allowance of 10 to 20% against its actual output. Further, some of the mines plan to step up in a near future. From a short-range forecast, it seems that new mines would not be developed because of inevitable high cost.

5. Present status and future of production technology

Mining has become more efficient than before on account of its modernization and advanced mechanization.

Ore-dressing for low-grade ore sintering, nodulation and pelleting of dressed ore are now becoming a common practice. Introductions of innovative mining technology could not be expected, for some time, to be realized. It is presumed, instead, that improvement of the present technology and the conversion to a large-scale machinery/equipment will be the main improvement of the mining industry.

C. Consumption

1. Evolution and trend of consumption throughout the world and by country

The world consumption of manganese ore has evolved in such manner that it is linked to the production of ferro-manganese for which the majority of manganese ore is consumed. Since the oil crisis in 1974, the production structure of each country's ferro-manganese industry has changed due to soaring electricity cost and ore transportation costs based on crude oil price hike. Consequently, the ore consumption structure has changed.

2. Consumption by end use of principal consuming countries

Manganese consumption by end use shows no significant change in the consumption ratio of the iron/steel sector, non-ferrous sector and chemical sector. However, manganese ore consumption by end use is largely influenced by the production status of ferro-manganese as described in paragraph "Evolution and trend of consumption through the world and by country".

3. Innovation of utilization technology

Innovation utilization technology in the near future is not expected. It is presumed that the present consumption pattern will continue henceforth.

D. International trade

1. Evolution of trade volume by principal country

Manganese ore trade basically flows from the manganese ore producing countries to the principal iron/steel producing countries where manganese resources are scarce. Since the oil crisis in 1974, an increase in ferro-manganese trade volume and a decrease in manganese ore trade volume have been apparent.

2. Form and practice of international trade

In international trade direct transactions between the producer and the consumer seldom take place. Actually, almost all the deals are made through trading firms. There is no unified international price under a cartel.

E. Pricing

1. History of international price and change factors

The price, which reached to a peak during 1964 and 1965, due to a short supply has been declining on account of oversupply thereafter. However, because of a soaring price of oil following the 1974 oil crisis, the price increased sharply. Thereafter, however, the price has leveled off.

As long as oversupply continues in the future, the price will climb up only in proportion to an inflationary increase, and will not change markedly.

F. Projection

Demand projections (short, medium, and long term) (pessimistic, standard and optimistic) on the basis of demand/supply projections of ferro-manganese, which is the main manganese ore consumer, will be made by taking into account a foreseeable change of apparent consumption of manganese ore per ton of crude steel.

G. Conclusion

Based on the afore-mentioned study, a conclusion will be made on the possibilities of expanding markets to which Brazilian manganese ore will be exported.

Manganese Ore
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Committees and Export Projection Division
Economic Analysis and Projection Department

III-5 Copper Concentrate and Refined Copper

A. General description of copper

Copper has been one of the important metals in the advance of industry for its high electrical conductivity, high heat conductivity, and anti-corrosion. The outline on the properties of copper, types of copper ore, production methods, specifications and uses of the products will be described.

B. Supply (copper concentrate and refined copper)

1. Location of the world's copper deposits and reserves

The world copper reserve is estimated at 505 million tons of copper. The large deposits exist in Chile and the United States which account for 37% of known copper reserves.

In addition, an estimated 1,100 million tons of copper is contained in other land-based resources and another 700 million tons in oceanic manganese nodules.

Proven and estimated reserves by countries will be studied on the basis of the United States Bureau of Mines' (USBM) data.

2. Copper mine production

The chronological data of the world copper mine production by producing countries and the analyses of the factors causing the change in production structures for the period 1965/1981 will be described on the basis of the following data:

Metallgesellschaft AG Metal Statistics (MAMS),
World Bureau of Metal Statistics (WBMS), and
American Bureau of Metal Statistics (ABMS).

3. Refined copper production

The chronological data of the world refined copper production (including secondary copper) by producing countries and the analyses of the factors causing the change in production structures for the period 1965/1981 will be described on the basis of the data of MAMS and WBMS.

4. Producing capacities

Current producing capacities in the world copper mines and smelting/refining plants and the future expansion plans will be explained on the basis of the following data:

for mines:	The Mining Journal, the World Mining Register, and Australian Mineral Economics (AME)
for smelting/ refining plants:	ABMS, and the Mining Handbook of Japan
for future plans:	Engineering & Mining Journal (E/MJ), and AME

5. Production costs

The production costs depend largely on the grade of ore, including that of by-products, the method of extraction, and the geographical location. At present, Chile stands at the overwhelmingly competitive position for copper production costs.

The trends in the production costs and the analyses of the factors influencing the production costs in the major producing countries, i.e. the United States, Chile, Zambia, and the Philippines will be studied on the basis of an available data.

6. Government policies

Production incentives and other industrial policies in the Philippines, Mexico and the Intergovernmental Council of Copper Exporting Countries (CIPEC) will be explained on the basis of the information from the Metal Mining Agency of Japan (MMAJ), Metals Week, and AME.

7. Technological innovation

The impact and outlook of technological innovation on the production in the copper mines and smelting/refining plants will be analyzed by our working group.

C. Consumption (refined copper)

1. Consumption

The chronological data of the refined copper consumption by consuming countries for the period 1965/1981 and the analyses of the factors influencing the copper consumption will be described on the basis of the data of MAMS and WBMS.

2. Consumption patterns in the end-use sectors

The largest use of copper is in electrical equipment and supplies. The corrosion resistance of copper and its alloys results in many uses in the industries.

The trends in the refined copper consumption by major sectors in the major consuming countries such as the United States, Japan and E.C., and the analyses of the factors causing the change in the consumption patterns will be explained on the basis of the data of the International Wrought Copper Council (IWCC), USBM and MAMS.

3. Government policies

Present and future policies with respect to tariffs, quotas and stockpiling systems in the major consuming countries will be explained on the basis of the data collected by our working group.

4. Technological innovation

The impact of technological innovation relative to new demand on the copper consumption, and the effect of substitution such as fiber optics on the copper wire markets will be analyzed.

D. World trade and transaction

1. International trade

The world-trade-flow of copper concentrate and refined copper between the major producing and consuming countries will be described on the basis of Yearbook of International Trade Statistics, and WBMS.

The trends in the trade flow among the major countries for the period 1965/1981 and factors for the change in the trade structure will be also analyzed.

2. Transaction

The overview of international transactions by copper concentrate, blister, refined copper and scrap will be described on the basis of the informations collected by our working group.

3. International cooperation

The movements of the United Nations Conference on Trade and Development (UNCTAD), CIPEC and other international organizations will be described.

E. Market prices

1. Trend of copper prices

The free world prices are determined either by reference to the London Metal Exchange (LME) price or by a national producer price. Aside from the producers in the U.S. and Canada, most producers base their price on the LME price.

Copper prices tend to react to political uncertainty and speculative influences, in addition to changes in physical supply and demand.

The trends in the LME price and the U.S. producers price for the period 1965/1981 and analyses of the causes for fluctuating market prices will be described on the basis of the data of Metals Week, and MAMS.

2. Pricing system

The pricing mechanism of the LME will be explained.

F. Projection

1. A review of projections

Supply and demand projections published by various institutions, e.g., World Bank, Chase Econometrics, and USBM will be reviewed.

2. Revised supply/demand projections

1) Short-range projection

The short-range demand and supply projection will be derived on the basis of the predictions compiled by major producers and consumers.

2) Medium and long-range projections

The long-range projections for 1990 and 2000 under three cases, i.e., the optimistic, standard and pessimistic ones, will be made.

G. Marketability

Marketability of the copper concentrate and refined copper in Brazil and the possibility of Brazilian copper entry into the international trade markets will be studied in view of the results of the foregoing researches.

III-6 Tin

A. General description

Tin is a soft, silver-white metal, which is nontoxic, has a high resistance to corrosion and fatigue, and alloys readily with other metals. Tin metal are used for tinfoil, solder, tinchemicals and others. The main tin mineral is cassiterite: SnO_2 . Placer deposits and lode deposits are main tin deposit. Tin concentrate upgraded with ore dressing is smelted and refined with pyrometallurgical or hydrometallurgical process to 99% to 99.999% metal. The basic items for the market research are described.

B. Production

1. Reserves

Total world tin reserves are estimated at approximately 10 million tons. Geological distribution and reserves by country are studied on the basis of the statistics by the United States Bureau of Mines (USBM) and the International Tin Council (ITC).

2. Tin concentrate production

About 200,000 T/Y of tin concentrate as metal are produced in the free world and 80% of concentrate produced by Malaysia, Thailand, Indonesia and Bolivia.

Trends in the tin concentrate production and the change in the production structure by country are studied on the basis of the ITC data from 1968 to 1981.

3. Tin smelter

The current producing capacities of each producer by country and expansion plans are studied.

4. Metal production

Almost 80% of primary metal in the free world is produced by Malaysia, Thailand, Indonesia and Bolivia.

Trends in the primary metal production and the change in the production structure by country are studied on the basis of the ITC data from 1968 to 1981.

5. Production cost

The recent production cost by countries of ITC members and by mining method i.e., drédges offshore, dredges onshore, gravel pump, opencast and underground are analyzed and studied for the cost competitiveness.

6. Government policies

Present and future policies for production by countries in Malaysia, Thailand, Indonesia and Bolivia are studied.

7. Technological innovation

The impact of technological innovation for mining ore dressing and smelting are studied.

C. Consumption

1. Consumption by country

Major consuming countries are the U.S.A., Japan and E.C. which are also importing countries of concentrate or metal.

Trends in the tin consumption by country from 1968 to 1981 and the change in the consumption are analyzed on the basis of the ITC data.

2. Consumption by sector

Trends of the consumption in the principal sectors, i.e., steel industry (tinplate), electronic industry (solders), machinery industry (bearing alloys and bronzes), chemical industry (stabilizer for vinyl chloride) in the major consuming countries, and the change in the consumption by sector are analyzed.

3. Recycled metal

Only limited data on secondary tin consumption is published and actual amount of secondary tin consumed is estimated at 20% of total world tin consumption. The total share and role of the secondary tin in the major consuming countries are studied.

4. Government policies

Present situation and outlook of the policies with respect to tariffs, importation and stockpiling systems in the major consuming countries are studied.

5. Technological innovation

The effect of technological progress in the consumption by sector such as tin-free-steel (steel industry), Large Scale Integrated Circuit (LSI) (electronic industry), etc. and substitution such as aluminum on the can market are studied.

D. Price

1. International market price

Trends and factors for the fluctuation in the London Metal Exchange (LME) price and the Penang Market price for the period from 1968 to 1981 are analyzed on the basis of the ITC data.

2. Price determining factor

The effect of LME price and Penang Market price on the international market is studied.

E. International trade

1. Trade structure

The international trade-flow between the major producing countries and consuming countries are analyzed on the basis of the ITC import and export data from 1968 to 1982.

2. Practices

The forms of the products, the distribution system, types of contracts and price-setting mechanism are described.

3. International relation

The ITC consists of 23 consuming countries and 7 producing countries (Australia, Bolivia, Malaysia, Indonesia, Nigeria, Thailand, and Zaire). The Sixth International Tin Agreement (ITA) is running from July, 1982 without joining of the U.S.A. and Bolivia. The outline of ITA and the function of ITC, and its effect on the world market are analyzed.

F. Projection

1. Short-term projections

The short-term projections will be made on the basis of the demand forecasts by major sectors in the major consuming countries and the planned production capacities in the major producing countries.

2. Long-term projections

The long-term projections will be made on the basis of the long-term projections of the world steel production and production of electronic industry, in addition to the projection of substitution effecting the demand.

G. Marketability

The necessary conditions for entry of Brazilian tin into the world market will be discussed in view of the situation of international market and the cost competitiveness to be analyzed.

III-7 Pig Iron and Semi-Steel Products

As part of a study for overall development project of Carajas district, this study concerning pig iron and semi-steel products (semis) is unique in that these two items generally do not comprise main lines of the trade on iron and steel products. In the usual sales and export of iron and steel products, main trade items are mainly finished steel products. Pig iron also can be one of the items, but semis for sales are generated when there is disparity in capacity among the production processes, resulting in occurrence of surplus of semis.

Their sales can take place in certain limited cases, for example, where there are demands for semis arising from so-called backward integration of a steel mill (hot coils for cold strip mills, billets for bar mills and slabs for plate mills).

The iron and steel industry is an industry characterized by heavy reliance on fixed assets or equipment and installations. Its development and its efficient and economic production, or production at cost minimum, is only possible when the industry is backed by concurrent establishment and progress of broad supporting fields of infrastructures such as related industries and public utilities. Consequently, establishment of a steel industry calls for vast investment for its construction including those for related industries.

Therefore, in case of an integrated iron and steel mill, in fact, iron and steel products are produced most efficiently when various processes of production flow such as raw material acceptance and treatment, iron-making, steel-making, rolling and processing are organized systematically

in a good balance. Recently this production flow is controlled by an on-line computer system.

Because of this fact, if a steel mill is to sell only pig iron or semis as merchandises in their respective form, it is difficult for a steel mill to be competitive as they are low value-added, unless the production is conducted in exceptionally favorable conditions or is protected by special selling condition.

When this project is considered with due attention to those fundamental factors, it would be reasonable to study production condition and characteristic pattern and their future trend of pig iron and semis in the world in comparison with those produced in Brazil taking the production condition there as a given factor and aim at viewing the Brazilian production at those products in worldwide perspective. For this purpose, this paper aims to outline the present status and future prospect of steel industry in major industrialized countries, developing countries (advanced and less advanced) and communist countries in the waves of structural change in the world steel industry and view from worldwide perspective the Brazilian production of pig iron and semis which wants to cope with the change in pattern in world iron and steel production while considering the progress and direction of innovation of iron and steel making technologies.

Consequently the center of the analysis will be placed in the industrialized countries in the West world, but the analysis is made also on the future progress of the industry in newly industrialized developing countries in comparison. In this sense, the present study concerns the relevant field in the major steel-making countries and aims principally at placing the Brazil in the structure at the world steel industry.

The following are the basic concepts for the study following the terms of reference, "TOR".

A. Outline

Main component is the basic concept centered on specialty of pig iron and semis as merchandises and consideration with respect to their sales and export. Basic consideration is given also to the aspect of raw materials.

B. Present condition and structural characteristics of the world steel industry

By considering characteristics of steel industry by country and by region, efforts will be made to picture a pattern by which the steel industry of Brazil is given a position in the world steel industry in future based on the structural change of the world steel industry and its future trend.

C. Supply of pig iron and semis

With respect to the supply of pig iron and semis (billets, slabs and blooms) based on blast furnaces, the present condition of world pattern of iron and steel making facilities and change of such pattern in conjunction with known projects will be studied.

D. A consideration of production cost of pig iron and semis

It is impossible to estimate costs of pig iron and semis of individual steel mills in the world. The costs may be only guessed indirectly from published domestic selling prices in each country and other data such as foreign trade statistics. But rough estimation of the costs from CIF price assumed in Brazil is considered possible.

E. Present condition and trend of world iron and steel consumption

There is a considerable difficulty in grasping consumption of pig iron and semis. The reason is partly that those products are inherently intermediate products produced in the middle of production process rather than those used by end users. Their sales varies according to management policy based on business cycles and demand and supply condition.

However, it may be said that iron and steel consumption is estimated basically based on the trend of steel consumption converted to crude steel base and its pattern and can be forecasted by understanding those factors. Such pattern and consideration of various technological factors will give some suggestions for forecast of consumption of pig iron and semis.

F. Present condition and trend of world trade in steel

In view of the object of the project under study, this has the strategic importance, and the present condition and characteristics of the world steel trade and the direction of change in the pattern will provide an effective tool for research of Brazil's international competitiveness in the production of pig iron and semis in future.

G. International organizations related with steel industry in the world and their function

Highly suggestive discussions are being made at various meetings of international organizations related with steel industry about giving a position to a newly steel-making country in the world steel cycle. This question involves varied aspects including patterns for

co-operation and assistance, and the present status may show the direction of effective steps for development of a steel industry.

H. Positioning of Brazil's production of pig iron and semis in the world steel industry

The above studies and considerations are combined to reach a conclusion in view of the objective of the present project.