

No.

REGIONAL DEVELOPMENT STUDY OF THE THREE STATES:

ESPIRITO SANTO, MINAS GERAIS AND GOIAS,


FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT

JULY 1979

JAPAN INTERNATIONAL COOPERATION AGENCY

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FOREWORD

In conformity with the provisions of an agreement between the Government of the Federative Republic of Brazil and the Government of Japan, the Government of Japan decided to make a Regional Development Study of the Three States: Espirito Santo, Minas Gerais and Goiás, through the Japan International Cooperation Agency (JICA).

The JICA entrusted the International Development Center of Japan with the Study and dispatched a field survey team consisting of 11 members led by Mr. Fumikatsu Tachibana. The survey was conducted during July 25 through October 17, 1978, with the cooperation of the Brazilian Government, the Directive Committee of the Three States (Chairman: Dr. Mario Bhering) and the organizations concerned. At the same time, the survey team was given guidance and help by the JICA Steering Committee (Chairman: Dr. Saburo Okita) temporarily established for the Study.

The survey team analyzed and evaluated their findings and the data supplied by counterparts, according to the scope of work. They prepared a Draft Interim Report on the Study.

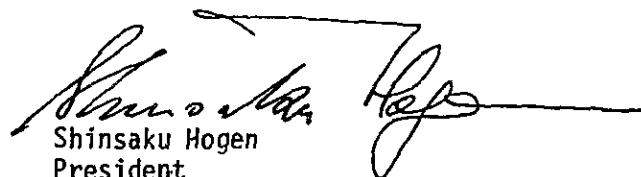
Upon arrival in Brazil of Dr. Saburo Okita and his colleague, discussions were made between them and the survey team on the Draft Interim Report. They made useful comments on the Report. Then, the Interim Report was submitted at the end of the field work.

The written comments by the Directive Committee of the Three States on the Interim Report were mailed to the survey team in November, 1978. Based upon those comments and the discussions with Dr. Mario Bhering and his colleague on the occasion of their visit to Japan in January, 1979, as well as with the JICA Steering Committee, the Draft Final Report was prepared by the survey team in March.

Based on the final comments cabled to the survey team in early June, the Report was revised and finalized. I am pleased to submit herewith the Final Report to the Government of Brazil.

I wish to express my deep appreciation for the close cooperation and assistance extended by the people concerned to the survey team throughout their stay in Brazil.

July, 1979


Shinsaku Hogen
President
Japan International Cooperation
Agency

LETTER OF TRANSMITTAL

Mr. Shinsaku Hogen
President
Japan International Cooperation Agency
Shinjuku Mitsui Bldg., Nishi-Shinjuku 2-1
Shinjuku-ku, Tokyo
Japan

Dear Mr. Hogen:

It is my pleasure to submit to you the final report entitled "Regional Development Study of the Three States: Espirito Santo, Minas Gerais and Goiás, Federative Republic of Brazil." This report has been prepared according to the contract signed on July 8, 1978 by the Japan International Cooperation Agency and the International Development Center of Japan.

The International Development Center of Japan undertook this study by use of a team of experts headed by Mr. Fumikatsu Tachibana and the field survey was made from July 23 to October 20, 1978. The members of the field survey mission were:

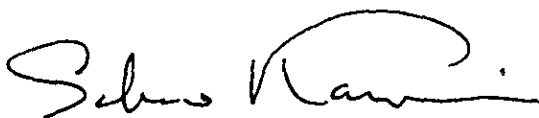
- | | |
|----------------------------|-----------------------------------|
| 1. Mr. Fumikatsu Tachibana | Project Manager, Railway Engineer |
| 2. Dr. Chujiro Ozaki | Agricultural Economist |
| 3. Dr. Yuji Nakajima | Financial Analyst |
| 4. Dr. Takashi Sato | Agronomist |
| 5. Mr. Hitoshi Yanase | Transportation Engineer |
| 6. Mr. Naohiko Toda | Development Economist |
| 7. Mr. Masamitsu Toriyama | Transportation Specialist |
| 8. Mr. Hiroshi Yamamoto | Rural Sociologist |
| 9. Mr. Noboru Takebe | Coordinator, Regional Economist |
| 10. Mr. Kiminari Tachiyama | Transportation Specialist |
| 11. Mr. Tetsuo Wakui | Transportation Economist |

We are thankful to a number of persons of the Government of Federative Republic of Brazil as well as the Directive Committee of the Three States whose great efforts and hearty cooperation were very helpful and without which we could have never completed our study. Our appreciation goes especially to Dr. Mario Bhering, chairman of the Directive Committee of the Three States who is in charge of this study in Brazil.

We are also indebted to a number of persons in the Embassy of Japan as well as the Consulate General of Japan in Rio de Janeiro, and the Ministry of Foreign Affairs of Japan in Tokyo.

Lastly but not the least, we acknowledge the tremendous efforts and hearty cooperation given to us from Japan International Cooperation Agency.

July, 1979



Saburo Kawai
President
International Development Center
of Japan

I N D E X

I N D E X

			<u>Page</u>
SUMMARY			1
PART I	BASIC PHILOSOPHY		15
Chapter	I	Objectives of the Study	15
Chapter	II	Policy Background behind the Three-States Development Plan	18
Chapter	III	Potentiality of Agricultural Production in the Project Area	20
Chapter	IV	Transport Organization under the Three-State Development Plan	22
Chapter	V	Marketing System under the Three-State Development Plan	24
Chapter	VI	Public Investment and Railroad Rates-Making Policy under the Three-State Development Plan	25
PART II	DEVELOPMENT STRATEGY		29
Chapter	I	Covered Area	29
Chapter	II	Strategic Position of the Three States and the Backbone of the Study	29
Chapter	III	<i>Regional Development Plans of the Nation and their Relationship to the Three-State Development Plan</i>	33
Chapter	IV	Strategy for the Three-State Development Plan	34
Chapter	V	Agricultural World Market Prospects for 1990-2000	36
PART III	POLICY PROPOSALS		43
Chapter	I	Breeding of Varieties	43
		(1) General	43
		(2) Improvement of Soybean Variety	46
Chapter	II	Farm Management	48

Chapter III	Social Setting-Up	53
Chapter IV	Marketing System and Agricultural Cooperatives ..	55
	(1) General	55
	(2) Fostering and Strengthening of Multipurpose Agricultural Cooperatives and Financial Measures Required	59
	(3) Suggested Measures for Those Farmers who are not Presently Members of Agricultural Cooperatives	62
Chapter V	Training	65
	(1) Training for Farmers and Farm Laborers	65
	(2) Basic Training for Agricultural Cooperatives	67
Chapter VI	Physical Distribution	69
	(1) Port for Export	69
	(2) Railroad Routes	70
	(3) Feeder System	73
	(4) Storage	76
	(5) Railroad Rates-Making Policy	78
Chapter VII	Conclusions and Recommendations	85

* * * * *

APPENDIX I	Review of the Production Volume Goal of Agricultural Products in the Project Area	91
APPENDIX II	Rough Estimates on the Investment Amount of Infrastructure for Railroads, Roads, Ports, Silos, and Warehouses in the Project Area	115

S U M M A R Y

SUMMARY

i. In the central region of Brazil there is a vast unexplored area, with a total surface of approximately 1.3 million km² (approximately 3.5 times larger than the whole Japanese territory), extending over the States of Goiás and Minas Gerais. In view of the ecological characteristics of its flora, this region is called Cerrado. Topographically it is characterized by gentle undulations, and its mantle of reddish soil is covered by scattered shrubs and grasses. The agricultural productivity of this area is immense in potential, which can be realized by means of improvement of the soil and cultivation of suitable crops, with subsequent crop breeding in order to better adapt them to local conditions. It is related that some centuries ago, the first Portuguese to set foot in this area even considered it to be a veritable "land flowing with milk and honey." It can be said that the establishment of the conditions making possible a genuine rural life of wealth and prosperity in this region of mystical beauty has been the ideal long dreamed of by the Brazilian people since those remote times. However, it can be said that the process of searching for that ideal has just started the first step of its long journey.

ii. The problem which was presented to us is: "To find the best way to promote the establishment of agriculture in the Cerrado, to impart international competitiveness to the huge quantities of agricultural products produced by it, and to ship them to the overseas grain markets, through port facilities located in the surroundings of Vitória, in the State of Espírito Santo." This is a problem of enormous

proportions. The main difficulty is the magnitude of this Development Plan. Not only is the surface of this region vast, but also so is the importance of such an undertaking, which has the intention of realizing a granary able to feed an important portion of the world population, taking into consideration the economical and social development of Brazil in the 21st century. Generally speaking, the regional development of a given area should be analyzed in view of four aspects: 1) political, 2) economical, 3) social, and 4) technical aspects. When giving shape to a regional development project, a harmonization and mutual adjustment of those aspects, which by their diversity of nature have conflicting points of interest, are required. It goes without saying that when carrying out the present study we have based our efforts on the directives mentioned above. However, in view of the gigantic proportions of the Development Plan, the determination of clearly defined goals regarding the harmonization and compatibilization of the antagonistic points was extremely difficult. In other words, the data related to the Development Plan are too complex and diversified, and furthermore for many vital matters data are still unknown.

iii. Thus, we must admit that many difficulties were encountered when trying to find complete solutions to all questions presented to us, and consequently, the present Report makes a visualization of the general sketch of the Development Plan itself, within the widest possible scope, and the presentation of proposals on the directions to be followed, in which the Brazilian Government should formulate its policies and measures in making possible the materialization of the Development Plan. The Report, based upon the directives presented above, is composed of three Parts and two Appendices.

Part I: Basic Philosophy

This Part presents the general description of the Development Plan from a macroscopic point of view.

Part II: Development Strategy

This Part defines concretely the project area under the Development Plan and sketches the basic strategy to be adopted in order to systematically promote the Plan.

Part III: Policy Proposals

This Part describes the measures and directions to be adopted by the Brazilian Government, as a part of the tactical aspects for the realization of the Development Plan.

Appendix I: Review on the production volume goal of agricultural products in the project area.

Appendix II: Rough estimates on the investment amount of infrastructure for railroads, roads, ports, silos, and warehouses in the project area.

iv. The results of the Study carried out by us, described in the Report, can be summarized as follows.

v. At first, with regard to the objectives of the Development Plan, there are the following three important themes to be tackled, from the point of view of the national policy to be adopted from now on:

1) Having in view the present state of development of Brazil, it is required to create a "new stream," aiming to secure a bridgehead for the social, economical, and cultural development of the area extending

from the central region toward the northern region of the country, which hitherto has remained unexploited, by means of the utilization of the immense natural resources existing in the central region;

- 2) It is necessary to find means to make possible a decisive increase in the acquisition of foreign currencies through the massive export of agricultural products, to contribute to the improvement of the balance of payments of the country; and
- 3) It is necessary to find means to make possible the full utilization of the agricultural potentialities of the Cerrado, transforming it into a "world granary," with the purpose of increasing furthermore the importance of the position occupied by Brazil within international society.

As a summary, we are starting from the premise that the Development Plan refers not only to the activation of the potential of the natural resources of a given region, but also to a long term problem, covering an important part of the national planning of Brazil in the 21st century.

vi. When trying to find solutions to the problems related to the Development Plan, we focus upon the problem as follows: the immense latent natural resources existing in the Cerrado have been hitherto closed by two great gates. These two gates preventing the penetration of development are the agricultural productivity of the Cerrado and the problem of transportation. In order to knock those gates, we have devised two means, which are described below:

- 1) Creation of conditions making possible an agricultural farm management able to turn out crops of high grade, in large quantities, at low costs, with stability and without interruption, and able to

compete fairly in the international market with products of other origins, through the improvement of the soil and the quality of the products to be planted there; and

- 2) Creation of a physical distribution system able to carry out the transportation of the agricultural products from the Cerrado to the international market, at low costs and in large quantities.

Fortunately, the project area yields, in abundant quantities, limestone and phosphate required to improve the soil of the Cerrado. Further, with regard to the means of transportation, a half (approximately 500) of total distance of the route planned for the transportation of the crops to the Port of Vitória, in the State of Espírito Santo, is served by the railroad of the Companhia Vale do Rio Doce, which is modern and has a large transportation capacity. We consider that railroad as an important element for the solution of the transportation problem. Presently that railroad transports annually to the port of Vitória several tens of millions of tons of iron ore, which is exported to foreign countries. In the future, in the case of utilization of combination-type vessels able to carry both grain and iron ore, a substantial reduction in the costs of ocean transportation will be possible.

vii. In order to carry forward the Development Plan based upon the means described above, a vigorous driving force, able to create the "new stream" referred to above, is required. For this reason, we have introduced the "Grand Axis" concept. Below is described the fundamental meaning of the concept. For example, in order to develop water resources, it is first necessary to secure the required water source,

and then to build the waterway, the dikes, the dams, etc., and to be able to control and guide the flow of water in accordance to the planned utilization methods and objectives. Similarly, it is necessary to assure the creation and the maintenance of the infrastructure to support agricultural production and also the rapid, safe, stable and low-cost transportation of the crops to be exported. Based upon this "Grand Axis" concept, as explained above, we have tried to figure out the individual measures to be adopted by the Government in order to promote the Development Plan.

viii. The Development Plan would be, in its nature, of an extremely long time span, but within our Study we have stated the goals to be reached within a relatively short term, restricting our outlook to the time horizon of around 1990. The project area covers an area of approximately 500,000 Km², extending over the Triângulo Mineiro and the southern part of the State of Goiás (hereinafter called area A) and the area surrounding Pirapora, in the region of upper waters of the São Francisco river (hereinafter called area B). The results of the studies carried out by us indicate that the crops best suited to be cultivated in the project area are soybeans, maize, and sorghum. The identification of these products has been made by taking into consideration the studies related to: 1) export market potentialities, 2) land productivity, and 3) feasibility, from the point of view of agricultural technology. We have carried out reviews on the production volume in the project area of these crops, with results as obtained below.

Goals of Development to be Attained in 1990

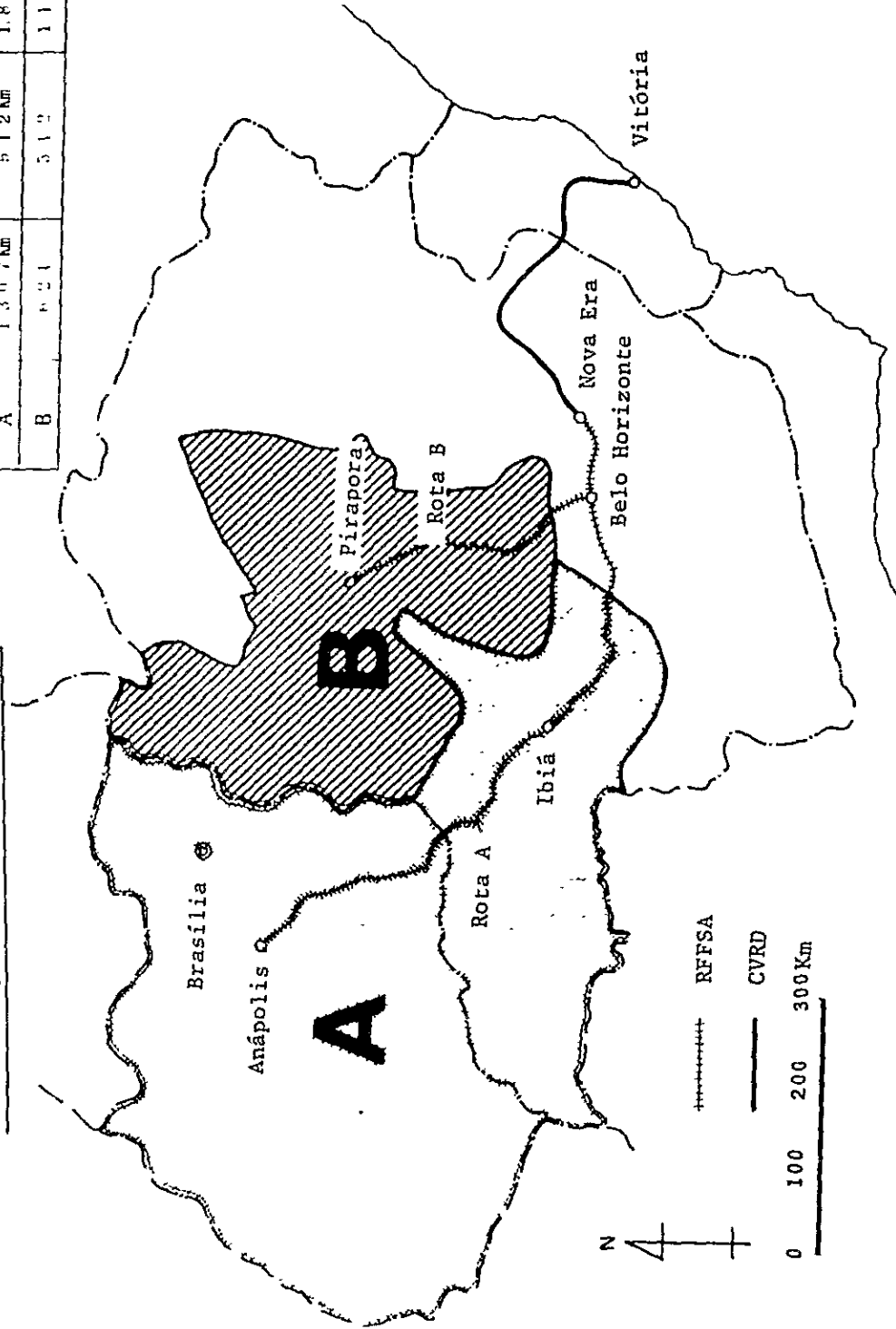
<u>Product area</u>	<u>Goal of cultivated area (10,000 ha)</u>	<u>Goal of annual production (1,000,000 tons)</u>
A	581	12.6
B	94	2.0
Total	675	14.6

Of the production volume of 14.6 million tons, how many tonnages of the agricultural products are to be exported depends on their international competitiveness. To strengthen this international competitiveness, we have emphasized that it is essential to strongly promote such harmonious and compatible policies as mentioned later, which cover both the agriculture sector and the transport sector.

ix. One of the most important problems of the Development Plan is the route for transportation of the products for export, from their origin to the port of shipping. The transportation route assumed for the sake of the Study is indicated in the accompanying map. The agricultural products for export from the project area must be transported for distances exceeding 1,000 Km from their origin to the port of shipment. This is regarded as one of the major reasons why the agricultural products are weak in international competitiveness. Presently in Brazil most of cargo is transported by truck, except some special cases, such as that of iron ore. However, truck transportation is not presently capable of assuring the long-distance, large-scale, and stable transportation of agricultural products at low costs. Thus, in the Study, we

Área do Projeto e Nota de Transporte

Rota	RFFSA	CVRD	Total
A	1.307 km	512 km	1.819 km
B	621	512	1.133



assume that the railroad will be the fundamental means of transportation. In this case, the section between Vitória and Nova Era, belonging to the Companhia Vale do Rio Doce, does not present any problem at all regarding capacity of transportation because of modernization already made. However, the sections of railroads belonging to the Rede Ferroviária Federal require investments for track improvement, for increase of the capacity of transportation, and for modernization of the train blocking system. Below is described the background leading us to the choice of the export corridor of Vitória on the basis of the "Grand Axis" concept:

- a) The advantages offered by the possibility of utilizing the modern railroad belonging to the Companhia Vale do Rio Doce;
- b) The overburden to be imposed on the existing export corridors of Rio de Janeiro and Santos, because of a larger shipment of agricultural products produced in the project area, which are expected to be ever-increasing from a long-term viewpoint; and
- c) Undesirability of further expansion of the Rio de Janeiro and Santos areas, both of which are already congested, in view of regional development plans applicable to both areas.

The table below presents the results of rough estimates on the investment amount required for infrastructure in order to equip the Vitória export corridor, including ports and railroads.

Investment Required to Equip the Infrastructure of
the Vitória Export Corridor

<u>Description</u>	<u>From 1979 to 1985</u>	<u>From 1986 to 1990</u>	<u>Total</u>	<u>Remarks</u>
	Million of Cr\$	Million of Cr\$	Million of Cr\$	
Railroads	500	3,000	3,500	Excluding rolling stock
Roads	7,130	8,070	15,200	Feeder roads in the production area
Ports	30	170	200	Capuaba Wharf only
Silos	590	1,730	2,320	Silos at terminals in the production area
Warehouses	2,000	3,340	5,340	Grain storage facilities in the production area
Total	10,250	16,310	26,560	

(Based on mid-1978 constant prices;
Exchange rate US\$1 = Cr\$20)

One of the premises adopted for the calculation of the above data is the minimization of the amounts to be invested. For example, in the calculation we have assumed the utilization of the port of Capuava, to minimize the required port investments. However, with the possible future utilization of vessels of larger size, the investments for port facilities appearing in the above table will increase to some extent.

x. In order to make possible the success of the Development Plan, the Brazilian Government should pay special attention to two very important groups of measures. The first group refers to the creation of the conditions making possible the production, in large quantities and at low costs, while allowing sufficient competitiveness in the international market, and of high-grade agricultural products. In principle that can be accomplished through the creation of large farms or estates, where economies of scale may be obtained. It is also recommendable to facilitate in parallel the creation of small- and medium-size farms, operated collectively and with a modern technical approach as well as the support of the authorities. Besides the measures to improve infrastructure, i.e., physical change through construction of civil works, and intangible change such as reform of the tax system so as to facilitate the acquisition of land, or such as strengthening of institutional credit, or such as measures related to the creation and operation of agricultural cooperatives, should be adopted, in accordance with the basic directions of the "Grand Axis" concept. Basic to this global agricultural policy is, first, the adoption of measures which farmers can accept as being really convincing. Second, there is to be the confirmation of the feasibility of farm management, to be attained through the combination of stable production techniques, supply of credits, price guarantees and facilitated marketing of the crops, all to serve as a starting point for the promotion of the development. Confirmation of the feasibility of the farm management, based upon conditions which are considered fully satisfactory to the farmers, will in fact compose a very real incentive, causing the chain reaction of attraction of capital and introduction of new technology, resulting finally in accelerated promotion of the development process.

xi. The second group refers to transportation policy, especially measures related to the railroad rates-making based on objective consciousness concerning the Development Plan. In short, the requirement is to create conditions which make possible the planned transportation expansion and improvement, and reduced costs, for bringing the agricultural products from their origin to the export port. However, if the rates-making policy were to place a financial burden on the railroads, its long term feasibility would be quite doubtful. This is the point of vital importance. Following we present our proposal on the determination of an balanced policy regarding transportation and freight rates. First, the investments in railroad infrastructure required to materialize the Development Plan should be done without financially burdening the railroads. Second, the railroad freight rates for transportation of the agricultural products should be determined within the range having as their lowest limit the additional costs of the transportation in question and having as their highest limit the freight rates which the price of the agricultural products is able to bear without having negative influence upon the international competitiveness of the transported products, if they are intended for export. Third, the transportation should be carried out intensively, by means of unit trains, with the purpose of reducing the additional costs resulting from the transportation of the products in question. We are sure that the adoption of the measures described above will make possible a substantial reduction in the costs of transportation compared with the railroad freight rates prevailing presently.

xii. Having in view the considerations presented above, we recommend that the directions in which the Brazilian Government should formulate its policies covering both the agricultural sector and the transport sector in achieving the goals of the Development Plan be the following:

Agricultural Sector

- a) Improvement of production technology, with the purpose of obtaining high-grade agricultural products at low cost, with stability and without interruption. For this purpose, high priority should be given to the adoption of measures making possible assurance not only of the quantity but also of the quality of the required extension workers;
- b) As a process of development, instead of exploiting all at once the project area from scratch, the test of a limited number of agricultural farm management should be carried out, in order to obtain, through trial and error, relevant data required for formulating a global policy to be adopted by the Government. When carrying out such tests, the Government should intensively offer assistance to the farmers, according to local requirements, assigning special priority to the strengthening of the system of collective joint sales of agricultural products. Then, the farm management of proven capability should be enlarged in number and established in depth;
- c) Besides the improvement of the production technology mentioned in item a) above, improvements in the tax system making possible enlarged utilization of the land, the creation of multipurpose agricultural cooperatives, the reinforcement of the institutional

financing structure, and the establishment of systems for formation and training of the personnel are also required. Those measures should cause a highly positive impact on the tests, enlargement, and establishment of the farm management described in item b) above;

- d) Execution of investments for warehouses, silos, feeder roads, etc. should cause a highly positive impact on the tests, enlargement, and establishment of the farm management described in item b) above;

Transportation Sector

- e) Collective joint transportation by means of unit trains is required. More importance should be attributed to the unified and centralized control of the unit trains in order to make this improvement possible;
- f) Formulation of a railroad rates-making policy suited to the project area's agricultural products destined for export; and
- g) Execution of investments in the sectors of railroads (RFFSA) and ports (Capuava), proportional to the transported quantities of the agricultural products, to support the introduction of the rates-making policy described in item f) above.

PART I BASIC PHILOSOPHY

CHAPTER I OBJECTIVES OF THE STUDY

1.1.1. The "oil crisis" was a tocsin reminding us that resources are not available in infinite quantities. It also warned us of the danger of disorderly exploitation and wasteful consumption of those resources.

1.1.2. Although our resources are limited, vast quantities of resources of unconfirmed quantity and quality are believed to exist--some in the remote mountains and others at or below the sea bed, in places to which mankind presently does not have easy access. Still more resources exist elsewhere on the earth, in more accessible locations, but mankind does not know precisely where those locations are. In other words, it can be said that the Lord in His infinite wisdom provided those resources for the future human society, but behind gates tightly closed by Him.

1.1.3. In Brazil, such resources of high potential as the Amazon forest and underground deposits elsewhere in the country can be said to have been secretly reserved. Agricultural and mineral resources in the vast project area extending over the Goiás and Minas Gerais States and adjacent areas, with which the Regional Development Plan is concerned, are typical of such reserves.

1.1.4. Why have those extensive and precious resources remained unexploited? The only explanation for this question would be that so far the Lord has not permitted mankind to open the gates. Now, however, the necessity to open the gates is becoming urgent.

1.1.5. The Brazilians are now trying to open the gates. Our first duty is twofold: to look for what the tightly closed gates of the secretly reserved resources have been, and to discover the key to open the gates.

1.1.6. The oil crisis taught us that resources were limited, but at the same time, that they had to be fairly consumed on the basis of the joint partnership of the international community where, even though they belong to a specific country, their value does not exist solely in that country. In other words, it is when they are exploited and reach the international market that their real value as resources is heightened, and that economic development of that country will be made all the more become meaningful. Agricultural and mineral products under the Development Plan should follow this principle.

1.1.7. Our second duty is to look for how to make the Development Plan succeed, with the principal purpose that the agricultural products produced under the Plan reach the international market and that they achieve a stabilized expansion on it.

1.1.8. The fundamental purpose of the Development Plan is to enable the national economy to expand, and to promote the welfare of the Brazilians. For this purpose, the driving force enabling the Plan to be carried out should arise from the willingness of agricultural producers to directly participate in the Development Plan. Therefore, unless those producers can really enjoy a better life through their exploitation work, the Development Plan would be spiritless. In other words, those

agricultural pioneers should be given very attractive incentives for economic guarantee. Our third duty therefore is to determine how to integrate the above mentioned measures and the international marketability of the agricultural products thus produced.

1.1.9. It is not an easy task to open the gates, behind which the Lord has secretly reserved those precious resources since uncountable billions of years ago. It would be necessary for not only the Brazilian Government but also the Brazilians and all the world's people to combine their earnest efforts, sufficient enough to persuade the Lord. To concretely promote the Development Plan, what should, in particular, the Brazilian Government do? Our fourth duty is to suggest the clearly-defined role of the Government.

1.1.10. To do our duties mentioned above, it is necessary to evaluate the potentiality of agricultural production in the project area, on which the Development Plan is based, and at the same time, to concretely define the orientation of transport organization, by which the Development Plan is promoted. This is our final and most important duty.

CHAPTER II POLICY BACKGROUND BEHIND THE THREE-STATE
DEVELOPMENT PLAN

1.2.1. We believe that we should view the Development Plan as a part of the nation's policy to adapt herself to the future development. In other words, the Plan is to be viewed as being based not only on the microeconomic concept of promoting agricultural production, exporting of products, and acquiring foreign currencies, but also on Brazil's anticipation that in the future she will be an agriculture-oriented, self-supporting country, and will participate in the international community as a "world granary" and major foodstuff supplier.

1.2.2. In contrast to the vast land area of Brazil, the population, industry and economy are excessively concentrated in the southeastern region centering around São Paulo and Rio de Janeiro, both of which have long been points of contact with foreign countries. Furthermore, as the growth and development of heavy industry in those areas has made considerable progress, their ability to absorb both capital and labor has been augmented, and those cities have become too large and too densely populated.

1.2.3. Therefore, if those trends continue, the economic vitality of the nation will be limited to those areas while the central region despite being endowed with natural resources of high potential, never would be given the opportunity to link itself systemically with the economic development of the nation. The nation's policy to adapt herself to the future development which we are discussing, from the above

point of view, makes it mandatory to realize the agricultural potential of the project area in central Brazil, to connect the project area's self-supporting economic strength with foreign countries through the eastern port and thereby to more effectively mobilize agricultural resources, which should play a larger role in the nation's economy. The success of such a policy will naturally become a "detonator" for explosive development in northern Brazil which has also been left behind in economic development.

1.2.4. To carry out such a fundamental development policy of the nation as this, it is necessary to introduce the "Grand Axis" concept to strongly guide and organize the policy.

1.2.5. "Grand Axis" is defined as the formulation of a kind of the integrated channel consisting of infrastructure such as railroads, roads, ports, etc., to move agricultural products in the project area to the export terminal, and of soft-ware, namely, modernized control systems and the transport policy including, in particular, an adequate railroad rates-making policy, to make the above mentioned infrastructure function more effectively.

CHAPTER III POTENTIALITY OF AGRICULTURAL PRODUCTION
IN THE PROJECT AREA

1.3.1. The core of the Development Plan is how to realize the potential of agricultural production (in addition to phosphates and other minerals in the project area). However elaborately a development plan is drawn up, the plan would at best result in a house built on sand unless there is the possibility that valuable products are effectively produced in suitably large quantities under stabilized conditions. This is one of our most important concerns.

1.3.2. Realizing the potential of agricultural production consists primarily of the following two elements:

- i) Identification of economically promising crops and varieties evaluated on the basis of land in a broad sense (including climate) and of agro-technical feasibility; and
- ii) Compound effect of production costs and transport costs.

1.3.3. In other words, if any possibility is found positive by reviewing "i" above, a relation arises between that possibility and "ii", which is mentioned in the following paragraph.

1.3.4. An increase in production efficiency and a subsequent decrease in production costs cause an increased demand, which stimulates, in turn, another increase in production efficiency, because of the merit of scale. At the same time, on the transport side also, the same merit of scale functions, resulting in a decreased unit costs of transport.

CHAPTER IV TRANSPORT ORGANIZATION UNDER
THE THREE-STATE DEVELOPMENT PLAN

1.4.1. What is the reason why agricultural resources of high potentiality in the project area have not so far been exploited? One of the tightly closed gates has been that the means of transport, particularly railroads, has not functioned well. Therefore, the first requirement for the Development Plan to be feasible is that the managerial organization of railroads which carry to the port agricultural products of the project area should be made efficient and stable.

1.4.2. First of all, the problem that we face is the selection of the export port for agricultural products, because unless this problem is resolved, we cannot come to grips with issues related to the railroad route linking the origin with the port, notably projected transport costs, and the cost-based railroad rates-making policy.

1.4.3. In this case, it can be said that the selection of the port for export is to be made from among three candidates: Vitória, Rio de Janeiro, and Santos. We believe that this issue should be resolved by the nation's development policy based on a comprehensive and long-term point of view and, according to the orientation of the Development Plan under the "Grand Axis" concept.

1.4.4. On the above basis, we premise that the port chosen for export under the Development Plan is at Vitória and/or an adequate location nearby. Then, our review on the transport organization will cover

the following items;

- i) Candidates for the port to be Vitória and its environs, namely, Capuaba, Portocel, and Praia Mole; determination of the port from the long-term point of view, with consideration given to permissible draught and area for storage;
- ii) Railroads to be a route comprising CVRD from the port up to Nova Era and RFFSA from Nova Era through Belo Horizonte up to Ibiá, Patrocínio and Anápolis (called hereafter as A Route), and another route comprising CVRD from the port up to Nova Era and RFFSA from Nova Era through Belo Horizonte up to Pirapora (called hereafter as B Route);
- iii) Wagons exclusively used for grain transport on both A and B routes;
- iv) Control over the unit train to be unified through cooperation of CVRD and RFFSA; some control organizations to be considered;
- v) RFFSA to be able to carry an additional grain at the initial stage of development by lengthening crossing tracks at stations and by installing train-crossing stations between two consecutive stations whose interval distances are long; including the railroad beltway to be desirable in and around Belo Horizonte;
- vi) Silos and loading facilities at the port to be examined according to the projection of the shipments following determination of the selected port; and
- vii) A transport system (a feeder system) consisting of roads and truck-haul between silos at the origin terminal and farms, as well as the origin terminal and farms to be examined; the feeder system to be examined individually in accordance with the respective conditions of individual locations (generalization to be intentionally avoided).

CHAPTER V MARKETING SYSTEM UNDER THE
THREE-STATE DEVELOPMENT PLAN

1.5.1. Supply and demand, and prices of grains in the international market, are fluid. To make grains produced by the Development Plan participate in the international market under as favorable conditions as possible it is necessary to have an organization responsible for the fair activities of marketing. If the marketing is left in hands of free competition in the commercial activities, there is the danger that the assistance and development of agricultural producers of medium and small size will be hampered.

1.5.2. Properly speaking, the marketing system is expected to develop spontaneously. We would find it difficult to advocate guiding the system by a policy. However, the Development Plan still requires much of an aggressive research and guidance in agricultural technology. Also, the raising of agricultural capital, particularly for the producers of medium and small size, requires strong assistance on their financial aspects, by the Federal and State Governments. In parallel with provision of guidance and assistance on the production side, it is necessary to recommend what the features of the marketing system should be.

CHAPTER VI PUBLIC INVESTMENT AND RAILROAD RATES-MAKING
POLICY UNDER THE THREE-STATE DEVELOPMENT PLAN

1.6.1. To carry out the Development Plan, it is necessary to make public investments to improve railroads, roads, ports, etc. Those investments are one of the jobs in fabricating the key to open the tightly closed gates mentioned in the preceding Chapters. Therefore, to hesitate in making investments would not facilitate success of the Development Plan.

1.6.2. In making investments, it is essential to fully utilize the existing facilities as much as is technically possible, by strong efforts, ingenuity, and by collaboration.

1.6.3. The existing facilities of RFFSA have many problems, among which acquiring capability to carry grain is one. However, if it is possible to make a technical review from the new point of view of formulating the export corridor, and to modernize RFFSA, step by step, by incremental investments in improvement, it seems to us that RFFSA will acquire capability to carry grain traffic for a considerably long period of time.

1.6.4. Even though it is possible to utilize the existing railroad facilities, it is, nevertheless, difficult to make agricultural products of the project area competitive in the international market under the railroad rates-making policy presently adopted. Therefore, together with the adoption of the unit train system which will give a

practical cost-reducing effect, it is necessary to have the proposed new rates-making policy reflect more effectively the impact of unit train operations. We now propose the "Avoidable Costs Concept" to determine reasonable railroad rates.

1.6.5. *Avoidable costs are, by definition, the costs which accrue by the undertaking of the railroad to carry a new cargo and which can immediately be avoided by the railroad if the railroad stops to carry that cargo. Here, for easy understanding and simplification of actual cost calculations, we assume the direct train operation costs as the above mentioned avoidable costs. An actual example is shown in the following paragraph.*

1.6.6. *The Table below indicates the cost calculations for the direct train operation costs in the case where RFFSA operates a 1,500 ton soybean unit train consisting of 30 grain wagons (pulled by three locomotives) over a distance of 778 km between Patrocínio and Nova Era. As the unit train is back-hauled empty to Patrocínio after finishing that soybean transport, the return-haul costs of the unit train are included in the calculation.*

TABLE I-1 EXAMPLE OF AVOIDABLE COSTS CALCULATION

	T O T A L (Cr\$)	Average per Ton (Cr\$)	Average per Ton-km (Cr\$)
. Personnel Costs	9,760	6.51	0.008
. Fuel Costs	28,008	18.67	0.024
. Maintenance Costs of Locomotives	21,908	14.61	0.019
. Maintenance Costs of Wagons	529	5.67	0.007
. Depreciation of Locomotives	8,511	0.35	0.001
. Depreciation of Wagons	1,058	0.71	0.001
TOTAL	69,774	46.52	0.060
. Rates Based on Existing Tariff	355,305	236.87	0.304
. Percentage of Costs Over Existing Rates	19.6		

Remarks: The calculation has been made on the basis of the data (as of August 23, 1978) provided by Belo Horizonte Region of RFFSA. There are additional factors to be carefully taken into account when the Table is actually used.

1.6.7. The costs, which the railroad obviously added for that soybean transport, are the direct costs of operating the unit train as indicated in the Table above. Therefore, when determining the rates, the railroad has to be compensated to that extent as the minimum. Even in the case where the Government forces the railroad to discount the rates for exporting agricultural products, the discounted rates should be above this minimum limit. If not, the Government should make up the difference.

1.6.8. For the railroad, if the avoidable costs are compensated by rates revenue, there will be neither advantages nor disadvantages. As seen in the Table, the avoidable costs are very low, compared with the existing rates on the full costs basis; this indicates the difference in transport efficiency between a general freight transport and the unit train operations.

1.6.9. To carry to the port agricultural products at the lowest rates possible, and to strengthen the competitiveness of those products in the international market, it is necessary for a flexible rates-making policy to be used when determining the railroad rates, as indicated in the following three steps:

- i) Avoidable costs to be the minimum limit of rates;
- ii) Capability in price of agricultural products, which can bear railroad rates in accordance with the international market prices, to be a maximum limit of rates; and
- iii) Practical rates to be determined, with advantages and disadvantages of both the producers and the railroad taken into consideration, to strongly promote the export of products.

PART II DEVELOPMENT STRATEGY

CHAPTER I COVERED AREA

2.1.1. This Study covers the three States of central Brazil, namely the States of Espírito Santo, Minas Gerais, and Goiás. We define, as the project area, an area of around 500,000 km² which extends over northwestern Minas Gerais and southern Goiás (see Fig. II-1). Cerrado Area constitutes the main part of the project area. In addition, linkages with other parts of the country are given special attention.

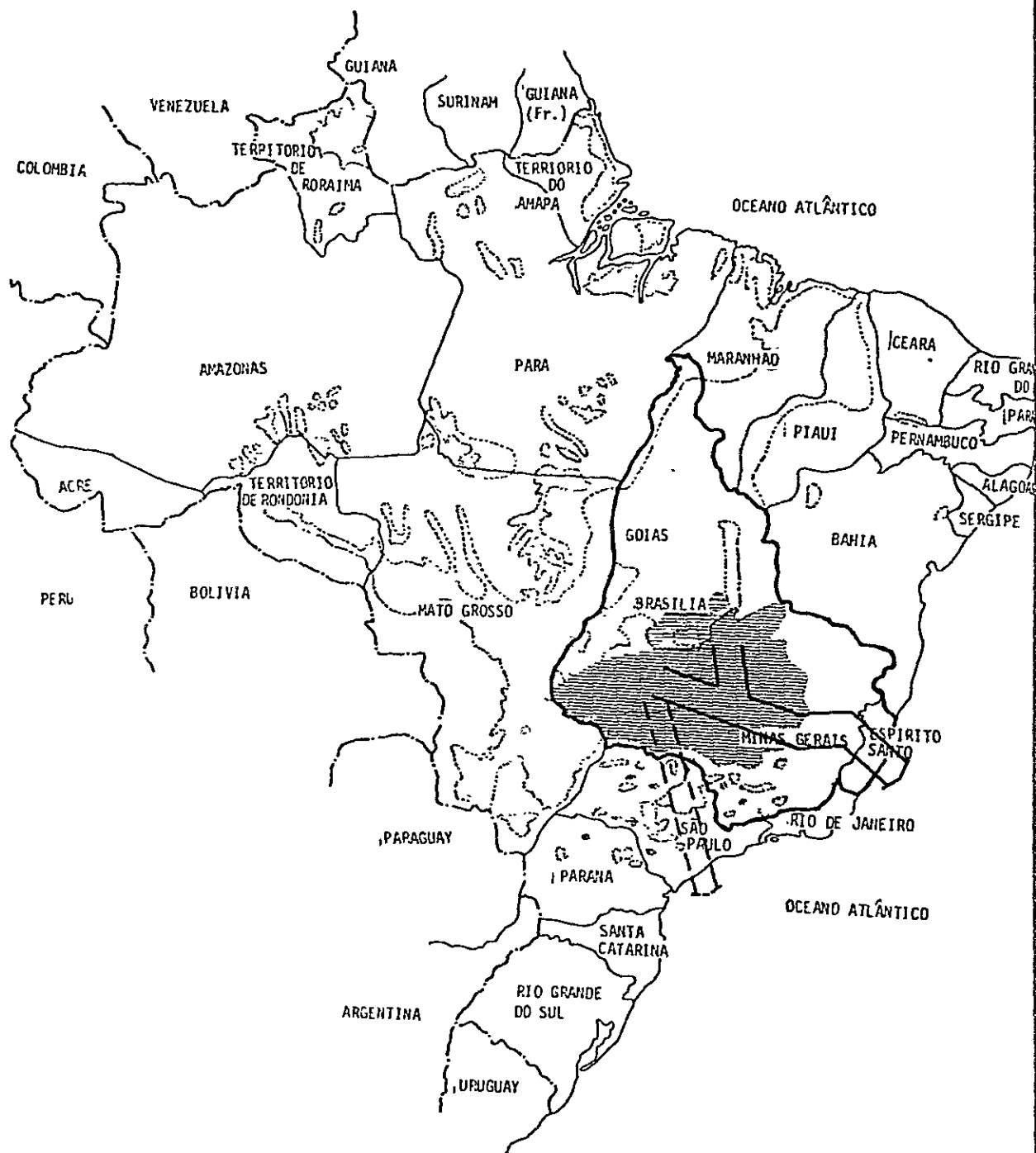
CHAPTER II STRATEGIC POSITION OF THE THREE STATES AND THE BACKBONE OF THE STUDY




2.2.1. Strategic position of the three States is characterized as:

- i) Nearness to the two big economic centers: São Paulo and Rio de Janeiro;
- ii) Well-developed transport infrastructure (specially roads) and connections with other parts of the country; and
- iii) Contact point for future development of Amazon and the North-East Regions.

Moreover, the Cerrado area as a frontier, and Vitória and its surroundings as an export base, comprise the major economic and geographic characteristics of the three States.

Fig.II - 1 Location of the Three States and Project Area



-  Cerrado Area
-  Project Area
-  Export Corridor based upon "Grand Axis"

2.2.2. The backbone of the Study comprises the following four components: i) decentralization of economic activities; ii) development of agricultural frontiers; iii) improvement of the international balance of payments; and iv) contribution to world food supply.

2.2.3. Brazil's economy has so far been developed primarily along the coast, particularly in southeastern Brazil including the States of São Paulo and Rio de Janeiro. As a result, we can recognize today over-concentration of economic activities in these areas. For the future development of the Brazilian economy, therefore, it is recommended to decentralize these activities toward other areas of the nation. For this reason, the future development of the three States in terms of agriculture as well as industry will have a big impact upon the Brazilian economy.

2.2.4. In regard to agriculture, southeastern Brazil has fertile soil. However, this area has already been developed to the fullest, and there is not much room left for further development in the future. It is essential therefore for Brazilian agriculture to attain growth by outward extension, and emphasis should be placed upon the Cerrado area in central Brazil which includes the project area. This direction of development would contribute not only to export promotion but to satisfy the future increase in domestic demand as well.

2.2.5. Brazil's trade balance, which had been almost in equilibrium during the high growth period, continued to show large deficits since 1974 triggered by the occurrence of the oil crisis, but

turned into a surplus in 1977 for the first time in four years. Major contributors were the sharp rise in the price of coffee and expanded exports of soybeans for which a good crop was recorded. The latter example shows that untraditional agricultural products could make a strong contribution to the improvement of the international balance of payments.

2.2.6. The world food supply and demand balance is expected to be a serious problem at the end of this century, and it is argued that the central part of Brazil could contribute greatly to attaining balance. It would not be an exaggeration to say that the agricultural development of this area is destined to resolve world food problems for the coming century.

CHAPTER III REGIONAL DEVELOPMENT PLANS OF THE
NATION AND THEIR RELATIONSHIP TO THE THREE-STATE
DEVELOPMENT PLAN

2.3.1. The turning point of the regional development policy of the Brazilian Government was the great drought in the North-East region in 1970. As a result, the National Integration Plan (PIN) was introduced and this formulated the basic policy of the regional development strategy of the First National Development Plan (I PND 1972-1974). In July 1971, the PROTERRA Program aiming at strengthening PIN was adopted, but this program covered, in relation to the three States, only the northern part of Goiás. In November 1971 with the adoption of the PRODESTE Program the Central-West region was included for the first time in national development strategies. This program covered the States of Mato Grosso and Goiás, excluding the northern part of Goiás which is the SUDAM area.

2.3.2. The Second National Development Plan (II PND, 1975-1979), based upon the PIN and PROTERRA, adopted five special development programs. Among these, only one, POLOCENTRO, has relationships with this Study. POLOCENTRO referred to an integrated agricultural development of the Cerrado area. It defined twelve priority areas as "poles for development" in the States of Goiás, Minas Gerais and Mato Grosso.

2.3.3. Judging from the importance of the strategic position that the three States have in national development strategies, special attention toward this area by the Government of Brazil is urgently needed.

CHAPTER IV STRATEGY FOR THE THREE-STATE
DEVELOPMENT PLAN

2.4.1. As already mentioned in "BASIC PHILOSOPHY", the basic strategy for the development of the three States is based on the "Grand Axis" (Grande Eixo) concept.

2.4.2. The Grand Axis concept originally means the connection of two points by railroads. However, this Study gives this concept a wider meaning. Grand Axis is, by the definition of this Study, the formulation of a kind of the integrated channel consisting of infrastructure such as railroads, roads, ports, etc., to move agricultural products in the project area to the export terminal, and of soft-ware such as a modernized management formula and the transport policy including, in particular, an adequate railroad rates-making policy, to make the above mentioned infrastructure function more effectively.

2.4.3. The identification with agricultural development is an intrinsic part of the concept and is given special attention. This concept is neither against the "Export Corridor concept" nor against the "POLOCENTRO concept", but rather it does cover and integrate those concepts.

2.4.4. Study of the agricultural sector identified soybeans, maize and sorghum as the most promising agricultural crops in the project area. This identification was made by examining export market potential, land productivity and agro-technical feasibility. Details are described in the following Chapters.

CHAPTER V AGRICULTURAL WORLD MARKET
PROSPECTS FOR 1990-2000

2.5.1. It is a well known fact that the world food and feed grains market has been long affected by those factors such as:

- i) The U.S. production volume fluctuating easily due to her agricultural policy and weather conditions, and
- ii) Russian and Chinese import quantities varying yearly with their cropping levels.

Agricultural production, depending basically on climatographic conditions, suffers from instability. This causes difficulty in foreseeing the medium and long range outlook of the world grain market. However, our analysis of political and economic trends in major countries may lead to the following scenario for prospects up to 1990-2000.

2.5.2. The U.S. as a super-dominant supplier will not be capable to expand substantially her production in the course of her refrained application of "Set Aside" policy. The rate of growth is estimated to be not more than that in the past. Since yields in soybeans and maize have already reached considerably high levels, they are not expected to increase steeply. Consequently enlargement of the cultivated area is the main way to increase production. The U.S. may expand her cultivated area to a certain extent in response to increasing world and domestic demands. However, the expansion will be saturated, because the area of farm lands suitable for grain cultivation which can be newly used is not so large. Disadvantages in international cost competitiveness resulting from cultivation of less-productive land will discourage agricultural

Producers from expanding grain production. All in all the U.S. soybean production is estimated to increase at an annual rate of a little less than 4% up to the 1990's, while maize and sorghum production will also be expanded at a rate of less than that in the past.

2.5.3. Russia and China will continue to move toward self-sustaining levels in compliance to their economic policy and principle. It is expected, however, that Russia does not raise much its productivity and that it does not expand much its cultivated area. Moreover, actual policy for emphasizing industrialization with less attention to agriculture will not be modified. Russia may remain a grain importing country for long time from now on. China, as a soybean producing country, will make an effort to enlarge production. But judging from her policy for allocation of economic resources, future soybean production will reach only the level of satisfying domestic needs, or may possibly fall below that level. In any case, supply and demand volume will grow annually on the average by 3% and be around 21-22 million tons in 1990.

2.5.4. Western Europe is also playing an important role in terms of grain consumption. She has a clear target for maintaining upward trends in the ratio of self-sustenance as shown in the EC common agricultural policy. However, the soybean market is different. The EC's production is negligible and supply depends mainly on imports either as grain or cake (with a ratio of 2 to 1 or 6 to 4). This means that soybeans in the EC have much more importance as feedstuff materials than as oil

materials. A substitution in part of grain for cake may happen in the future. Taking into account such a possibility, grain consumption in EC will still attain a level of 22 million tons in 1990, having marked an annual growth rate of 5%.

2.5.5. In Japan, the volume of consumption of feed grains such as soybeans, maize and sorghum has grown rapidly to the level of 10 million tons a year, in correspondence with development of domestic poultry and pig raisings. In the course of her economic growth, increasing demands for highly nutritive foods encouraged these increases. However, the future trends of Japan's feedstuff consumption may be a little different from those of the past, since the demand for animal proteins will be saturated at higher living standards and also imports of meat will be expanded, substituting for domestic meat production. Meanwhile, it is expected that some Asian countries following the same pattern of industrialization as that of Japan have growing demands for feedstuff.

2.5.6. Based on these major countries' perspectives we can reach the conclusion that consumption of soybeans in the world except Brazil may be expected to increase at an annual rate of 4%. It will be expanded from slightly less than 70 million tons in 1977 to 115 million tons in 1990. Even if there will be a rise in the U.S. supply from 46.7 million tons in 1977 to 74-76 million tons in 1990, a supply at least 15 million tons will be needed to meet the growing demand of Western Europe and Japan. If China will turn out to be an importing country, an additional supply shortage of 5 million tons may come into being. An over-all country review shows that there exists only Brazil which has the potential of

supplying such a large volume of soybeans, taking advantage of internationally-comparable or high yields already achieved. Thus actual Brazilian soybean production will be likely to be tripled in 1990 or expanded to around 30 million tons, of which half will be for domestic use and half will be exported to supply to the world.

2.5.7. A tight world market is foreseen for coarse grains such as maize and sorghum. Maize can be easily substituted for sorghum and vice versa as feedstuff materials and both can be produced all over the world, and are being so produced. However, for the future, a large part of the European countries, some of the Asian countries, and Japan will continue to depend on imports, while only some countries will be able to expand their production. Brazil is also expected to expand her production. But these products in Brazil are accompanied by many export-restrictive factors. For example, yields are inferior to those of the U.S. and stable supply for domestic consumption has greater priority than exportation. Consequently Brazilian coarse grains supply to the world will be at the level of a few million tons in 1990.

2.5.8 It is the most important issue in the Study how and to what extent the agricultural production in the project area is able to respond to the increase in demand, both abroad and at home. Also, in order to support the possibility of agricultural production in the project area, it is necessary to make clear various kinds of measures to be adopted by the authorities. Since at this stage, definitive basic data are not made available, we have envisaged the goal of the agricultural

production volume in the project area in around 1990, mainly on the basis of the outlook of supply and demand in the international market, and partly on the basis of data in the southern States of Brazil. The results envisaged are shown in Table II-1 below. Detail is given in Appendix I.

Table II - 1 Goals of Development in 1990

Product Area	Goal of Cultivated Area (10,000 ha)	Goal of Annual Production (Million tons)
A	581	12.6
B	94	2.0
Total	675	14.6

- Remarks:
- i) Annual production is a total of soybeans, maize, and sorghum.
 - ii) A-area comprises Triângulo Mineiro and the southern Goiás State, and B-area constitutes the Pirapora region of upper waters of the São Francisco river.

Of the annual production goal of 14.6 million tons appearing in Table II-1 above, how many tonnages of agricultural products are to be exported from the project area depends on their competitiveness in the international market. In order to strengthen the international competitiveness, we have emphasized in the next Part titled "POLICY PROPOSALS" that it is necessary to strongly promote various measures covering both the agricultural sector and the transport sector. In the meantime, the goal of the

cultivated area of about 6.8 million ha appearing in Table II-1 above accounts for about 14% of a total of the project area (about 500,000 km²). This means an annual increase in the cultivated area of 0.3 ~ 0.4 million ha. In view of actual increases, which were seen in Parana State and Rio Grande do Sul State in the first half of the 1970's, we do not believe that the annual increase rate mentioned above is overestimated. Table II-1 should eventually be determined, with agricultural development to be made in the areas other than the project area being taken into consideration.

PART III POLICY PROPOSALS

CHAPTER I BREEDING OF VARIETIES

(1) General

3.1.1.1. On the basis of the condition of temperature, precipitation and its seasonal distribution, and sunshine, it can well be said that the project area is suitable, although not the best, for growing soybean, maize, and sorghum. The varieties of soybeans differ in their sensitivity to day-length and temperature. The Cerrado area under the Development Plan extends over a wide range of latitude (15°S-20 S Lat.), includes places at various altitudes above sea level, and includes areas of a single cropping of soybeans and of double-cropping of soybeans and wheat. In the future when water resources are further developed, it would be possible for the cropping system to comprise the double-cropping of soybean, maize, sorghum, paddy, wheat, etc. Research and development for selection of suitable varieties, particularly of soybeans, requires added importance.

3.1.1.2. To grow soybeans, maize, and sorghum in the Cerrado area, lime and phosphate should be applied to improve the acidity and fertility of the soil. Potash fertilizers for soybeans and nitrogenous and potash fertilizers for maize and sorghum should also be applied in sufficient amounts for high yields and continued production. However, much use of chemical fertilizers deteriorates the physical and chemical properties of the soil. Therefore, much organic matter should also be applied. In regard to soil fertility, soybeans would be the most suitable crop for the Cerrado area, because their fallen leaves, husks, and roots are recycled

to the soil after harvest, while the soil's nitrogen is also enriched by root bacteria. On the other hand, however, it is necessary to breed the high-yielding varieties of soybeans, which have a stronger response to fertilizer. For maize, as soil fertility develops and fertilizers are used to an increased extent, the introduction of its F_1 hybrid would be made possible. In view of this prospect, the breeding of varieties of maize should also be taken up.

3.1.1.3. It is of course desirable to breed varieties which are highly resistant to the pests and diseases prevalent in the project area. Much use of fertilizers, in general, causes a more frequent occurrence of pests and diseases. Also, the high-yielding varieties are, in some cases, particularly susceptible to pests and diseases. Furthermore, as a cultivated area is enlarged, the occurrence of pests and diseases becomes frequent and it often happens that new pests and diseases appear. The breeding of varieties resistant to pests (including birds and animals) and diseases is the most important.

3.1.1.4. If the harvesting is mechanized, it is important that the form of crops should be suitable for mechanization (specifically, seed pods in high positions, compact, and non-dehiscent for soybeans and heads in uniform levels for maize--possible in F_1 hybrid), to make the use of machinery more efficient and to minimize harvest losses. Therefore, it is necessary to develop the varieties of such forms.

3.1.1.5. It is essential for export products to be of high quality. In this respect, maize and sorghum appear to present no problem.

However, the size of soybeans produced in the Cerrado area is relatively small. Even though they are used for soybean oil, it happens that some soybean oil makers dislike to import the small-grained soybeans. If so, there is no other way but to rely on the breeding of new varieties.

3.1.1.6. In summary, to keep a stable production of crops of high yields, it is necessary to have the varieties which show good response to much use of fertilizers, high resistance against pests and diseases, much flexibility for a cropping system, suitable form for harvest mechanization, and high quality for export. To breed the ideal varieties, which are able to meet these requirements as best as possible, we propose the following:

- i) The existing breeding organization be greatly strengthened in terms of staffing and financial support by the Federal/State Government(s); and
- ii) The present "Production System" (Sistema de produção) services be extended in depth over the entire project area in terms of staffing and financial support by the Federal/State Government(s).

Note: In soybean cultivation, supply of the required N elements is dependent mostly on the N-fixing capabilities of root bacteria. In addition to the development of varieties, it is also important to develop the strains of root bacteria with better N-fixing capabilities and to spread them widely.

(2) Improvement of Soybean Variety

3.1.2.1. The cultivation of soybeans in Brazil, which originated in the country's southern temperate zone, has been spreading toward the north. Before wondering whether this project area (15°S-20°S Lat.) belonging in terms of latitude to the tropics is suitable for the cultivation of soybeans, it is necessary to examine whether there are any varieties of soybeans suitable to this area and, if not, to consider the possibility of producing suitable varieties. It is worth noting that in Asia, soybeans are now in cultivation everywhere from the north temperate zone to the tropical flatland right on the equator.

3.1.2.2. However, there are sharp differentiations among varieties and growing seasons. Varieties of tropical soybeans, for example, have not been exportable as for use as a source of oil because of their quality. Further their yield is low, although this may depend on growing techniques. In Thailand, efforts to improve varieties have been made with the cooperation of Japan since about ten years ago. Nevertheless, it is said that satisfactory varieties have not yet been bred in terms of quality and yield.

3.1.2.3. Those chiefly grown in the project area are varieties introduced from or developed in the south, such as Santa Rosa and IAC-2. Recently, cultivation of Visosa University's varieties known as UVF Nos. has been begun. While these varieties seem to be producing partly satisfactory results, it is doubtful whether they are suitable for export because they have poor quality when grown in this area. Since

soybeans, as mentioned earlier, have sharply differentiated varieties according to ecological conditions and according to growing seasons, it may be necessary to systematically breed the varieties under the control of a single responsible institution. The suggested methods are as follows:

- (a) i) To collect existing varieties from all parts of Brazil;
 - ii) To collect varieties from many parts of the world, particularly from the southern part of China, Taiwan and the southern States of the U.S.A.;
 - iii) To use the genetic pool thus formed for examination of the varieties' characteristics, and for preservation. For this purpose, it is necessary to set up an institution and an examination center to which personnel are assigned;
 - iv) To set up "branch centers" in several climatically different points - to be selected considering the height above sea level, and latitude - within the project area; and
 - v) To distribute pedigrees and varieties, produced at the central institution by the breeding methods in (b) below, among the branch centers and breed varieties suitable to a respective district.

- (b) Soybean breeding will be by these methods at least at the outset:
 - i) Pure line selection, and
 - ii) Pedigree method.

- (c) To promote the production and extension of the seeds of suitable varieties in the same manner as now is practiced in this area.

CHAPTER 11 FARM MANAGEMENT

3.2.1. As already stated, the agricultural production potential of the vast land in the project area can be brought to realization, provided that improvements on basic facilities such as land improvements and soil improvements are enforced, that improved varieties of crops are grown, and that the appropriate technologies for applying fertilizers and so on are introduced. However, since it is the farmers who develop the land and grow the crops, the realization will not be possible unless development of that land is attractive to the farmers themselves.

3.2.2. In developing the project area, it is said that a fundamental principle is to promote a highly productive modern enterprise farm comparable to that of the United States where most farms are operated on a commercial enterprise basis. The requirement for such commercially operated farms would naturally be higher profitability on capital invested than investment in other undertakings. If modern farming is to be operated under the technological system of using large machinery, the economy of scale would become the dominant factor for enhancing its operating efficiency and profitability. For instance, on the basis of the acceptable return on investment for a modern mechanized enterprise farm, it is estimated that the size of one farm requires at least 500 ha in the Triângulo Mineiro.

3.2.3. The present circumstances are such that land has become an attractive investment for those who own lands or who are about to invest in lands. Some people own or purchase land not for

operating a farm but merely for the sake of speculation. This situation is attributable to the fact that as development proceeded, the price of land soared, much more than the rate of inflation. This resulted in low land utilization rate, for it prevented the land owners from fully utilizing their land for farming.

3.2.4. If modern mechanized farms are created and operated on a large and efficient scale, they would undoubtedly acquire a dynamic force of agricultural development. And they would be able to produce a large volume of products comparable to that of the United States. But, if more people begin to own land for speculative purposes, agricultural development will not proceed. Therefore, countermeasures of some form or another, for instance, reforming the tax system for banning "speculative" land ownership is much to be desired.

3.2.5. When such modern mechanized farms are established and their business begins to thrive, there is another problem. It is the problem of the existing medium- and small-scale farms run by indigenous capital, and of the smaller subsistence-level family farms. Particularly in this project area where expanded production of soybeans, maize and sorghum for export is encouraged, these small farms will always be placed at a disadvantage relative to the large farms since their productivity will be lower than the mechanized farms. Also, in their marketing activities, their bargaining power will be weaker because of their smaller lot transactions. Further, as mechanization advances, employment opportunities would become lost to families of the subsistence-level farmers who until then had been earning part of their income by working for the large

farms. To cope with this situation, various institutional reforms such as: i) cooperative management of farming through common use of machinery procured by the agricultural cooperative, an organization of small farmers; ii) reinforcement of financing systems to the small farmers through institutional credit arrangement; iii) strengthening of bargaining power through cooperative marketing; and etc. will be needed as discussed later.

3.2.6. Establishment of agriculture-related industries in the project area will prove to be an effective measure not only for lowering the prices of agricultural supplies and for enhancing the value-added of farm products, but also for creating employment opportunities. Agricultural cooperatives are useful for these purposes. Furthermore, through increased demand for farm products by the increasing non-agricultural population in the area, the labor-intensive type of farming suitable for small farmers, such as growing fruits and vegetables, will prosper and help absorb their surplus manpower. Needless to say, giving technical guidance in such farming will necessitate the agricultural extension service system to be amplified.

3.2.7. As observed above, it will be impossible to fully exploit the precious potential of this vast stretch of land unless the Development Plan benefits all those who engage in farming, each in its own way, be it commercial farming, medium- and small-scale farming or family farming. For this reason, powerful government measures such as described above are required for land utilization, agricultural finance, farm product marketing, and the agricultural extension service system, particularly in relation to organizing small farmers. It will also be necessary to strengthen domestic

capital in agricultural investment, including land investment, and in the marketing system for farm products, particularly export products.

3.2.8. Pricing policy plays a very important role in establishing the base of farm management. It is all the more so, because this Development Plan puts emphasis on the export of specific products such as soybeans, maize and sorghum. We propose that the present pricing policy should be reviewed from the standpoint of giving incentives to farmers so that the goals described in the Development Plan could be attained smoothly.

3.2.9. Furthermore, since Cerrado is an area where soil is infertile, the maintenance of fertility and prevention of soil erosion should not be neglected, otherwise the stable and continuous crop production in this area would not be attained. Together with the advancement of modern technology, the traditional rotation system with some modifications should also be highly regarded for the farm management of the area.

3.2.10. For instance, in State of Goiás, a rotation system is practiced in traditional farms. According to this system, in the first year of cultivation at a farm, rice is grown and in the second year, rice, soybeans or maize, and the same in the third year. In the fourth year, the land is used as a pasture land. At the Simposio Cerrado IV, a study was presented which made ten combinations of crops in such an alternate cropping system and which analyzed their effectiveness by linear programming. The study referred to farms with an average size of 500 ha at Quirinópolis in State of Goiás. The combinations of crops considered

in the study area were, for example, rice-rice-rice-grazing, or rice-maize-soybeans-grazing, etc. and a combination adopted for a specific year was determined by price levels of agricultural products for that year. For a ranch, namely an artificial pasture land in this case, this study recommends that improved seeds of grazing grass be used and that 2 heads of cattle (presently 0.3 head) per ha be raised. Modernization of agriculture in the project area should proceed with due respect for this kind of traditional cropping method because of the reasons mentioned above. Inclusion of soybeans in the cropping system is necessary to maintain soil fertility.

CHAPTER III SOCIAL SETTING-UP

3.3.1. The agricultural development of the Cerrado area has so far been promoted with POLOCENTRO Program as a core. This program formulates special supporting measures for agricultural development. One is the development of infrastructures such as construction of warehouses, construction of farm roads and electrification, and the other, provision of special agricultural credits for mechanized farms. While the target figures of 1979 for the former have already been reached, those for the latter have been much delayed. The project area of this Study which includes the Cerrado area will continue to be very important as a base of agricultural production for export. Therefore, further strengthening of special agricultural credits and infrastructures would be much required. For instance, it is desirable for the POLOCENTRO area to cover the area east of Triângulo Mineiro. It is also desirable for the POLOCENTRO infrastructure investment to include that for water resources utilization.

3.3.2. The agricultural development of the project area in the future would require a new concept. The basic concept is stabilization and level-up of life as well as pursuit of real happiness of agricultural producers through formulation of an affluent agricultural society, where, efficiency and equity will be balanced at a higher degree. This would lead to sounder local communities in the 21st Century.

3.3.3. It can well be said that affluent society is an ideal image of modern agricultural society. However, realization of such a society would require a long span of time as well as various stages. One of the most useful and practical approaches would be the institution of agricultural cooperatives. This institution is described, in connection with a marketing system, in the next Chapter.

CHAPTER IV MARKETING SYSTEM AND AGRICULTURAL COOPERATIVES

(1) General

3.4.1.1. In Brazil, the soybean distribution system is quite different from that of maize. The soybean market is characterized by following facts:

- i) Area-wise concentrated production,
- ii) Close linkage with the international market in terms of prices,
- iii) Limited number of buyers such as oil extractors and dealers, and
- iv) Concentration of seed supply often corresponding to oligarchic structure of buyers due to importance of quality control.

The main dealers or oil extractors (some of them are affiliated companies of internationally famous grain traders) have a tendency to broadly dominate the soybean market by expansion of their business upstream (seed supply) and downstream (oil extraction and feedstuff production). On the other hand, maize markets are spread throughout the country. Local demand in any state is basically met with local supplies from within the state. Of the total production, about 50% is estimated to be for producers' own use or local consumption. Therefore, there seems to be less room for the middleman's function of large dealers or wholesalers.

3.4.1.2. At present, soybean production volume has reached around 10 million tons, of which almost all is produced in the four states of the southern part of Brazil. Oil extractors, also being mostly located in the same part of the country, purchase 70-80% of total production. Brazilian oil-extraction capacity is estimated at 3.5 million tons.

Among those, 30% of the total is controlled by affiliated companies of international traders. As to export business, oil cake is naturally handled by the main dealers or oil extractors and even shipments of grain to overseas are chiefly under control of these main dealers or their affiliated dealers with some exceptions of export through capable trading companies controlled by agricultural cooperatives in the southern areas. Actual production of soybeans in the project area is only 100,000 tons in Goiás and 100,000 tons in the western region of Minas Gerais. A large part of production is delivered to oil extractors in São Paulo and elsewhere, directly or through dominant dealers who have also seed supply businesses. Only a small quantity seems to be purchased by local extractors.

3.4.1.3. The present maize market situation may not change. Due to a possible growth of supply to meet increasing domestic demand, only a small portion of production is likely to be left for export. Domestic demand will continuously increase in parallel with expansion of user industries such as poultry and pig raising (poultry raising is expected to grow annually by 7%). In the course of this expansion, the number of fowl and pigs raised by the farmers inevitably will be magnified, or production may become more concentrated. This may encourage re-organization of the distribution channel for a more direct flow from large scale maize producers to feedstuff manufacturers or poultry and pig raising industries. Actual supply-demand conditions in the project area shows that a supply surplus of 1-2 million tons is sold to poultry raisers in São Paulo and elsewhere, while a half of production volume is consumed locally. However, the market structure or distribution channel of the commodity is not rigidly fixed, but is

rather flexible. The distribution channel or destination of shipment can be easily changed according to imbalance of supply-demand in and out of the project area. The same flexibility is observed in the soybeans market because production level in the project area is still so low that the area plays only the role of a marginal supplier.

3.4.1.4. In considerations of these market structures, we suggest that it be high time to establish a new marketing system under the control of agricultural producers. In order to strengthen, by joint actions, suppliers' bargaining power in transactions, as a practical measure we propose a re-organization of existing agricultural cooperatives into powerful institutions to work effectively in both production and sales areas. At this moment, there exist many agricultural cooperatives in the project area. But they are small-sized in terms of number of associates and range of activities. In some municipalities there are even two or more cooperatives in accordance with kind of product or type of activity. Agricultural producers' participation ratio is usually less than 50% and little attention is paid to joint purchase of materials or joint utilization of facilities.

3.4.1.5. Functions of agricultural cooperatives are usually defined as follows;

- i) Technical guidance and information services,
- ii) Joint sales of products,
- iii) Joint purchase of materials,
- iv) Joint utilization of facilities and machinery,
- v) Mutual or institutional guarantee system,

vi) Financing, and

vii) Cooperative activities in general rural life.

In Brazil, financing activity was separated from producers' cooperatives and re-organized into independent credit cooperatives subject to many restrictions. This policy seems to have been introduced in accordance with a principle of integrated monetary flow and financing controls. We, however, consider that agricultural producers' cooperatives aiming at obtaining bargaining power as a supplier in the market cannot compete with buyers without some kind of accompanying financial operations. If cooperatives do not take the risk of a wholesaler in conventional financial transactions such as acceptance or issue of bill, and/or grants of credit, they play only the useless role of commission broker. It should be noted that under the present financing system, agricultural producers or cooperatives without such financial resources cannot reject offers from dealers with conditions of cash payment and relatively low price quotation in the harvest season.

3.4.1.6. It is also recommendable that some guideline policy for agricultural cooperatives' involvement in seed supply and technical information services be worked out in order to recover producers' initiatives in those activity areas. With only a slogan of joint production and sales, agricultural cooperatives cannot expect participation of a large number of associates and consequently an influential power in the market. By their inexhaustible engagements in the entire spectrum of agricultural activity, agricultural cooperatives will gain the producers' support, and may function effectively in joint production and sales. In this context, agricultural cooperatives should have a wide variety of

services spanning the entire production schedule such as seed supply, technical assistance, joint purchase of input materials, joint efforts to secure better crops (anti-disease treatment), roll-over financing or refinancing, joint sales and improved access to processing industries for guaranteeing a certain amount of demand, if necessary. We propose that such multipurpose agricultural cooperatives be created. If they will work systematically, producers will acquire influential power in the market through the cooperatives. The establishment of multipurpose agricultural cooperatives is also required from the aspect of decreasing marketing costs which strengthens their products' price competitiveness in the international market.

(2) Fostering and Strengthening of Multipurpose Agricultural Cooperatives, and Financial and Monetary Measures Required

3.4.2.1. It is useful to compare Brazil's agricultural cooperatives with those of Japan. Japan's cooperatives have these special features: (1) they provide credit business, a function into which various other businesses are integrated; (2) they handle a wide range of goods including livestock products; (3) the government's administrative guidance calls for them to maintain the system of one cooperative for one area and nearly all farmers in that area join the cooperative. By way of contrast, Brazil's agricultural cooperatives: (1) do not engage in the supply of credit, but take on the character of a production and sales cooperative; (2) grain production and sales cooperatives constitute the mainstream of Brazil's cooperatives, in view of export-oriented agricultural production

performed by large-scale mechanized farming; and (3) a variety of associated and non-associated cooperatives conduct independent activities, without much unification or solidarity. Therefore, the term "multipurpose agricultural cooperatives" in this context does not necessarily mean the Japanese type but a multipurpose and multi-functional one advocated for Brazil. The functions to be performed are described in paras. 3.4.1.4 to 3.4.1.6 and 3.7.7.

3.4.2.2. In order to foster and strengthen multipurpose agricultural cooperatives in the project area, it is necessary to organize agricultural production and sales groups - agricultural operation zones - with agricultural cooperatives at the centers. This method can be employed not only in the newly developed area but also in the already developed area. In the newly developed area, cooperatives by settled farmers should be made central. Further, existing farmers in the surrounding area should be invited to join such cooperatives or participate in cooperatives' businesses (transactions). In the already developed area, the range of joint activities in production, sales, purchase and financial aspects should be expanded by considering actual production and distribution conditions and life-related social conditions so as to lay a foundation for forming cooperatives. In areas where cooperatives exist, new joint activities should be created with cooperatives as the nuclei. If a plurality of cooperatives exists in the same area, cooperation between them should be promoted beginning with practical fields to expand the range of cooperation and urge them to merge through independent negotiations. In order to strengthen farmers' ties with cooperatives, needless to say cooperatives' organized business activities must exist as they will enable the cooperatives

to lead farmers in production, distribution and financial efforts. To this end, it is necessary to organize and maintain a set-up for guiding farmers in agricultural operation including technical and management guidance and to support farmers in collecting information essential to the sale of farm products and in financial measures for their farm work and sale of farm products. Further, it would be desirable for cooperatives to take a leading role in conducting joint activities related to living conditions so that farmers may improve the quality of their daily lives.

3.4.2.3. To insure that the cooperatives can carry out the activities mentioned above, financial and monetary support from the Federal and State Governments is necessary. The financing system for the agricultural development program in this project area should be an expanded and improved version of the existing POLOCENTRO Program. Among the arrangements which should be made, favorable treatment measures should be considered for agricultural development programs carried out through cooperatives. In the newly developed area, for example, a portion of the funds (e.g., 50%) for building agricultural operation zones could be borne by governments (or public institutions). If new infrastructure such as that for utilizing water resources, electrification, farm roads and warehouses is organized in this area and the already developed area as well, a portion of the funds could be furnished on condition that the work be collectively done through cooperatives. The remaining funds should also be loaned on favorable terms. In the operation of the existing agricultural financing system for farmers and cooperatives, the production programs carried out collectively through the cooperatives in this project area should be given favorable treatment, such as by provision of a higher

financing ratio, than that for the nation-wide system. Further, in the implementation of agricultural development programs through cooperatives, agricultural credit institutions should have access to government or public institution grants enabling them to pay a fixed rate of interest so that the loans may have more favorable terms than otherwise. In addition, stabilized management of agricultural credit institutions should be considered. Financing terms for farm-product processing facilities to be built by cooperatives should be improved.

(3) Suggested Measures for Those Farmers who are not Presently Members of Agricultural Cooperatives

3.4.3.1. While the agricultural cooperatives are expected to play a major role in the promotion of agricultural development in the project area, this does not mean to suggest that all farmers be made members of the cooperatives immediately. There are self-contained large scale enterprise farmers on one hand, and unorganized medium and small farmers on the other. As for the former, most of them are equipped with such functions as the cooperatives can provide in terms of financing, production and marketing, and, therefore, they have no need for membership in the cooperatives. The latter type of farmers, however, are those who should be encouraged to associate with the cooperatives through its routine business and educational activities, and to eventually join the cooperatives as soon as practical.

3.4.3.2. Measures to encourage farmers to join the co-operatives vary depending on the areas in which they live. In case there is a cooperative in their district or the adjoining districts, their relationship with the local cooperative cannot be ignored. And those farmers who are not ready yet to become members of the local cooperative can be invited to associate with the cooperative through business or to participate in educational activities possibly, for example, as associate members. The problem is a case where there are no cooperatives in the district or the adjoining districts. In this instance, there is no other recourse than to newly organize a cooperative in the district or to transplant an existing cooperative from another district (by building a network of warehouses in the district).

3.4.3.3. When a cooperative is started from scratch, it should not be expected to be organized in a complete form from the outset. It might not be impossible to provide for facilities and staff to handle the daily work required for ordinary activities of a cooperative in the short term if considering their transfer from other existing cooperatives. But the most important thing is the cooperation and solidarity of the membership, and the leadership of cooperatives' representatives. It cannot be emphasized too much that this process of organizing efforts is vital to the success of a new cooperative. Therefore, we would like to propose that a "Pre-Cooperative" be organized as a first step to make a cooperative movement successful.

3.4.3.4. The Pre-Cooperative provides opportunities for those farmers with no experience in cooperative activities to

learn, by experience as well as from mutual exchange, benefits of working through a cooperative in business transactions. For the time being, the areas of such cooperation are as follows, subject to characteristics of respective areas and demands of the membership: (1) collective negotiations and mutual security for agricultural financing; (2) group studies of agricultural production technology; and (3) joint marketing of agricultural live-stock products on an experimental basis. Such activities should be based on groups of 10 to 20 farmers and experienced members of existing cooperatives can be dispatched to help those group studies. On the basis of Pre-Cooperative experiences, organization of a full scale cooperative should be attempted.

3.4.3.5. If consideration is given to such farmers as involved in the above processes so that credit and financing policies of State and Federal government agencies will be applied to them, it will contribute a great deal to help organize a cooperative. In that instance, however, some measures should be taken to guarantee the loans provided to Pre-Cooperatives by existing cooperatives, which are to provide guidance and assistance to them, and also to create a credit insurance system to such existing cooperatives.

CHAPTER V TRAINING

(1) Training Program for Farmers and Farm Laborers

3.5.1.1. To systematically proceed with the agricultural development program in the project area, farmers and farm laborers must be provided with necessary training. The training program should include not only farm work but also general education, family planning, sanitation, welfare, etc. However, discussions here are limited to agricultural problems. The instructors may be agricultural extension workers. Large farms seem to have their own technicians who take charge of training, so therefore, the training program may concentrate on farmers and farm laborers working at small- and medium-sized farms. In this section, problems related to agricultural extension workers themselves, and with the spread of training, are discussed.

3.5.1.2. Agricultural extension workers can never be divorced from agricultural research. The purpose of extension service is to put knowledge and actual work together. Extension service without agricultural research, or agricultural research without extension service do not make sense.

3.5.1.3. Extension service by the Federal and State Governments should be put under one umbrella as much as possible. This is to avoid duplicated assignment of a limited number of useful extension workers under various systems. (However, if agricultural cooperatives have their own extension workers as a supplement to those of the country or states

there is no problem so far as assignment of extension workers is well coordinated between the country or states and the agricultural cooperatives.)

3.5.1.4. Extension service should perform the function of a pipe to carry information both upward and downward. This means that the smaller the number of administrative levels, the better.

3.5.1.5. Agricultural extension service should be educational. This means bringing about desirable changes in farmers' behavior, that is, making desirable changes in farmers' knowledge, skills and attitude. In this sense, agricultural extension service is regarded as out-of-school education for farmers.

3.5.1.6. Extension workers should reside in their assigned farm villages. In so doing, they must try to know their farmers well, thereby enjoying the confidence of the farmers, establishing close relations with them and giving realistic assistance to them.

3.5.1.7. Extension workers should be accorded reasonably good treatment. A salary scale should be established for them. They should be fully provided with communication allowances and traveling expenses, and given an opportunity for promotion. In this way, to be an extension worker will be seen as a good lifetime career, giving a stimulus to applicants.

3.5.1.8. Extension workers should be well-trained. They must receive both technical and social training to carry out jobs required of them. Generally, the shorter their academic career, the more frequent in-service training and the longer training course are required.

3.5.1.9. When extension workers teach and train farmers, useful teaching materials must be provided in sufficient quantities. Such materials should be prepared on the basis of agricultural research, and be in simple form and in easy language. This will enable farmers to understand them easily, and thereby farmers will come to utilize them. The materials should be prepared and checked thoroughly by subject-matter specialists to see if they are suitable to farmers before they are published and distributed.

3.5.1.10. In drawing up training and extension programs, local people should be made to participate in it in some way or another so that the programs are assured to be practical. This is because it is local people who actually carry them out.

3.5.1.11. To insure that the training and extension programs are successful and to help solve the problems facing their assigned villages and communities, extension workers must extend genuine assistance to farmers in carrying out the extension program. This is another reason why extension workers, as mentioned earlier, have to reside in their assigned villages.

(2) Basic Training for Agricultural Cooperatives

3.5.2.1. In addition to the technical training as mentioned above, farmers and farm laborers must be provided with fundamental knowledge and information concerning agricultural operation and sales and financial measures. Importance should also be attached to training in routine work

on agricultural cooperatives (before and after joining cooperatives) and the accumulation of studies through experience with joint activities. Studies in this field include study meetings, echange-of-experience meetings and case study meetings held in small groups with local cooperative leaders as chairman.

3.5.2.2. For cooperative leaders, a higher level of practical training is desirable. General managers are required to take overall, strategic action on production, distribution and financial matters. Staff members in various fields are required to have expert knowledge, the ability to analyze information, and personality as an excellent organizer. Training in business, management and organization administration in this field cannot be successful by training in the classroom alone.

CHAPTER VI PHYSICAL DISTRIBUTION

(1) Port for Export

3.6.1.1. In "BASIC PHILOSOPHY," we have premised that the export corridor for the agricultural products under the Development Plan is the Vitória route (para. 1.4.4.). Backgrounds behind the premise of the export corridor of Vitória are: a) advantages offered by the possibility of utilizing the modern railroad belonging to the Companhia Vale do Rio Doce; b) overburden to be imposed on the existing export corridors of Rio de Janeiro and Santos, because of a larger shipment of agricultural products produced in the project area, which are expected to be ever-increasing from a long-term viewpoint; and c) undesirability of further expansion of the Rio de Janeiro and Santos areas, both of which are already congested, in view of regional development plans applicable to both areas. Of the Vitória port complex, the Capuaba wharf under construction is presently able to play a role of the port for export in regard to the Vitória corridor for the agricultural products. In the Capuaba port, the wharf for export grain, loading facilities, silos, railroad sidings, access roads, etc. are now being built.

3.6.1.2. Agricultural products of the project area will be exported through the Vitória port complex. However, this volume would not become much overnight. Instead, the export volume is expected to gradually increase from now on, as agricultural production develops in the project area. Therefore, the above increase in export grain could be met by the step-by-step enlargement of the facilities in the Capuaba wharf.

3.6.1.3. In view of minimizing the port investment amounts, we propose at this stage that the agricultural products for export be handled by the Capuaba wharf. For this purpose, in line with the increase in export cargo, schemes such as for additional silos, additional grain loaders, improved sidings in the port yard, etc. should be reviewed. In addition, along with the increased export cargo such improvements in the highway system in and around the Greater Vitória area as interconnections, underpasses, and bridges, etc. should be given considerations.

3.6.1.4. In determining the port dues and charges for agricultural products for export, their market competitiveness should be emphasized much more than compensation for capital and operation costs.

3.6.1.5. In a longer term, one would have to expect that the Capuaba port will come to be insufficient to meet the scale of demand for its services. A new port would then have to be acquired. Candidates for the new port would be the environs of the Capuaba port, Tubarão, PORTOCEL, and the Praia Mole port. The selection would have to be reviewed from an integrated and long-term viewpoint including: i) permissible draught of vessels in use; ii) area of storage; and iii) possibility of the use of "combination-type vessels" able to jointly load both grain and iron ore. The use of those combination-type vessels is expected to substantially reduce the costs of ocean transportation of agricultural products.

(2) Railroad Routes

3.6.2.1. The export corridor selected under the Develop-

ment Plan consists of the following line sections of railroads:

- i) The line section of CVRD between Vitória and Nova Era, and the line section of RFFSA from Nova Era through Belo Horizonte, Ibiá, and Patrochínio to Anápolis; and
- ii) The line section of CVRD between Vitória and Nova Era, and the line section of RFFSA from Nova Era through Belo Horizonte to Pirapora.

When looking at the status of the above two routes, one finds that the line section between Vitória and Nova Era has already been modernized and has the capacity for high-volume transportation, but that the capacity of line sections belonging to RFFSA has to be gradually improved, as transport demand increases as a result of the implementation of the Development Plan. Fundamental ideas on the improvement are mentioned in the following paragraph.

3.6.2.2. The RFFSA line sections are characterized by sharp curves and steep gradients, together with poor track structure. This causes train speed restrictions and small trainloads. However, it is not advantageous to RFFSA to attempt to immediately eliminate those sharp curves and steep gradients, because of the huge investments which would be required, and which could easily approximate to the cost of building an entirely new line. Agricultural development, by its nature as a process, generates a gradually increasing additional transport demand. Therefore, in an early stage of development when transport demand is small, it would be more economical to enlarge the trainload by lengthening train-crossing tracks at some stations, together with strengthening the track structure (now partly under way). The next step would be to increase the line capacity by installing train-crossing stations, between two consecutive

stations, whose train block section is long, while it is necessary to newly assign train operations personnel at those opened stations. In a further stage of agricultural development when transport demand has further increased, it would be necessary to modernize the train blocking system on those line sections. When transport demand is expected to reach about 10 million tons per year, investments to remove steep gradients and small curves, which are fundamental defects on those line sections, would be justified. We propose that the Federal Government be responsible for the above-mentioned investments, since they are made under the Development Plan, which forms part of the nation's policy. In the meantime there is a scheme of metropolitan railroad passenger transport improvement in Belo Horizonte, with the railroad beltway bypassed, which is desirable.

3.6.2.3. In the Part of this report titled "BASIC PHILOSOPHY," we describe in evaluating the potentiality of agricultural production that there is a compound effect between agricultural production costs and transport costs (para. 1.3.4.). To realize the compound effect, the unit train will have to shuttle back and forth between the origin terminals (silos in the production area) and the port (silos in the port area). It is desirable for a unit train consist to have at least 30 grain wagons of 50-ton capacity each, to attain a merit of scale. Unit train operations make transport costs decrease, resulting in an increased demand for agricultural products. An increase in agricultural production makes, in turn, production costs decrease thanks to the scale merit. Thus, the compound effect of both transport costs and production costs will all the more reinforce the competitiveness in the international market of the region's agricultural exports.

3.6.2.4. At present, we observe that while there are CVRD wagons on the RFFSA line sections, there are also RFFSA wagons on the CVRD line sections. It appears that this fact indicates that there would be no major problem for the unit train to be operated smoothly despite there being two different railroad entities. However, the transport demand of agricultural products is seasonal and the unit train also plays a role in making adjustments between storage requirements in the production area and at the port. Therefore, it is desirable for some organization such as a committee to be established, to maintain unified and coordinated control over the unit train operations. In addition, there is the high probability that the multipurpose agricultural cooperatives proposed in the preceding Chapter (para. 3.4.1.6.) would be the shipper using the unit train. However, there would be some cases where the shipper is other than the multipurpose agricultural cooperatives. In such cases, it is necessary for the agricultural products for export to be efficiently consolidated at the origin terminals, so that the unit train could be operated effectively.

(3) Feeder System

3.6.3.1. However efficient they are, unit train operations have an impact on development only through a limited number of origin terminals on the railroad lines. The importance of the role of roads, for transport of agricultural products from the production area to the points of collection, which include the origin terminals of the unit train, is therefore increased. Those roads consist of: i) highways

(the Federal and State highways), ii) feeder roads (part of the State highways as well as municipal roads); and iii) farm roads. The transport system, whereby the agricultural products are moved from the production areas to the points of collection through the above three kinds of roads, is a "feeder system" in a broad sense.

3.6.3.2. The function of the feeder system is to transport agricultural products smoothly and economically from the production areas to the points of collection. In other words, roads and trucks comprising the feeder system should function so that the total road transport cost may be minimized, given the basic condition of the projected transport demand structure. While truck rates are presently not controlled, they have so far been low because of severe competition among small firms in the truck transport business. However, the spread between rates and costs (i.e., profit) is now getting less because of rising costs. Since there is a sign of modernization in trucking industries themselves, trucking costs (and, accordingly truck rates) will tend to go up. Therefore, it is important to develop the roads of the feeder system, to assure competitive power in the market to the agricultural products.

3.6.3.3. In the project area, the main cities are linked with each other by the Federal and State highways, and the highway network is well developed. However, because of the small number of cities in this region, there remain vast areas of unused land hardly served by the network. Penetration of roads into the unused land should be emphasized to enhance the development potential in the project area. For this reason, the construction of the feeder roads in a narrow sense ("Vicinalis") becomes more important.

3.6.3.4. The level of the development of the feeder road network (the density of municipal roads) in the project area is very low as compared with that of the three southern States. For the feeder road network in the project area to reach the present level of the three southern States, huge investments and a long period of time would be required. Therefore, in working out a construction program for feeder roads, the uniform and standardized planning should be avoided. A careful review is necessary on individual agricultural development schemes on which the feeder road construction in question is based. In this manner, the feeder roads of high priority should be determined.

3.6.3.5. We propose that the Federal/State Government(s) continue and enlarge the financial support for the feeder road development program, with emphasis on such a new frontier as the project area.

3.6.3.6. It is important to shorten the incubation period between road construction and its generation of benefits, to assure efficient utilization of money resources. Therefore, a close linkage of road and agricultural plans, to realize projected benefits much earlier than otherwise, is advocated. To materialize the linkage, one example of steps which may be taken would be that upon request of private institutions or individuals, who intend to undertake agricultural development, the Government agencies review the development plan requested, and assign it priorities for construction only when prescribed conditions are satisfied. The introduction of such a system would be worthy of review. Since there could even be a case where a road construction request is made merely for the purpose of increasing the value of land, some inspection system would

have to be established, to follow up on and keep watch on the progress of the agricultural development. In case the agricultural development does not make progress as planned, some measures would be necessary to make the landowner refund to the public sector benefits he has obtained from the increase in value of his land.

(4) Storage

3.6.4.1. How to store grains produced in the project area should be reviewed not only for the purpose of improving stock adjustments in the market, but also for that of establishing a workable physical distribution system. Therefore, the most suitable site selections and network for storage installations and management should be worked out in line with the most effective total system of transport. As to the location of storage, a widely accepted idea is that it is desirable for as much as possible of the grains to be stored in the production area, if lower costs of storage and higher flexibilities of transport in response to change in destination are required. However, it seems to be more effective for adequate stockpoints or terminal storage installations in the production area to be established in favor of transport by railroads or truck since the production area is extended so widely as the project area. In fact, on the basis of these principles, enlargement of silos, warehouses, storage facilities, and their related installations are now being carried out at various places of importance (including silo construction at terminals for unit train transport system). As a result of a brief analysis, we propose that expansion of storage facilities at terminals in the production area and the consumption area or shipment port be kept in pace with the growth of traffic demand

and changes in transportation mode.

3.6.4.2. Storage at terminals in the production area cannot work well without their surrounding collection-and-delivery network for products. For strengthening the collection-and-delivery network, improvements in distribution- or production-warehouse capacity, establishment of the feeder system (paras. 3.6.3.1. to 3.6.3.3.), rationalization of loading/unloading and storage operations, etc. are required. We observe that construction of distribution-warehouses are being expanded to the extent that each local center will be able to meet local demand. However, there still seem to be unbalanced location of warehouses, in number and in capacity. Sometimes producers are obliged to bear the financial burden of moving their grain a great distance for temporary storage, because there are hardly any storage facilities in their vicinity. In order to resolve such a problem, it is desirable that a further effort be made for enlargement of distribution-warehouses. For rationalization of the loading and storage system, greater emphasis should be placed on their effectiveness in managerial or institutional aspects than that in mechanization of operations.

3.6.4.3. At present, there are many kinds of warehouses in terms of their ownership and function. Federal or State government-owned, and private- or cooperatives-run warehouses are under operation at different levels of function. Some can issue warehouse certificates and store government-purchased grain, while others are not engaged in these businesses. This seems to cause difficulty in forming an effective and integrated storage network. To reduce inconvenience and unreasonable costs stemming from the existing warehousing system, we propose that an orderly

storage system be established.

3.6.4.4. The storage business handling seasonally-fluctuating grain can contribute to a significant reduction in the costs of grain to be exported. Therefore, it is quite true that such business is not suitable for the private sector since low profitability is foreseen due to the nature of the business. We propose that financial resources of public sector be continuously mobilized and be enlarged, if necessary, for securing systematic and effective investment in storage facilities.

(5) Railroad Rates-Making Policy

3.6.5.1. One approach to the railroad rates-making policy, as we suggested in the Part titled "BASIC PHILOSOPHY," is to provide economic rationality to the following two measures for promotion of the Development Plan. The first measure is to improve and strengthen the railroad routes for establishment of the export corridor as described in section (2), "Railroad Routes." The other measure is to set the railroad rates as low as possible to increase price competitiveness of agricultural products in international markets as envisioned in the Development Plan. These two measures are obviously contradictory from the standpoint of the corporate economy of railroad operations. Therefore, a satisfactory solution can hardly be expected if it is left all up to the initiatives of the individual railroad companies. Particularly for the line section of RFFSA, since its tracks are in poor condition and its capacity is sub-standard, large amounts of initial investments in infrastructure will be required for well-planned and efficient transport of agricultural products

in the large volumes that the Development Plan calls for. This requirement, however, from the standpoint of corporate economy of railroad operations, contradicts the policy for low railroad rates for agricultural products for export. Therefore, in order to successfully implement both of these measures at the same time from the initial stages of development, the railroad policy should include financial assistance of the Government.

3.6.5.2. One important consideration in this instance is the form and manner of Government financial assistance. An excessive assistance would not be acceptable domestically as well as internationally because it could invite criticism as an unfair practice in the international competitive markets of agricultural products. This is why the railroad rates policy must have economic rationality. From the above standpoint, our proposed railroad rates policy is based on the following four-part concept.

(1) Since the improvement and strengthening of the railroad routes for establishment of the export corridor forms a basis of the Development Plan which the Government intends to pursue as a national policy, all the required costs should be financed by the Government as in the case of the costs required for construction and improvement of roads and port facilities planned for a development region.

(2) The expenses involved in the transport of agricultural products by means of the completed railroads should be paid for by the rates revenue from such operations. This is based on the similar concept for the trucking industry which profits from utilizing the roads completed by the public funds.

(3) In the initial stages of the Development Plan, the railroad rates should be set at levels as low as possible within a certain range, to cover the expenses added for transport of export agricultural products in the interest of an overall promotion of the Development Plan.

(4) As the Development Plan progresses and the economy of scale in both production and transport of agricultural products begins to be achieved and helps to increase the competitiveness of agricultural products in international markets, railroad rates should be increased in phases accordingly.

3.6.5.3. One feature of the concept for the proposed railroad rates policy is that it considers the transport of agricultural export products as added demand for services of railroad companies. Therefore, it is not regarded as economically irrational that the railroad rates be based on the marginal costs resulting from such added demand. However, the theory of marginal costs involves many problems in its application to actual operations. Even assuming that the scope of production is the same, marginal costs vary depending on levels of operation. Especially in the railroad business where scope of production and level of operations change or develop in stages, it is almost impossible to determine the actual marginal costs. Therefore, we have decided to introduce a unique concept of Avoidable Costs for easy and practical understanding of this problem.

3.6.5.4. Implementation of the proposed railroad rates policy as yet involves some problems in the calculation method of avoidable costs and their incorporation in the rates system. The avoidable costs as we define them refer to such costs as are indispensable for execution of a transport plan for agricultural export products formulated by a railroad company. When individual railroad companies make their plans for transport of agricultural export products in terms of the unit train, they provide for rolling stock, personnel, fuel, oil and other consumable supplies required and prepare a budget accordingly. Such costs are referred to as avoidable costs.

3.6.5.5. This concept of a railroad rates policy does not mean to say that the amount of avoidable costs should be the rates for transport of agricultural export products. As previously pointed out, it will be necessary to keep the railroad rates as low as possible in the initial stages of the Development Plan. What is suggested is, even in such instances, the lower limit of the rates should be no less than the amount of avoidable costs so as to maintain economic rationality. Actual application of this concept in the rates system is discussed in the following, based on Figure III-1:

- i) It is assumed that avoidable costs are proportional to transport distances. In practice, however, avoidable costs are different between RFFSA and CVRD because their respective conditions involved in transport operations are different. But those differences are not assumed in this discussion;

- ii) Such costs as FOB of agricultural products at Port Vitória, port dues and charges, expenses involved with silos at the site of production as well as at the port, and truck costs at origin terminals, are not related to the railroad transport distances; and
- iii) Producers' costs and their necessary surplus is not related in principle to railroad transport distances. In practice, however, they may vary due to differences in productivity among individual production sites. This is where a problem exists for the railroad rates policy relating to the Development Plan.

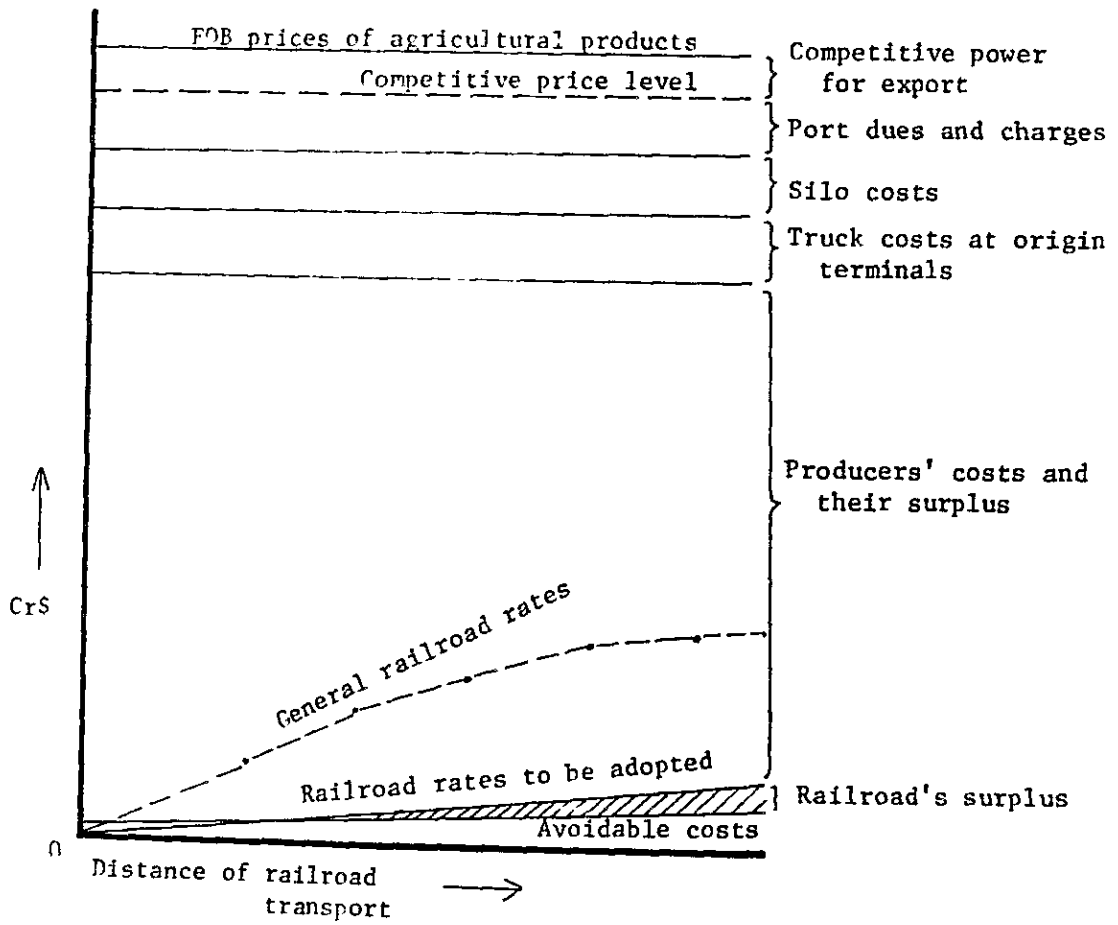
Namely, while productivity in the Triângulo Mineiro is high, the railroad transport distance is long. In other areas, where transport distances are relatively short, productivity is lower. In order to evenly develop the project area as a whole, it should be necessary to see to it that necessary surpluses for producers be equalized by means of the railroad rates policy.

3.6.5.6. As shown in Figure III-1, although tapering-off rates for distance are applied in the current general railroad rates, the railroad rates of products that require a long distance transport by railroad are burdening on producers' costs and their necessary surplus, to the extent that it is working against the expansion of production. In view of this situation, the only resource that the Government can take in policy maneuvering to adjust such differences to promote exports of agricultural products is the railroad rates policy. Therefore, under the given conditions, it should be necessary to provide administrative guidance to hold down the railroad rates as close to the lower limit as possible in consideration of producers' costs and their necessary surpluses. The concept

of avoidable costs as suggested here should provide a guideline for the lower limit of rates in such instances.

3.6.5.7. In the initial stages of the Development Plan, it is anticipated that avoidable costs increase as the economy of scale works in a reverse manner. A transitory phenomenon cannot be helped and in such an instance, the railroad rates should be regulated so as to be held below avoidable costs. In such a case, the Government should be held responsible to pay the railroad companies for the balance of avoidable costs over the rates revenue.

Figure III - 1 Illustrated Railroad
 Rates-Making Policy by the
 Avoidable Cost Concept



CHAPTER VII CONCLUSIONS AND
RECOMMENDATIONS

3.7.1. In the Part titled "BASIC PHILOSOPHY", we have emphasized that the Development Plan should be grasped as part of the nation's policy. Further, to strongly guide this basic development policy of the nation, we have introduced the concept of the "Grand Axis".

3.7.2. On the basis of the concept of the "Grand Axis", we have premised that from an integrated and long-term point of view, the export corridor for the agricultural products under the Development Plan is the Vitória route.

3.7.3. We have identified the three kinds of crops -- soybeans (the most promising), maize, and sorghum -- which are promising crops and are to be developed under the Development Plan. The identification has been made on the basis of the review on: i) export market potential; ii) land productivity; and iii) agro-technical feasibility. Among the three crops, maize and sorghum are substitutive for each other in production. Since the Development Plan is export-oriented, we have put emphasis on soybeans, which have the highest export-market potential, in carrying out the Study.

3.7.4. On the basis of the above, after a careful review on various issues, we have made policy proposals in the preceding Chapters of this Part. Almost all proposals contain references to either infrastructure investments or policy-based intervention by the Federal/State

Government(s), whose role is important, indeed. At the same time, it is a matter of course that parties concerned (related institutions, organizations, and individuals) also play an important role. Between the role of the Federal/State Government(s) and that of the parties concerned, there should be a closer relationship supported by the spirit of collaboration.

3.7.5. Among the policy proposals, there are two proposals, whose nature is of the short term. The first one refers to formulating the railroad rates-making policy regarding the agricultural products transported for export from the project area. Thanks to: i) infrastructure investments to be made *pari passu* by the Federal Government concerning railroads and ports; and ii) effective operations of collective joint transport of the agricultural products to be carried out by the unit train, the above-mentioned policy formulation on railroad rates-making makes physical distribution costs of the agricultural products decrease, and thereby increase their competitiveness in the international market.

3.7.6. The second proposal in the short term is the test of agricultural farm management. Instead of trying to exploit all at once the project area from scratch, carrying out the test of a limited number of farm management is needed to obtain relevant basic data, through trial and error, for eventually establishing a harmonious and compatible policy by the Federal/State Government(s) in promoting the Development Plan. Farmers should fully understand the objectives of the test and the Government(s) should provide the farmers with intensive assistance. In the medium term, the farm management of proven capacity should be enlarged in number and established in depth. This process is indispensable for the

farm management to be built up firmly. In the process of the test, enlargement, and establishment of the farm management, priority should be given to the following two points. The first one is securing agricultural extension workers in both quality and quantity; the second, creating conditions, under which agricultural products are sold jointly, in the interests of the farm management in group. The joint sale will be made by strengthening marketing activities, which is one of the most important functions of multipurpose agricultural cooperatives. Improvement of production technology by extension workers makes possible agricultural products of high grade and at low costs. Improvement of the marketing system results in lowering marketing costs for agricultural products and thereby increasing international competitiveness. Further, such investment as that for production warehouses, distribution warehouses, silos, feeder roads, etc. should have a great impact on the test, enlargement, and establishment of the farm management. In the meantime, rough estimates on the above investment amount including that for railroads and ports, as referred to in the preceding paragraph, are shown in Table III-1. Details are given in Appendix II.

3.7.7. As mentioned in the preceding two paragraphs, the formulation of the railroad rates-making policy and the test of the farm management are our policy proposals in the short term. However, to promote extensively the development in the long term, thorough consideration should be given to the bringing-up of the driving force. We have therefore proposed that: i) the breeding of varieties including the "production system" be strengthened, ii) the taxation system be reviewed and improved, to enlarge land utilization, iii) the setting-up of agricultural society

be fostered, iv) multipurpose agricultural cooperatives be established, v) the institutional credit system be strengthened, and vi) the training be intensified. Those proposals play a role of the sun in an old fable, "the sun and the north wind," and should be carried out with the support of a national consensus.

Table III - 1 Investment Required to Equip the Infrastructure of the Vitória Export Corridor

Description	1979-1985 (Cr\$ million)	1986-1990 (Cr\$ million)	Total (Cr\$ million)	Remarks
Railroads	500	3,000	3,500	Excluding rolling stock
Roads	7,130	8,070	15,200	Feeder roads in the production area
Ports	30	170	200	Capuaba Wharf only
Silos	590	1,730	2,320	Silos at terminals in the production area
Warehouses	2,000	3,340	5,340	Grain storage facilities in the production area
Total	10,250	16,310	26,560	

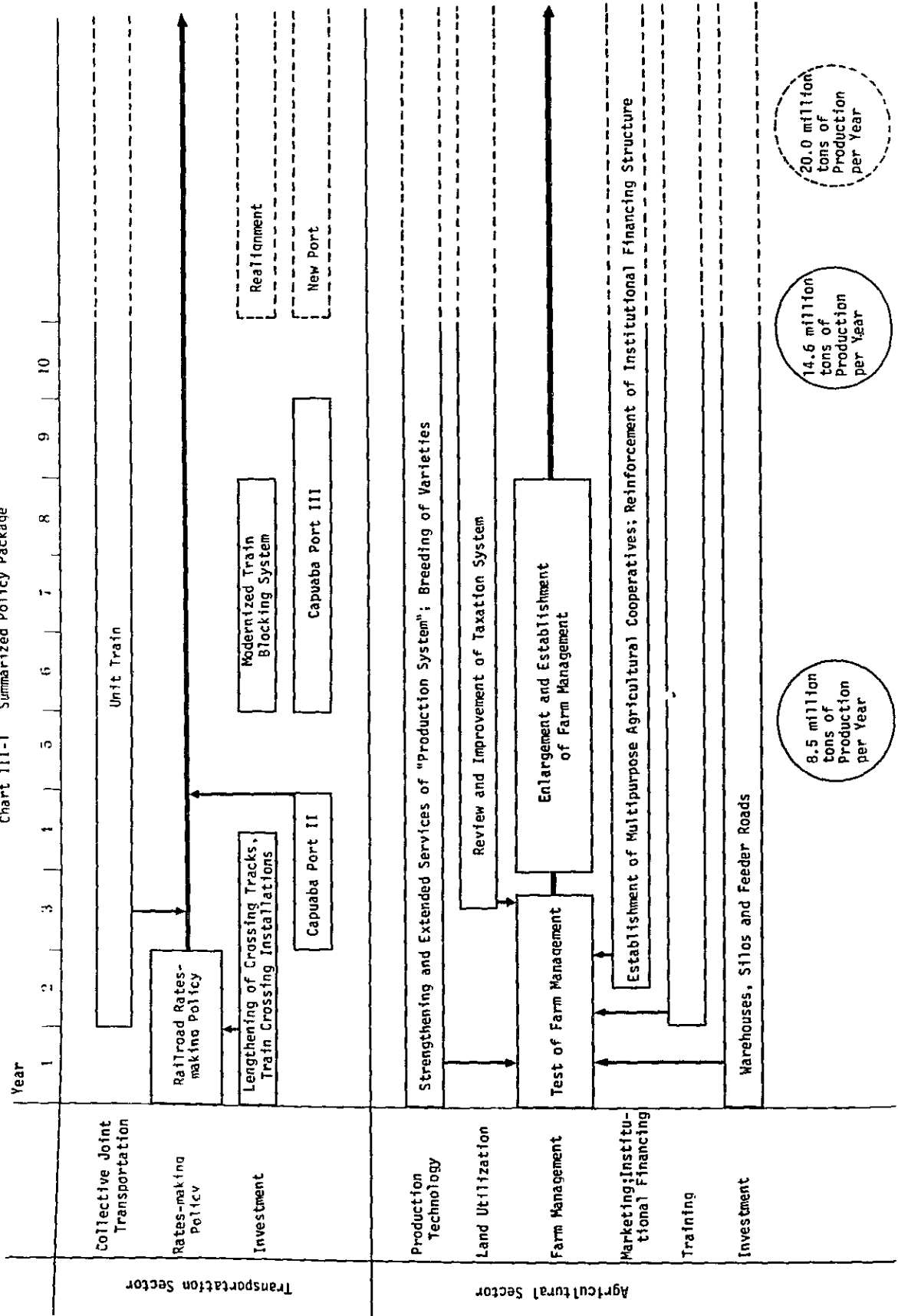
(Based on mid-1978 constant prices:
Exchange rate US\$1 = Cr\$20)

3.7.8. The above policy proposals are closely related to each other and have a specific time sequence. In other words, the policy proposals should be recognized as a policy package, which should define the relationship among individual proposals, and which should indicate priorities and time phasing. Chart III-1 gives a summarized policy package, which constitutes our recommendations.

3.7.9. A brief explanation on lines and shapes appearing in Chart III-1 is given below:

- i) The railroad rates-making policy in the short term and the farm management in the short and medium terms appear in the middle of the Chart as solid-line square blocks;
- ii) Two bold solid lines extend horizontally from those square blocks to the right of the Chart beyond Year-10, indicating implementation;
- iii) Two solid-line circles appearing in the bottom of the Chart indicate annual production volumes in the project area at the ends of Year-5 and Year-10; we have regarded the annual production volume in the Year-10 (about 14.6 million tons) as the development goal to be attained in around 1990;
- iv) A broken-line circle appearing in the bottom to the right of the Chart indicates an annual production volume in the project area at the end of some years beyond Year-10; and
- v) Vertical lines with arrow (bold solid-lines) indicate action (impact/support).

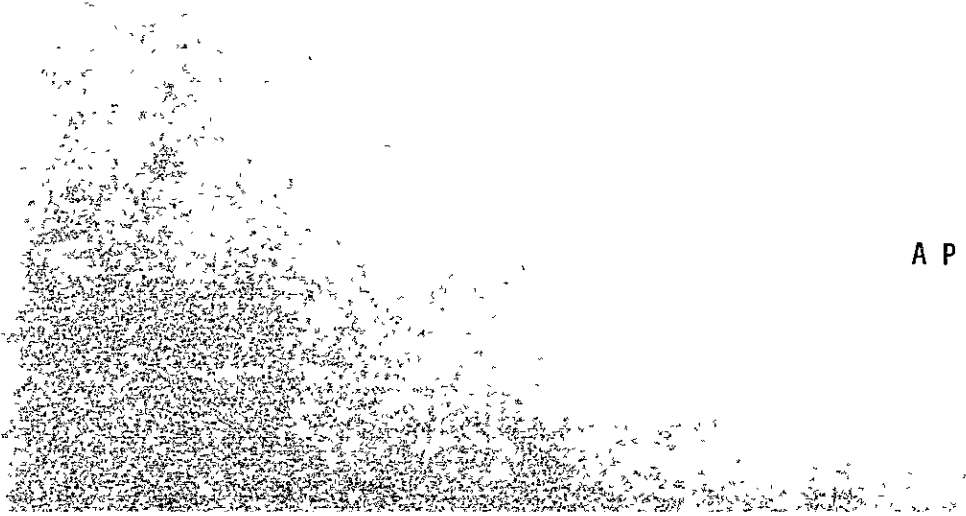
Chart III-1 Summarized Policy Package



20.0 million tons of Production per Year

14.6 million tons of Production per Year

8.5 million tons of Production per Year



A P P E N D I X

APPENDIX I REVIEW OF THE PRODUCTION VOLUME
GOAL OF AGRICULTURAL PRODUCTS
IN THE PROJECT AREA

CHAPTER I OBJECTIVES AND RESULTS OBTAINED

1.1. This Appendix aims at: i) reviewing an annual production volume of agricultural products in the project area, ii) envisaging the goal of development under the Development Plan, and thereby iii) facilitating other study work to be done by us.

1.2. Originally, this Development Plan would be, in its nature, of an extremely long time span. In this Study, however, we have chosen the year of around 1990 as the year when the goal of development is reached. In addition, we have reviewed the annual production volume in 1985, only for the sake of reference.

1.3. We have identified three crops -- soybeans, maize, and sorghum -- as suitable crops in the project area. The identification has been made on the basis of the reviews on: i) export market potential, ii) land productivity, and iii) agro-technical feasibility. The first two items are dealt with later in this Appendix; the last one, in the main text (Part III, Chapter I). Then, we have envisaged the goal of development in 1990, mainly as a result of the outlook on the international market concerning supply and demand. The results are shown in Table App. I-1.

Table App. I - 1 Goals of Development for Soybeans,
Maize, and Sorghum (1990)

Product Area		Goal of Cultivated Area (10,000 ha)	Goal of Annual Production (10,000 tons)	
A	Southern Goiás State	373	817	
	North-western Minas Gerais State	A ₁	100	211
		A ₂	108	228
		Subtotal	581	1,256
B	North-western Minas Gerais State	B ₁	49	104
		B ₂	45	96
		Subtotal	94	200
Total		675	1,456	

Remarks: i) A₁ and A₂ constitute Triângulo Mineiro;
B₁ and B₂, the region of upper waters of the
São Francisco river.

ii) A₁, A₂, B₁, and B₂ are defined in Appendix I,
para. 4.2.

1.4. According to the review on supply and demand in the international soybean market in 1990 (Appendix I, para. 3.1.8.), there would be supply shortage of about 15 million tons, or of about 20

million tons including a further 5 million tons. Of the annual production volume of about 14.6 million tons appearing in Table App. I-1 above, how many tonnages of the agricultural products are to be exported depends on their international competitiveness. Policy proposals presented in the main text of the Report (Part III) deal with the directions to be followed, in which various measures should be formulated by the authorities in strengthening the international competitiveness.

1.5. In working out Table App. I-1 above, possibility of the production volumes in the individual areas should have also been reviewed. However, since definitive production data in the project area are not made available at this stage, we have carried out our study work on the basis of bold assumptions, with the data in the past of the southern States in Brazil taken into account. The goal of the cultivated area of about 6.8 million ha accounts for about 14% of a total of the project area. This means an annual increase of 0.3 - 0.4 million ha in the cultivated area. In view of the increase rate of cultivated areas, which were seen in the southern States in the first half of the 1970's, we do not believe that the above goal of the cultivated area is over-estimated.

CHAPTER II IDENTIFICATION OF CROPS
IN THE PROJECT AREA

2.1. In the project area, a fairly wide variety of agricultural products can be produced. But there are not many that can be supplied to the market as economic goods or merchandise. The types of crops mentioned in the Scope of Work have been compared and evaluated objectively on the basis of the following criteria: (1) marketability - possibility of increase demand, and (2) productivity - land suitability and productivity. At the same time, from the business standpoint of farmers, the following factors have been considered: (1) stability, (2) salability, (3) unit price levels (or added value rates). In addition, interviews have been conducted with farmers in the project area in an effort to identify promising crops for the area.

2.2. The results of the above studies are summarized in Table App. I-2. Judging from the sizes of domestic and international demand and possibilities of supply shortages, soybeans, wheat, maize and sorghum are considered promising. As for soybeans, producing areas are limited to certain regions of certain countries and, therefore, the demand situation can be expected to be tight at home and abroad, while maize and sorghum are already in a tight situation at home and a large market can be expected to meet the growing domestic demand.

2.3. Next, in the following, the crops are studied in terms of international competitive power based on crop productivity and

Table App. I - 2 Comparison of Agricultural Products in the Project Area

Objective Criteria for Comparison		Subjective Criteria from Farmers Standpoint			
International Competitive Power Land Productivity	International Demand Supply-Demand Gap	Domestic Demand Supply- Demand Gap	Price Stability (existence of built-in stabili- zizer such as Government purchase)	Added Value (payable for transport costs)	Merchandising (existence of difficulty in quality control, sales routes, etc.)
Soybean	⊙	⊙	⊙	⊙	⊙
Wheat	▲	⊙	⊙	⊙	⊙
Rice	⊙	⊙	⊙	▲	⊙
Maize	▲	⊙	⊙	▲	⊙
Sorghum	▲	⊙	⊙	▲	⊙
Meat	⊙	⊙	⊙	⊙	▲
Cotton	⊙	⊙	▲	⊙	⊙
Coffee	⊙	⊙	▲	⊙	⊙
Orange	⊙	⊙	▲	⊙	▲
Tobacco	⊙	▲	⊙	⊙	▲
Tapioca chips	⊙	⊙	⊙	▲	⊙
Pulp chips	⊙	⊙	⊙	⊙	⊙

Remarks: ⊙ Best, promising
 ⊙ Superior (in relative terms), promising
 ▲ Inferior (in relative terms)

land productivity. International competitiveness is not determined by a single factor of yields alone but by comparative input-output balances. To put it simply, it is the balance of the input capital, labor and land on one hand and the output on the other. Assuming that capital is transferable, and labor is minor element in a large scale and highly mechanized agriculture, then, a basic factor that determines competitiveness and comparative superiorities of productive conditions is theoretically land productivity. This factor may not be constant, but can be altered by soil improvement and development of suitable varieties but it would take a long time. Therefore, judging from the land productivity in the present technological circumstances, soybeans and coffee have international competitive power as agricultural products for the project area, while wheat, maize and sorghum are less competitive.

2.4. On the other hand, from the business standpoint of farmers, wheat, rice, soybeans and maize, in that order, are better selections in terms of price stability, while coffee and oranges are subject to a wider range of price fluctuation. From the merchandising standpoint of salability and quality control, wheat and rice are relatively easy crops. With respect to absolute levels of added value and prices, which are important factors when transport costs are considered, soybeans and coffee are superior to be followed by wheat, while rice, maize and sorghum are inferior.

2.5. From both macro and micro standpoints as seen in the above, production of dry land rice will continue at a constant level with a possible expansion in the project area when its soil conditions

are considered, while double cropping production of soybeans and wheat as well as single cropping soybeans together with coffee will grow significantly as cash crops considering their export markets. On the other hand, rice, maize and sorghum can be considered promising mainly for the regional and nation-wide markets.

1

CHAPTER III INTERNATIONAL MARKET PROSPECTS

(1) Soybeans

3.1.1. As is already known, the soybean demand is influenced by the demand for edible vegetable oils, particularly soybean oil, and for soybean cake for feeds. Edible vegetable oils materials include peanuts, cottonseeds and many others in addition to soybeans. But the demand for soybean oil is rapidly growing. The demand for edible vegetable oil as a whole increased at an annual rate of 5.3% for 1962-1974, while the growth of demand for soybean oil for the same period was 6.6% at an annual rate. For feeds, there are other alternative sources of protein like fish meal, and demand volumes fluctuate, but soybean cake accounts for 50-60% of the total of oil cake and meal feeds, and its share has been growing steadily. As a result, the soybean production for the same period increased at an annual rate of 5.8%.

3.1.2. The supply and demand of soybeans is almost totally dependent on that of the USA which produces 60% of the world's total soybean production and consumes 40-50% of the total world-wide supply. As a consumption market, the USA is followed by EC (Western Europe), China and Asia. As producing countries, China and Brazil are the only other major producers except for the USA. In terms of land productivity, the USA has an yield of 1.5-1.9 tons/ha (variable yearly), Canada 1.6-2.3 tons/ha and South American countries have relatively high productivity but those of Asian countries are generally as low as less than 1 ton/ha (See Table App. I-3.).

Table App. I - 3 Soybeans Production and Comparison of Yields

Country	1974 Production Volume (1,000 tons)	1964-1974 Yield Range (Kg/ha)
World Total	56,803	1,104 - 1,408
USA	33,569	1,531 - 1,870
Canada	180	1,601 - 2,287
Argentina	334	1,032 - 1,732
Mexico	245	1,600 - 2,109
China	11,860	787 - 827
Indonesia	550	620 - 786
Japan	135	1,106 - 1,534
Korea	260	570 - 610
Thailand	115	910 - 1,133

Source: FAO Production Yearbook

3.1.3. Judging from the situation as seen in the above and considering the balance of population and food supply, increasing efforts are expected to be made for more production of other basic foods than soybeans in Asian countries. For a future outlook, the following should be considered as key factors which influence world-wide market conditions: (1) trends of production in the USA; (2) prospect of consumption in Europe; and (3) supply-demand movements in China. As minor factors, (1) the demand situation in Asia including Japan, and (2) supply prospects in Canada and South American countries, should be considered.

3.1.4. The world-wide demand except that of Brazil grew 5.5% for 1965-70 and 2.1% for 1970-75, both at an annual rate. For 1970-77, when the demand was affected by the after-effects of the oil crisis, the annual growth rate was 4.0%. Although demands in advanced countries are expected to reach a saturation level in the near future, demands in semi-advanced countries, China and other communist countries will increase and a 4% annual growth rate can be reasonably assumed for the future world-wide demand.

3.1.5. U.S. production increased at an annual rate of about 6% in the latter half of the 1960's and in the 1970's. Unless there will be a breakthrough increase in yields, the planted areas are least likely to expand due to limited marginal cost effectiveness, and, thus, the production growth will remain 4% at an annual rate. In Western Europe, soybean production is negligible and amounts of imported soybeans in grain or in cake should be no greater than the level of total demand.

The demand for soybean oil is expected to continuously increase by about 5% in the future. Demand for soybean cakes are mostly for feed and can be met by imports. All in all, the demand for soybean grains will increase by about 5%.

3.1.6. China is a moot area. In the past, China's soybean production has been constant at a level of 13 to 15 million tons. From the standpoint of China's self-reliance policy, demand has been adjusted to meet the production. In the future, however, as their policy orientation will shift to high rate growth and also as a result of population increases, the demand is likely to steadily increase. The demand growth will be about 3% per year or slightly below the world's average, for the time being. As long as their efforts for self-sufficiency continue, significant increases in Chinese production can be expected. But, as seen before, in view of their inferior land productivity, manpower and financial resources may well be diverted and invested intensively in other higher priority sectors such as manufacturing industry in the course of major agricultural and trade policy changes. In that eventuality, there is a strong possibility that China can become an importing country to a significant extent. Soybean demands in the USSR and East European countries will steadily increase. They import more soybean cake as feed than soybean grains and this situation is expected to continue in the future. Therefore, as far as soybean grains are concerned, demand volumes on the international market will not be so large.

3.1.7. The soybean demand in Japan is 3-4 million tons and it appears to have leveled off for now. Due to increasing consumption of soybean oil and meat as a result of changes including rises in the standard of living, the demand for soybean cake has been increasing thus maintaining the demand for imports of soybeans at a relatively high level. But such imports will be increasingly replaced by imports of processed foods like meat in the future and, furthermore, per capita consumption cannot be expected to increase as much as in the past. Therefore, the growth of the demand for soybean grains will be 1-2% per year. On the other hand, there are rapidly developing countries in Asia like the Republic of China and Korea where a rapid growth of the demand for soybeans as seen in Japan in the past years can be expected. But in view of the differences in the sizes of population and the supply-demand mechanisms for oils and feed, even when the import demands start rising in such countries in the future, they will stop short of 1 million tons. As supply countries, Canada and Argentina can be mentioned among others as having large supply potential. Both countries, however, have other agricultural products than soybeans that are superior on the international market and, therefore, they have no reason to emphasize soybeans from the standpoint of optimum distribution of resources. In this context, their production will expand only at moderate rates according to change in international demand.

3.1.8. From the prospects as seen above, the world's supply and demand of soybeans are envisaged for 1985 and 1990 on the basis of the 1975 records in Table App. I-4. The Table indicates that supply shortages of about 9 million tons in 1985 and 15 million tons in

Table App. I - 4 Outlooks for World Supply-Demand of Soybeans Excepting Brazil

	1970 (actual) (1,000 tons)	1975 (actual) (1,000 tons)	1977 (partly estimated) (1,000 tons)	Growth rate (%)		1985 (estimated) (1,000 tons)	Growth rate (%) '77-'85	1990 (estimated) (1,000 tons)	Growth rate (%) '85-'90
				'70-'75	'70-'77				
A. World Demand	44,970	50,817	68,840	2.5	6.3	94,200	4.0	114,600	4.0
USA	21,800	22,300	30,330	0.5	4.8	40,100	3.2	46,500	3.0
Western Europe	5,610	10,500	11,580	13.4	12.9	17,100	5.0	21,800	5.0
China	11,645	11,860	14,830	0.4	3.5	18,800	3.0	21,800	3.0
Japan	3,281	3,334	3,600	0.3	1.3	4,500	3.0	5,100	2.5
Others	2,634	2,823	8,000	1.4	14.9	13,700	7.0	19,400	7.2
B. World Supply	42,451	46,851	65,700	2.0	5.0	85,500	3.4	100,200	3.2
USA	30,839	33,062	46,700	1.4	5.1	62,000	3.6	74,000	3.6
China	9,200	9,750	14,000	1.2	6.2	17,000	2.5	18,700	2.0
Others	2,412	4,039	5,000	10.9	10.9	6,500	3.5	7,500	3.0
Supply-Demand Gap (A - B)	2,519	2,966	3,640			8,700		14,400	

1990 will occur in the international market and they will have to be supplemented by Brazil and, if need be, Argentina and Canada. Furthermore, if China's production falls far below the domestic demand level, there will be a need for additional supply on the order of several million tons.

(2) Maize

3.2.1. Coarse grain crops for feed include ryes, barley, oats, maize and sorghum and those can substitute each other as feed to some extent. They are selectively grown in various parts of the world. Maize among others is a leading crop as such, accounting for almost 50% of the world's total coarse grain crop production. Major maize producing countries are as shown in Table App. I-5 with the USA producing 40% of the total, followed by China. Compared to soybeans, maize producing areas are located more widely around the world. Since the unit prices of maize are low and there are many substitute crops, generally needs for maize are met locally in the respective regions except for the USA which is the largest producer with exceedingly high rates of yields. Supply shortages in Western Europe, the USSR and East Europe are offset by supply surpluses of the USA. Regional supply-demand balances are as shown in Table App. I-6. The world's demand and production for 1970-75 registered a growth of around 4.5% per year each. Supply shortages due mainly to feed crop shortages in the USSR and East Europe led to expanded production in the USA and other producing countries resulting in supply increases in the 1970's. For 1965-75, both demand and production increased about 3.5% per year. For a future outlook on

Table App. I - 5 Maize Production and Comparison of Yields

	1974 Production Volume (1,000 tons)	1972-1974 Average Yield (Kg/ha)
World Total	292,990	2,696
USA	118,144	5,432
Canada	2,589	4,762
Mexico	7,784	1,147
Brazil	16,065	1,390
Argentina	9,900	2,450
China	31,085	2,837
Thailand	2,400	1,935
India	5,300	981
Indonesia	2,760	966
Philippines	2,289	814
Europe	44,069	3,722
USSR	12,142	2,933
South Africa	11,035	1,513

Source: FAO Production Yearbook

Table App. I - 6 Supply and Demand of Maize by World Region

Unit: 1,000 tons

	1970			1975			1970-75 (annual rate %)		
	Production	Apparent Demand	Balance	Production	Apparent Demand	Balance	Production Increase Rate	Demand Increase Rate	
North America	108,100	94,240	13,860	150,110	116,910	33,200	6.8	4.4	
Western Europe	23,420	37,010	-13,590	27,490	47,090	-19,600	3.2	4.9	
East Europe, USSR	23,180	23,120	60	27,370	35,470	-8,100	3.4	9.0	
Central & South America	38,160	32,800	5,360	39,440	38,340	1,100	0.7	3.2	
China	30,970	31,580	-610	35,430	36,660	-1,230	2.7	3.0	
Asia	16,240	15,370	870	16,100	14,920	1,180	-	-	
Africa	10,700	10,430	270	13,630	13,430	200	5.0	5.2	
Middle & Near East	4,210	4,460	-250	4,920	5,650	-730	3.1	4.8	
World	261,690	261,340	324,380	324,380	325,000	4.4	4.4	4.5	

Source: FAO The State of Food and Agriculture

Notes: Asia does not include Japan.
Africa does not include South Africa.

supply-demand movements, although there are uncertain factors that concern substitute crops of maize as feeds, it can be assumed that maize will continue to be a major feed crop. Then, the USA with its overwhelmingly superior position in maize production is expected to continue to expand production while in other regions also, continuous efforts will be made to meet growing local demand. On the other hand, unless there will be a breakthrough in agricultural technology innovation such as through improvement of varieties, there is no reason to expect a particularly large increase in production and, therefore, there will be little change in the present structure of the international supply-demand markets of maize.

3.2.2. Riding the tide of improved nutrition and promotion of the livestock industry, feed demand has kept growing. However, the growth of demand in advanced countries will become stagnant while demand in the USSR, East Europe and China will continue to increase to tighten their already taut supply conditions, resulting in widening supply-demand gaps. Maize is not a favorable crop in many countries of Asia and Africa in view of land productivity. Therefore, their efforts for food production to meet the growing needs of increasing populations will be directed toward more desirable crops like rice. As a result, the supply-demand situation of maize in those countries will move in such a manner that while demand is adjusted, production will be increased as much as necessary. Therefore, there will be little increase both in supply and demand. World-wide, both supply and demand of maize will grow at an annual rate of about 3% and demand increases in the USSR and East Europe and China will be met by the USA and Canada and partly by Central and South American countries. Therefore, as far as maize is concerned in this international

Table App. I - 7 Outlooks for Maize Production and Demand

	1985		1990		1975-85		1985-90		Increase Rate (%)
	Production (1,000 tons)	Demand (1,000 tons)	Production (1,000 tons)	Demand (1,000 tons)	Production (%)	Demand (%)	Production (%)	Demand (%)	
North America	212,000	150,000	246,000	166,000	3.5	2.5	3.0	2.0	2.0
Western Europe	33,000	63,000	35,000	71,000	2.0	3.0	1.5	2.5	2.5
East Europe, USSR	33,000	52,000	35,000	60,000	2.0	4.0	1.5	3.0	3.0
Central & South America	53,000	56,000	60,000	66,000	3.0	4.0	2.5	3.5	3.5
China	43,000	49,000	46,000	57,000	2.0	3.0	1.5	3.0	3.0
Asia	22,000	20,000	24,000	23,000	3.0	3.0	2.0	3.0	3.0
Africa	19,000	20,000	22,000	23,000	4.0	4.0	3.0	3.0	3.0
Middle & Near East	6,000	8,000	7,000	9,000	3.0	3.0	3.0	3.0	3.0
World	435,000	437,000	492,000	494,000	3.0	3.0	2.5	2.5	2.5

context, Brazil should see to it that production be increased aiming at, first, meeting the domestic demand and, then, meeting the demand of other Central and South American countries. (See Table App. I-7.)

CHAPTER IV DEVELOPMENT GOALS IN THE PROJECT AREA

4.1. The project area has high potential for crop production compared with other regions in Minas Gerais and Goiás. In the State of Goiás, rice production and cattle raising activities have been gradually moving to the northern region, and in the southern part of the State, which was developed relatively earlier, planted areas are expected to increase with emphasis on maize and soybean production. On the other hand, agricultural development in the project area of Minas Gerais State is lagging behind compared with other parts of the State and as such there is much room left for future development. In addition, since the area has extensive plains, large-scale crop production by mechanized farming can be expected.

4.2. It is considered most reasonable to divide the project area, Minas Gerais in particular, into the following zones in terms of distribution channels and such infrastructure as railroads, roads, etc.:

i) State of Minas Gerais:

Zone A₁ (Administrative Districts: Alto Paranaíba, Araxá, Mata de Corda, Alto São Francisco)

Zone B₁ (Sete Lagoas, Três Marias, Médio Rio das Velhas, Alto Médio São Francisco, Montes Claros)

Zone A₂ (Uberlândia, Uberaba, Pontal)

Zone B₂ (Chapadão de Paracatu)

ii) State of Goiás: Whole project area included in State of Goiás.

Therefore, it can be said that the project area comprises A area (Zones A₁ and A₂ plus the southern part of State of Goiás identified as ii) above) and B area. In addition, Zones A₁ and A₂ constitute the Triângulo Mineiro. Zones B₁ and B₂ indicate the region of upper waters of the São Francisco river.

4.3. The present manner in which soybean oil and mixed feeds to be consumed in the project area are produced in and shipped from the State of São Paulo will be greatly changed as agroindustry in the project area develops in the future. Outlooks for 1985 and 1990 are based on the assumption that the regional demand is in principle met by local production.

4.4. In crop production, rice, maize and soybeans are alternatives to choose from. Therefore, if it is assumed that rice production is made in the respective areas at a level to meet the local needs, rice production in the State of Goiás will increase at an annual rate of 2% taking population growth in Brazilia into account. If the yield is 1 ton/ha, additional planting area of 780,000 ha in Goiás and 200,000 ha in Minas Gerais will be required in 1990. In the State of Goiás, rice producing areas will be shifted to the northern parts of the State. In the case of the State of Minas Gerais, since the amount is small, there should be no problem in finding additional space for development. Therefore, major considerations are soybean, maize and sorghum production and their planting areas. Assuming the yields of 1.8 tons/ha for soybeans and 2.5 tons/ha for maize/sorghum, the cultivated areas and

annual production volumes for 1985 and 1990 are roughly calculated as follows (see Table App. I-8). The cultivated area and annual production volume obtained for 1990 have been assumed as the goals of the Development Plan.

Table App. I - 8 Cultivated Area and Annual Production
in the Project Area

Product area		1985		1990		
		Cultivated Area (10,000 ha)	Annual Production (10,000 tons)	Goal of Cultivated Area (10,000 ha)	Goal of Annual Production (10,000 tons)	
A	Southern Goiás State	188	428	373	817	
	North-western Minas Gerais State	A ₁	65	138	100	211
		A ₂	71	151	108	228
		Subtotal	324	717	581	1,256
B	North-western Minas Gerais State	B ₁	32	69	49	104
		B ₂	30	64	45	96
	Subtotal	62	133	94	200	
Total		386	850	675	1,456	

Remarks: i) A₁ and A₂ constitute Triângulo Mineiro; B₁ and B₂, the region of upper waters of the São Francisco river.

ii) A₁, A₂, B₁, and B₂ are defined in Appendix I, para. 4.2.

Table App. I-8 above shows that the goal of the cultivated area in 1990 is about 6.8 million ha, which account for about 14% of a total of the project area of about 500,000 Km². This means that the cultivated area in the project area has to be increased at an annual increase rate of 0.3~0.4 million ha. We do not believe, however, that the increase rate has been overestimated. In fact, the annual increase rate experienced in the southern States in the first half of the 1970's was 0.28 million ha in Parana State, 0.42 million ha in São Paulo State, and 0.45 million ha in Rio Grande do Sul State.

4.5. It is assumed that the needs within the State of Goiás are met by production within the State, and Uberlândia is supplied mainly by Zone A₁, and Belo Horizonte by Zones B₁ and B₂. On the other hand, outgoing shipments from Zones A₁ and A₂ are routed to São Paulo as seen fit presently. But, if the marketing system is better organized and transport routes improved accordingly, there is a possibility to route them via the Vitória Transport Corridor.

APPENDIX II ROUGH ESTIMATES ON THE INVESTMENT
AMOUNT OF INFRASTRUCTURE FOR
RAILROADS, ROADS, PORTS, SILOS,
AND WAREHOUSES IN THE PROJECT AREA

CHAPTER I OBJECTIVES AND RESULTS OBTAINED

1.1. This Appendix aims at: i) making rough estimates on the investment amount of infrastructure for railroads, roads, ports, silos (excluding port-head silos), and warehouses (production- and distribution-warehouses) in the project area; and ii) facilitating other study work to be done by us.

1.2. The Development Plan would be, in its nature, of an extremely long time span, but within our Study we have stated the goals to be reached within a shorter term, restricting our outlook to the time horizon of around 1990. Therefore, our estimates cover investment for about 10 years from now on, excluding that for the years beyond 1990. Further, we have divided the coming 10 years into the first half (1979-1985) and the second half (1986-1990). The reason for this is: i) that since agricultural products gradually increase as development makes progress, infrastructure investment can be made in accordance with the agricultural development; ii) that most of investment items have their characteristics that the investment can be made step by step, and, therefore, iii) that we find it appropriate to divide the coming 10 years into two periods, first half and second half.

1.3. At this stage when many uncertainties are still involved, it has been unavoidable for us to make many bold assumptions in estimating the investment amount. Therefore, a more attention should be paid to underlying assumptions and interpretation of the results obtained, rather than the absolute value of the investment amount. For

instance, in the case of railroad investment, we have made its rough estimates on the assumption that RFFSA is to be given an additional transport capacity of about four million tons of agricultural products on the line section from Ibiá to Belo Horizonte. This is, however, only tentative.

1.4. Further, we have made rough estimates in this Appendix on the assumption that the investment amount should be minimized. For example, in the case of port investment, we have premised that the Capuaba wharf is to be utilized. When considering the future use of a large-type ocean going vessel, the investment amount required for ports will increase to some extent from the amount appearing in Table II-1 below.

1.5. All investment items, except production-warehouses, have been estimated on the assumption that 100% of the calculated investment amount is regarded as public (As for production-warehouses, see Appendix II, para. 5.2.1.).

1.6. Price calculation has been based on the constant price in mid-1978. Therefore, neither an inflationary factor nor interest has been taken into account.

1.7. Rough estimates on the investment amount of infrastructure for railroads, roads, ports, silos (except for port silos), and warehouses in the project area are shown in Table App. II-1 below.

Table App. II - 1 Investment Required to Equip the
Infrastructure of the Vitória Export Corridor*

Description	1979 - 1985 (Million Cr\$)	1986 - 1990 (Million Cr\$)	Total (Million Cr\$)	Remarks
Railroads	500	3,000	3,500	Excluding rolling stock
Roads	7,130	8,070	15,200	Feeder roads in the production area
Ports**	30	170	200	Capuaba Wharf only
Silos	590	1,730	2,320	Silos at terminals in the production area
Warehouses	2,000	3,340	5,340	Grain storage facilities in the production area
Total	10,250	16,310	26,560	

(Based on mid-1978 constant prices; Exchange rate US\$1 = Cr\$20)

Remarks: * Amount figures are rounded up.
** Excluding sunk costs.

CHAPTER II RAILROADS

(1) Underlying Assumption

2.1.1. Railroad routes consist of A and B Routes, as defined in the Text (Part I, para. 1.4.4). However, A Route includes Goiânia, Araguari, Uberlândia, Uberaba, and Araxá. A Route covers 1,819 Km, originating from Anápolis; B Route, 1,133 Km. Since most of both routes belong to RFFSA, and since RFFSA lags behind other railroads in Brazil in terms of infrastructure improvement, rough estimates made in this Chapter are limited to those for RFFSA.

2.1.2. The next step is to envisage the number of trains in 1985 and 1990, which has been assumed on the basis of the following considerations:

- i) Actual number of trains, passengers and freight at present;
- ii) Agricultural products traffic to be developed under the Development Plan;
- iii) Increase in oil-products traffic between Embiruçu - Brasília/ Goiânia;
- iv) Increase in phosphate-ore traffic from Araxá toward State of São Paulo via Uberaba;
- v) Traffic increase in cement as well as limestone for steel mills in the Sete Lagoas area;
- vi) Traffic increase in iron- and steel-products between Costa Lacerda and Ipatinga; and

vii) Number of commuter passengers trains in and around Belo Horizonte to remain unchanged on the assumption that in the long term, the METROBEL plan aiming at bypassing the existing line section of RFFSA in and around Belo Horizonte to improve commuter services would be implemented; for the time being, the increase in commuter traffic can be met by an increased number of coaches per train.

On the above basis, the envisaged daily total number of trains in both directions is exemplified as follows. In 1985, it will be some 17 on the section Ibiá - Campos Altos and some 46 on the section Embiruçu - Belo Horizonte. In 1990, it will be some 31 on the section Ibiá - Campos Altos and some 58 on the section Embiruçu - Belo Horizonte. In contrast, the actual number of trains at present is five on the section Ibiá - Campos Altos and 34 on the section Embiruçu - Belo Horizonte.

(2) Description of Investments

2.2.1. Railroad investments consist of: i) lengthening crossing tracks at stations to 490m as well as installing train-crossing stations on sections between two consecutive stations whose distances are long; and ii) modernization of the train blocking system (Text, Part III, para. 3.6.2.2). While the former category aims at meeting increased transport requirements, the latter one is a kind of modernization, which is quasi-equivalent to that already being carried out by CVRD. Therefore, it is considered desirable that first of all, the former category is executed and second, that after positively identifying the busy

sections where in the future the number of trains would reach that of CVRD's (at present, about 40 daily, in both directions), the latter one is executed.

(3) Estimated Amount of Investment

2.3.1. The sites where work would be done on crossing-tracks lengthening and construction of new train-crossing installations are expected to be mostly concentrated on the line section Nova Era - Ibiá of A Route. The second concentration would be on the line sections both to the north and to the west of Ibiá. It is expected that there are few work sites on the line section of B Route, partly because of less traffic of agricultural products to be developed and partly because of relatively well improved line capacity between General Carneiro and Corinto. Based on the envisaged number of trains in 1990, the investment amount for crossing-tracks lengthening and for new train-crossing installations totals Cr\$ 800 million for about 10 years. However, this Cr\$ 800 million includes the investment amount (Cr\$ 400 million) needed to cope with an increased traffic demand other than that for agricultural products under the Development Plan. Therefore, the purely additional amount for the agricultural products comes to Cr\$ 400 million. In addition, some Cr\$ 100 million is necessary to provide for station facilities to consolidate wagons into a complete unit train at some stations. The total amount is, therefore, Cr\$ 500 million. It is desirable for these investments to be made approximately between Year-1 and Year-5, to avoid unnecessary extra works when executing modernization of the train blocking system, which is mentioned in the next paragraph.

2.3.2. The investment amount has been roughly estimated on the assumption that all the train operations on the line section Nova Era - Ibiá (662 Km) are centrally controlled by the train dispatching office to be installed in Belo Horizonte and that a telecommunications channel exclusively used for transferring the unit train from RFFSA to CVRD and vice versa is installed between the two train dispatching offices, Belo Horizonte (RFFSA) and Vitória (CVRD). The system consists of: i) single-track automatic-block signaling including train-speed control (ATC); and ii) centralized train control (CTC) including such an information system as train radio between the train dispatcher and locomotive driver. Wayside signals are not used any longer and instead, cab signals are installed in the locomotive. It is also assumed that the CTC messages are transmitted by microwaves. The total amount of investment is roughly estimated at Cr\$ 3,000 million. It is desirable that these investments be made between Year-6 and Year-10.

2.3.3. On the line sections of RFFSA, which belong to A and B Routes, the strengthening of the track structure (rails, sleepers, and ballast) is now under way and expected to be completed between Year-1 and Year-5. However, since those track works are being done according to a plan which has already been drawn up, their investment amount is not included in this Chapter.

2.3.4. It is assumed that the standard unit train consists of 30 grain wagons of 50-ton capacity each pulled by three diesel locomotives. RFFSA is now investigating whether railroads bridges on line sections concerned are able to support the weight of the above-mentioned locomotives. In case where weak bridges are identified, additional investments would be necessary to strengthen those bridges. However, such investments are not included in this Chapter, because the investigation is still under way.

2.3.5. On the basis of the above, the rough estimates for railroads investments total Cr\$ 3,500 million.

CHAPTER III ROADS

(1) Underlying Assumptions

3.1.1. Highways (the Federal and State highways) are being constructed according to the master plan which has been already drawn up. Therefore, their investment amount is excluded in this Chapter. That for farm roads is also excluded.

3.1.2. Investments, which this Chapter deals with, are, therefore, limited to feeder roads (Vicinas) only.

3.1.3. It is assumed that the density of feeder roads necessary to the cultivated area is 90 Km/100 Km². This level corresponds to about one-third of the feeder-roads density in the soybeans- and maize-production areas in the western Parana State.

3.1.4. Supposing that the ratio of the cultivated area to the project area is about 20%, the above-mentioned density of feeder roads means that the feeder-roads network in the project area is expected to be lattice-shaped and that the unit square of the lattice is about 11 Km by 11 Km.

3.1.5. Table App. II-2 summarizes demand for the cultivated area mentioned in Appendix I, together with feeder-road requirements.

Table App. II - 2 Feeder-road Requirements

Year	Cultivated Area (10 ³ ha)	Incremental Cultivated Area (10 ³ ha)	Feeder-road Requirements (km)
1977	2,626	2,547*	23,000
1985	3,860	2,890	26,000
1990	6,750		

Remarks: * It is assumed that about one half of the existing cultivated area is used for growing soybeans and maize/sorghum.

(2) Estimated Amount of Investment

3.2.1. Approximately from Year-1 through Year-5, the feeder-road requirements are 23,000 Km and their investments amount to Cr\$ 7,130 million. Similarly, from Year-6 through Year-10, the feeder-road requirements are 26,000 Km and their investments amount to Cr\$ 8,070 million.

3.2.2. On the basis of the above, the rough estimates for roads investments total Cr\$ 15,200 million for about 10 years. This investment amount corresponds to that for about 15 years, on the assumption that feeder-road investments increase at an annual rate of about 10% in real terms. In other words, to materialize the Development Plan approximately within 10 years, some emphasized allocation of funds should be necessary in financing feeder-road construction in the project area.

(3) Traffic Increase on Highways

3.3.1. It is assumed that the highways constituting the Vitória Corridor, BR 262 and BR 040, have to support a yearly traffic flow of agricultural products of about 400,000 tons each. Supposing that the traffic is handled by large-type trucks of 20-ton capacity each for 200 days a year, the additional daily average vehicles moving on BR 262 and BR 040 will number about 200 each (in both directions). While their capacity can easily absorb the increase in vehicles, road maintenance costs would to some extent increase because of an increase in the number of large-type vehicles, and supplementary road investments would become necessary to provide for an additional lane on upgrade sections, realignment, etc., in the hilly and mountainous areas.

CHAPTER IV PORTS

(1) Underlying Assumptions

4.1.1. It is assumed that the Capuaba port in the Vitória area is utilized (Text, Part III, para. 3.6.1.3.).

4.1.2. Possible investments for a new port, which would be made beyond Year-10, are not dealt with in this Chapter.

4.1.3. Enlargement of the entrance channel for the Capuaba port is not taken into account in this Chapter.

(2) Present Capacity and Extension Scheme

4.2.1. Of a total wharf length of 700 m, 220 m are exclusively used for grain. Water depth of 13 m enables ocean-going vessels of no more than 45,000 DWT to enter the port and to be brought alongside the wharf.

4.2.2. Unloading capacity is regarded as 600 tons/hour x 20 hours x 300 days = 3.6 million tons/year.

4.2.3. A plan for improvement of the port-head silo exists and is to be carried out in phases starting at intervals of 18-20 months. Static capacity of the port-head silo in the first (at present),

the second, and the third stages would be 30,000 tons, 45,000 tons, and 90,000 tons, respectively. Corresponding dynamic capacity would be 750,000 tons, 1,130,000 tons, and 2,250,000 tons, respectively, on the assumption that yearly rotation is 25 times.

4.2.4. Loading capacity by means of belt conveyors is now 1,200 tons/hour (two sets of 600 tons/hour each). In the future, it would be increased to 1,800 tons/hour (two sets of 900 tons/hour each).

(3) Estimated Amount of Investment

4.3.1. It is assumed that approximately from Year-1 through Year-5, the static capacity of the port-head silo is 45,000 tons and its required investment amounts to Cr\$ 30 million. Similarly, investments to be made from Year-6 through Year-10 including: i) increased installation of the belt conveyor of 400 m; ii) another increase in static capacity from 45,000 tons to 90,000 tons; and iii) additional facilities for the existing railroads-wagon marshalling yard, etc. amount to Cr\$ 170 million.

4.3.2. On the basis of the above, the rough estimates for ports investments total Cr\$ 200 million.

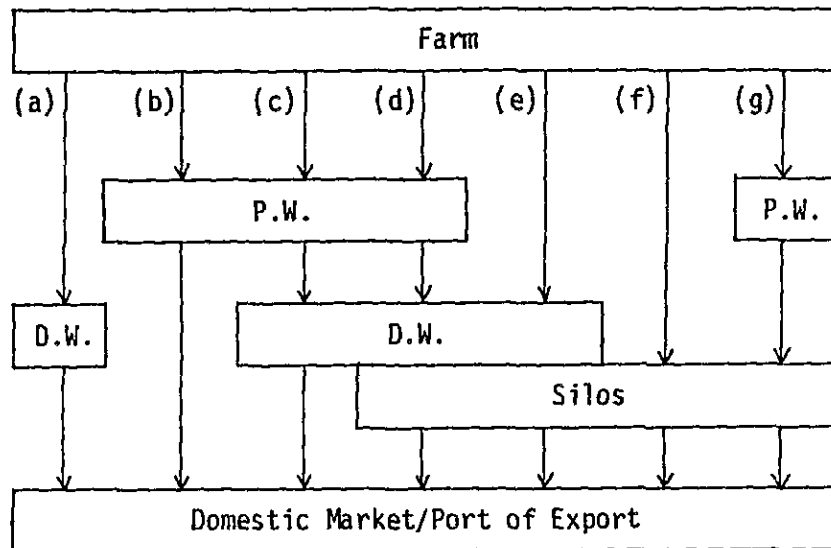
CHAPTER V SILOS AND WAREHOUSES

(1) Underlying Assumptions

5.1.1. For convenience, storage facilities for agricultural products are classified into: i) production-warehouses; ii) distribution-warehouses; and iii) silos (excluding port-head silos). The majority of production-warehouses are regarded as producers' warehouses, which should be dispersedly distributed in the project area, according to the distribution of cultivated areas as well as production volumes. On the other hand, however, distribution-warehouses and silos should be properly located at such key points for physical distribution as main nodal points for road traffic and origin terminals for railroad unit trains, with their respective service areas taken into account.

5.1.2. It is not necessary to provide for storage facilities for the entire volume of agricultural products to be developed. It is because some products are transported directly from the farm to the market, bypassing production-warehouses/distribution-warehouses. From the viewpoint of storage facilities, however, movement of agricultural products from the farm to the market is schematically shown in Figure App. 11-1.

Figure App. II - 1 Movement of Agricultural Products



Remarks: P.W.: Production-warehouses
D.W.: Distribution-warehouses

5.1.3. For the purposes of envisaging demand for storage facilities, it is assumed that:

- i) Of a total production volume of soybeans and maize/sorghum, 70% are moved through production-warehouses. At present, the majority of the total volume does not move through the production-warehouses, but in the future, a marketing system is to be developed in the production area, too. This is the reason why the high utilization of the production-warehouses is assumed;
- ii) The ratio of agricultural products moving through silos to the total production volume is assumed as shown in Table App. II-3;

Table App. II - 3 Ratio of Agricultural Products
Moving Through Silos

		Unit: %	
Description	Demand	1985	1990
Soybeans	Inside the production area	-	10
	Outside the production area	30	50
Maize/Sorghum	Inside the production area	-	-
	Outside the production area	10	20

- iii) The ratio of agricultural products moving through distribution-warehouses to the total production volume is assumed as shown in Table App. II-4; and

Table App. II - 4 Ratio of Agricultural Products
Moving Through Distribution-warehouses

		Unit: %	
Description	Demand	1985	1990
Soybeans	Inside the production area	50	70
	Outside the production area	30	50
Maize/Sorghum	Inside the production area	30	50
	Outside the production area	20	30

- iv) Annual rotation of production-warehouses, distribution-warehouses, and silos is assumed as once, 3.0 times, and 3.5 times, respectively.

5.1.4. On the basis of the above-mentioned assumptions, with consideration taken into account of the existing usable storage facilities in the production area, demand for new construction and replacement is envisaged as shown in Table App. II-5.

Table App. II - 5 Envisaged Demand for Storage Facilities

Description	Unit: 10 ³ tons	
	Year-1 ~ Year-5	Year-6 ~ Year-10
Production-warehouses	5,116	4,710
Silos	269	785
Distribution-warehouses	483	1,441

(2) Estimated Amount of Investments

5.2.1. On the basis of the above, the rough estimates for public investments for silos and warehouses are shown in Table App. II-6. In estimating the public investments, 50% of the calculated amount have been assumed as public for the production-warehouses, and 100% of the calculated amount have been assumed as public for the distribution-warehouses and silos.

Table App. II - 6 Public Investments for
Storage Facilities

Unit: Cr\$ million

Description	Year-1 ~ Year-5	Year-6 ~ Year-10	Total
Production-warehouses*	1,279	1,178	2,457
Distribution-warehouses	725	2,162	2,887
Sub-total	2,004	3,340	5,344
Silos	592	1,727	2,319
Total	2,596	5,067	7,663

Remarks: * In the southern States, the existing production-warehouses ownership ratio, public and private, is approximately 50 to 50. Therefore, the public investments have been assumed as 50% of the calculated amount.

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