Report No. 1580a-BR

Northeast Brazil: Appraisal of Ceara Rural Development Project—IBIAPABA

August 22, 1977

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CURRENCY EQUIVALENTS

Currency Unit	=	Brazilian Cruzeiro (Cr$)
US$1	=	Cr$14.56 (Selling Rate, August 1977)*
Cr$1	=	US$0.0687
Cr$1 million	=	US$68,681

WEIGHTS AND MEASURES

1 meter (m)	=	3.28 feet
1 kilometer (km)	=	0.62 miles
1 hectare (ha)	=	10,000 m^2 = 2.47 acres
1 square kilometer (km^2)	=	100 ha = 247.1 acres=0.386 sq. miles
1 cubic meter (m^3)	=	1.31 cubic yards=264.2 US gallons
1 kilogram (Kg)	=	2.2 pounds
1 ton	=	1,000 Kg = 2,205 pounds
1 kilovolt-ampere(KVA)	=	1,000 volt-amperes
1 kilowatt hour (kWh)	=	1,000 watt hours

GLOSSARY OF ABBREVIATIONS

(see next page)

GOVERNMENT OF BRAZIL FISCAL YEAR - January 1 to December 31

POLONORDESTE PROGRAM FISCAL YEAR - April 1 to March 31

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* Average Exchange Rates (Selling):

	1974	1975	Nov. 1976
US$1 = Cr$	6.789	8.128	11.800

GLOSSARY OF ABBREVIATIONS

BB	=Banco do Brasil (Bank of Brazil)
BEC	=Banco do Estado do Ceará (Bank of the State of Ceara)
BNB	=Banco do Nordeste do Brasil (Bank of the Northeast)
CAGECE	=Companhia de Agua e Escoto do Ceará (Ceará Water & Sanitation Company)
CEPA-CE	=Comissao Estadual de Planejamento Agricola (Ceará State Agricultural Planning Commission)
CERPI	=Cooperativa da Eletrificacao Rural do Planalto da Ibiapaba (Ibiapaba Rural Electrification Cooperative)
CIBRAZEM	=Companhia Brasileira de Armazenamento (Brazilian Storage Company)
CODAGRO	=Companhia Cearense de Desenvolvimento Agropecuario (Ceara Agricultural Development Company)
COELCE	=Companhia de Eletricidade do Ceará (Ceará Electricity Company)
CONSORCIO	=Consorcio Rodoviario Estadual do Ceará (Ceará State Road Construction Consortium)
DAER	=Departamento Autonomo de Estradas de Rodagem (State Highway Department)
ELETROBRAS	=Centrais Eletricas Brasileiras (Brazilian Electricity Holding Company)
EMATER-CE	=Empresa de Assistencia Tecnica e Extensao Rural (Ceará Technical Assistance and Rural Extension Company)
EMBRAPA	=Empresa Brasileira de Pesquisa Agropecuaria (Brazilian Agricultural Research Company)
EMBRATER	=Empresa Brasileira de Assistencia Tecnica e Extensao Rural (Brazilian Technical Assistance and Rural Extension Company)
EPACE	=Empresa de Pesquisa Agropecuaria do Ceara (Ceará Agricultural Research Company)
FSESP	=Fundacao Servico Especial de Saude Publica (Foundation for Special Public Health Services)
FUNRURAL	=Fundo de Assistencia ao Trabalhador Rural (Assistance Fund for Rural Workers)
IBC	=Instituto Brasileiro de Cafe (Brazilian Coffee Institute)
MEB	=Movimento de Educacao de Base (Basic Education Movement)
MOBRAL	=Movimento Brasileiro de Alfabetizacao (Brazilian Literacy Movement)
PIASS	=Programa de Interiorizacao das Acoes de Saude e Saneamento (Program for the Interiorization of Health and Sanitation Activities)
PIPMO	=Programa Intensivo de Preparacao de Mao-de-Obra (Intensive Program for Labor Force Training)
POLONORDESTE	=Programa de Desenvolvimento de Areas Integradas do Nordeste (Development Program for Integrated Areas in the Northeast)
SES	=Secretaria Estadual de Saude (State Secretariat of Health)
SOEC	=Superintendencia de Obras do Estado do Ceará (State Superintendency of Works)
SUCAM	=Superintendencia de Campanhas Medicas (Superintendency for Medical Campaigns)
SUDEC	=Superintendencia do Desenvolvimento do Estado do Ceará (Ceará State Development Superintendency)
SUDENE	=Superintendencia de Desenvolvimento do Nordeste (Northeast Development Superintendency)

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

APPRAISAL REPORT

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The report is based on the findings of an appraisal mission in October/November 1976 composed of Messrs. A. Uhlig, E. Senner, O. Lafourcade, G. Ashkenazi, E. Pinilla, Y. Tencalla (Bank) and E. Calderon (consultant) and following-up missions by Messrs. J. Graves (Bank) and J. Mora (consultant) in January 1977. Mr. C. Koch-Weser (Bank) also assisted in the preparation of this report.

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* These annexes are working papers which are available upon request.

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

SUMMARY AND CONCLUSIONS

i. In Northeast Brazil, which has a population of about 30 million of whom 60% live in rural areas, agricultural productivity is relatively low and rural per capita incomes are only about one-quarter the national average. Generally poor soils, periodic droughts, and an often highly unequal distribution of land add to the difficulty encountered in efforts to ameliorate the considerable poverty still existing in the region.

ii. The Government initiated in 1974 a major new program, POLONORDESTE, to raise the productivity and the incomes of the rural population in Northeast Brazil, largely through integrated projects in selected micro-regions or priority areas which have especially pronounced proverty problems and/or immediate development possibilities. Whereas many of the past Government programs directed to the rural population had been mainly in the areas of public works or social services, the POLONORDESTE program adds the specific aim of reorienting and strengthening, in an integrated approach, the various institutions which offer the support services required to develop a more productive small-scale agriculture.

iii. Ceara, with a population of about 4-1/2 million and a land area of 148,000 km^2, is one of the largest northeast states. Much of the state consists of semi-arid country, with relatively low immediate agricultural potential, and is subject to periodic severe drought. Within the state, however, there are certain areas of relatively higher agricultural potential, particularly along the coast and in several areas of higher altitude (serras). The Serra da Ibiapaba, which is located in the western part of the state, is one of these areas. The proposed project was prepared by a team in the state's agricultural planning commission (CEPA-CE) beginning in 1975 and in consultation with several Bank missions. It is the first POLONORDESTE project to be prepared in Ceara and, therefore, would provide a range of experiences particularly useful in the preparation and execution of similar projects in the other POLONORDESTE priority areas of Ceara. The project is the second appraised by the Bank in the context of the POLONORDESTE program after the Rio Grande do Norte project, for which a loan of US$12 million was signed in 1976 and which is generally proceeding satisfactorily.

iv. The Serra da Ibiapaba project area, a plateau of about 800 m altitude, covers some 4,800 km^2 and has a population of 194,000 of which 155,000 are rural. The area has considerable potential for increased production of a variety of crops including coffee, corn, bananas, sugarcane, beans, manioc, peanuts and miscellaneous other vegetables and fruits through both expansion of the area cropped and increases in yields. Geographically, the area is situated so as to make it one of the important sources of food supply for

several urban areas in the Northeast and North of Brazil. Recent development activities such as the completion of the primary road network, the initiation of a coffee expansion program by the Brazilian Coffee Institute (IBC) and the construction of an agricultural produce trans-shipment market are reflected in an obvious spurt of economic activity in the area. However, inadequate penetration of infrastructure and services still presents a serious constraint to realizing the intensification and considerable potential expansion of agriculture.

v. The proposed project would include: (a) the development of some 5,800 farms with up to 200 hectares (including about 1,000 sharecroppers/ tenants) and the provision of agricultural investment and production credit and agricultural extension to these farmers and land purchase credit to about 450 of those who currently own no or very little land; (b) the provision and improvement of other productive support services including the development of agricultural experimentation, the provision of technical and administrative assistance to existing cooperatives, the provision of farm machinery services and rural electrification, and the improvement and construction of feeder roads; (c) the provision of improved health and sanitation services benefitting a total of some 25,000 families (including provision of upgraded or new health posts and centers, community wells, and, on a pilot basis, family latrines and water filters, all linked with intensified health education) and of improved primary education and expanded vocational training for a total of about 10,000 rural families; and (d) the provision of special project coordination and evaluation units and the execution of several water resource, soil and soil conservation studies required for the preparation of projects in other of the POLONORDESTE priority areas in Ceara.

vi. The project would be executed by existing agencies, with overall project coordination and administration provided by a special project unit established by the state in CEPA-CE. Various pre-project investments and activities (establishment of a small research station, construction of some feeder roads and electrification works, staff recruitment and selection, etc.) began in 1976 with POLONORDESTE funding. Implementation of the project items selected for Bank financing would be over the five year period beginning in April 1977. A separate monitoring and evaluation unit would be established to review project impact, to help identify adjustments which might prove necessary, and to help assure that the experience gained in this project will be applied to the design of other similar projects to be undertaken elsewhere in the state.

vii. The proposed loan of US$17 million equivalent to the Federal Government would finance the foreign exchange component of the project (US$10.9 million) and about 14% of local costs. This would represent 30% of the total project cost of US$56 million. Disbursements would be made over a five-year period against all project costs except the land purchase credit which would be provided solely by the Government. It is estimated that beneficiary farmers will contribute, on average, over 10% toward project farm development costs. Contributions of cash, labor or materials would also be made toward the costs of the health and sanitation services. Farm inputs to be financed by the

credit component would be procured by individual farmers through local commercial channels. The principal items of equipment for the rural electrification component (amounting to about US$2.2 million baseline cost) would be procured through international competitive bidding. Other smaller purchases of equipment and materials for electrification, road maintenance and the mechanization service component, and civil works for the feeder road and education components (all together totalling some US$10.7 million) would be procured or contracted through competitive bidding advertised nationally; as the size of these contracts is relatively small and the works relatively scattered, international bidders, though not excluded, are not likely to participate. Local competitive bidding, negotiated contracts or force account would be applied, in accordance with established Government procedures, for other minor and varied works or purchases.

viii. Funds for agricultural credit would be channelled through Banco do Brasil (BB) and Banco do Nordeste do Brasil (BNB) and lent to farmers for investment or seasonal production purposes up to a maximum total outstanding of about US$6,000 per farmer. The investment credits would be of up to 12 years, including up to 6 years grace. The Government has established interest rates to farmers of 7%, unindexed, for investment and seasonal credit with the exception of credit for fertilizer purchase, which carries no interest charge. These rates are negative in real terms given the current inflationary environment. The credit, however, would be closely supervised and all of the beneficiaries would receive technical assistance from the extension service to help avoid a misallocation of funds. The bulk of the beneficiaries would be small farmers from the lower income groups.

ix. The project would result, at full development, in substantial increases in food production for consumption or processing, both in the project area and in several major Northeast cities linked by paved road to the project area. Marketable production (excluding coffee, for which the separately financed IBC program is already underway) would increase at full development by some US$14 million annually over the pre-project level, with significant increases in production of sugarcane, manioc, miscellaneous vegetables, oranges, peanuts, passion fruit, avocado, beans, annato (a food coloring) and corn. The incremental production would be a result of improvements in yields as well as increases in the areas under production. The estimated financial rate of return to the farmer, as tested on eight basic representative farm models, ranges from 22% to over 50%. The relatively high rates of return to the farmer must be viewed in the context of the very low base or starting point, and the fact that significant production increases can be achieved in the area with the use of improved inputs and techniques but with relatively low on-farm investment, assuming that certain critical off-farm investments such as in feeder roads are made simultaneously. Family incomes of participating farm families from agricultural activities are expected to increase from a current weighted average of US$425 (or a range from a weighted average of US$110 in the scrubland zone to US$1,015 in the humid zone) to a weighted average of about US$3,860 within about nine years of participating in the project (or to a range from a weighted average of US$1,255 in the scrubland zone to US$8,760 in the humid zone). These increases are high largely

because some of the crops to be produced (especially fruits and vegetables) provide unusually good returns, and market prospects are very promising. The project would provide increased employment opportunity equivalent to some 6,020 worker-years annually.

x. The estimated rate of return to the economy from the directly quantifiable agricultural aspects of the project would be 21%, dropping to 16% with either a 10% decrease in output or a 10% increase in cost. The rate of return of the rural electrification component, calculated separately, would be 17%, reflecting especially the important savings in substituting the use of hydroelectric power for diesel fuel. The combined rate of return would be about 19%. Important other benefits which are difficult or impossible to quantify would stem from the improved health and sanitation services and the education and training activities.

xi. The project bears the administrative risk attached to any project whose success depends on the coordinated implementation of activities in various sectors by numerous agencies. Also, there is the risk that the steps taken or proposed to assure greater coverage of small farmers by the credit and extension systems will be insufficient, or might not be adjustable as quickly as would be desired to offset possible declines in farmers' returns which could result for example from shifts in input and output price relationships or less than expected production increases. However, the measures taken by the state to establish a high level project coordination council and full time project coordination and evaluation units; the annual review mechanism to be followed in setting and adjusting the project work plans of participating agencies; and the potential of the project to benefit some 30,000 people with its directly productive components and 150,000 with improved health and education services and to strengthen the capacity of the institutions in the state which serve the rural poor, make the project risks well worth taking.

xii. The project would be suitable for a Bank loan of US$17 million equivalent, with a term of 15 years including 3 years of grace.

I. INTRODUCTION

1.01 In October 1974, the Government of Brazil created a special development program named POLONORDESTE to help improve the incomes and welfare of low income rural families in Northeast Brazil, a region which contains one of the largest concentrations of poverty in Latin America. The program is intended to provide the basis for expanding past programs and launching new efforts, particularly integrated rural development projects designed to raise the productivity and incomes of small-scale farmers. POLONORESTE is being focused initially on some 31 sub-regions which cover a large portion of the Northeast and which have been selected by the Government in view of both productive potential and concentrations of rural population.

1.02 In March 1975, the Government requested IBRD assistance for the preparation and financing of a rural development project in the State of Ceara. The project is the second of the new projects being initiated by the Government in the context of the POLONORDESTE program to be considered for Bank financing. The first was the Rio Grande do Norte rural development project for which a loan of US$12 million (1195-BR) was signed in early 1976 and which is now proceeding satisfactorily. Other projects have also begun or are being prepared by the Government and the Bank is maintaining close contact with several of these efforts, particularly in the states of Paraiba and Bahia, where projects may be ready during the next year for possible Bank consideration.

1.03 The proposed project for the Serra da Ibiapaba region in the State of Ceara was prepared by a team in the state's agricultural planning commission (CEPA-CE), assisted by a number of visits of Bank staff and consultants. Particular attention was given to the selection and refining, from a somewhat larger package of investments included in the original project proposal, those investments most urgently required to reach agricultural production targets, and those social and productive support improvements considered feasible in light of the administrative capabilities of the agencies offering those services. Appraisal was carried out in October/November 1976.

1.04 The Bank has so far made 10 loans, totalling US$339.4 million, for agriculture and rural development in Brazil. These include two, amounting to US$60.5 million, for livestock development; two, amounting to US$137 million, for agro-industries; one, of US$18.2 million, for grain storage; one, of US$40 million, for an agricultural research program for the Northeast, North and Center West of Brazil; and four, totalling US$83.7 million, for various settlement, irrigation and rural development projects, three of which are located in Northeast Brazil. Recently approved loans for a nutrition project and a secondary and feeder road project will also provide important benefits to the rural population. In addition to other agricultural and rural development projects, a rural education program is also under consideration for possible future Bank financing.

II. BACKGROUND

General

2.01 Brazil's economy has traditionally had a strong agricultural base. Although industrial expansion has become increasingly important, the relative contribution of agriculture to the national product has shown only a slow decline over the past decade, from about 20% of GDP in 1967 to about 15% at present. The sector still accounts for 60% of export earnings (soya, sugar and coffee are major export items) and provides the means of livelihood for 45% of the population. During the period 1967-75, agricultural production grew at an average annual rate of about 6% despite adverse climatic conditions in three of the years.

The Northeast 1/

2.02 The nine states of Northeast Brazil have a total population of about 30 million, of which some 60% live in rural areas. Agricultural productivity and rural per capita incomes are very low. Aside from a relatively narrow coastal strip in which sugar cane is the principal crop, much of the Northeast has a semi-arid climate, with periodic serious droughts, and generally poor soils. The problems of reducing the incidence of poverty in the region are further compounded by a highly skewed distribution of land ownership. Less than 1% of the total number of farm establishments account for 40% of the area, and in some areas up to 80% of the rural labor force own no land at all, though this varies considerably within the Northeast. However, since in many parts of the Northeast land is of very poor quality, even many of those farms which might in other countries be considered medium-sized (say 100-300 ha) produce very low incomes.

2.03 Numerous Government programs in the past have been directed at speeding economic development in the Northeast. The Goverment operates a development superintendency (SUDENE) and a special development bank for the Northeast (Bank of the Northeast, BNB), and substantial fiscal and monetary incentives have been made available over the past decade for both industry and agriculture. Overall per capita income in the region is still, however, only about half the national average (Northeast rural per capita income being only one quarter the overall national average). Programs to generate jobs in the industrial sector have not kept pace with overall population increases, and the gradual emigration from rural to urban areas has been coupled with considerable continued emigration from the Northeast to the more industrialized Center-South of Brazil. Past Government programs directed to the rural population have often been in the areas of public works (including substantial efforts in drought-prone areas to develop small dams and ponds) or social services, and only recently has the Government been moving actively toward the reorientation and strengthening of the institutions offering the services required to develop a more productive labor-intensive small-scale agriculture.

1/ Readers are directed to "Rural Development Issues and Options in Northeast Brazil," (Report No. 665a-BR dated June 23, 1975).

Federal Rural Development Policies and Programs

2.04 While the Government, in setting its agricultural policies, is pursuing multiple objectives--to stimulate output to meet a rapidly increasing domestic demand for food and fibers; to contribute to an improved balance of payments through increased production of export commodities or import substitutes; and to raise income levels of the rural poor--increasing emphasis is being placed on the last of these objectives. This is evidenced in the Northeast by the formulation in late 1974 of the POLONORDESTE program which is designed, inter alia, to raise the productivity and incomes of small farmers through integrated rural development projects, focusing initially on selected priority areas which have expecially pronounced poverty problems and/or immediate development possibilities. Consultants were appointed to help prepare projects for some of these areas while the states themselves are preparing projects for others. The normal pattern is for the projects then to be executed by existing agencies, coordinated by special units set up at the state level. All projects are reviewed and monitored by the regional POLONORDESTE team (located in SUDENE) which reports to a federal interministerial commission responsible for overall policy guidance of the POLONORDESTE program and for approval of project proposals and allocation of funding among projects.

2.05 So far, the POLONORDESTE program has mainly helped finance: (i) various preparation activities and/or some initial expenditures for 31 integrated rural development projects in the priority sub-regions, and (ii) the continuation or completion of several projects (particularly in the areas of land settlement and irrigation) begun or planned before the creation of POLONORDESTE. By the end of 1976, around US$370 million had been allocated to these various efforts, with much of the expenditure actually being made for the latter category. Project preparation guidelines and operating policies have only recently begun to emerge and the institutional capacity to plan, coordinate and execute the program requires further strengthening. As a result, some of the projects are still suffering execution delays as their administrative, policy and financial implications had not been fully thought through before they were initiated.

2.06 Notwithstanding the various start-up difficulties, the establishment of the POLONORDESTE program has helped generate support at different levels of Government for the development of programs directed toward the rural poor, with increased attention to improving economic productivity. For example, the national agricultural research company, EMBRAPA, is carrying out a research program (partly financed with Bank Loan 1249-BR) focussing especially on the Northeast and crops grown by small-scale producers. The national extension agency, EMBRATER, is preparing a special program aimed particularly at strengthening extension services offered to small farmers and improving the training of extension workers (a program which the Bank has been requested to help finance). In addition, a partial reformulation of credit policies in early 1977 (including the earmarking of POLONORDESTE credit funds to small scale farm operations and the increase from 12 years to 20 years in the maximum term of credits for small land purchases) has helped improve the prospects of reaching larger numbers of the rural poor with productive support. Also,

while no major land reform programs are foreseen in the near future, land redistribution efforts may be included in the context of some POLONORDESTE rural development projects, where inadequately used large estates exist and where institutions serving small farmers can be strengthened to a point where they can effectively service new small-holders as well. The Government is formulating a new rural health program, PIASS, as well as new rural education policies and programs, all with a view to improving substantially the potential productivity and the welfare of the rural poor.

The State of Ceara and its Development

2.07 Ceara, with a total population in 1970 of about 4.4 million of which about 59% are rural, and a land area of about 148,000 km^2 (see map), is one of the largest Northeast states. The metropolitan area of the capital city, Fortaleza, which is situated on the coast, has a population of over one million and accounts for the bulk of the state's light industry (mainly food processing, textiles and clothing, but recently also including some non-metalic mineral, metal and chemical processing). While agricultural potential is limited in most parts of the state by poor soils and low or irregular rainfall, potential is relatively higher along a narrow coastal strip, in several humid highland areas (one of which is the focal point of the proposed project) and a few river valleys. The majority of the state's land area, however, falls within the sertao or semi-arid zone which is subject to periodic severe drought and which ecologically is most suited for cattle ranching or other similar extensive systems of land use. Cotton (including drought resistant arboreal varieties grown in the sertao), beef, bananas, beans, corn, manioc and sugar have, in that order, traditionally been the state's most important agricultural products in terms of value. In recent years, however, production of cashew nuts, coffee and various fruits has been introduced on an increasing scale, and the coastal fishing industry has expanded. Overall, the state's five year development plan (1975-79) calls for a gradual decentralization of economic activity away from the Fortaleza area (partly through development projects in the several POLONORDESTE priority areas in the state), and an annual agricultural production growth rate of 6-7%.

III. THE PROJECT AREA

Location and Physical Features

3.01 The project area is located in the northwestern part of Ceara, bordering the State of Piaui (see map). It is one of the priority regions within the federal POLONORDESTE program, and includes 7 municipalities which cover about 4,800 km^2 or 3% of the state's territory. It extends about 100 km in the north-south direction and about 50 km east-west. The main part of the project area constitutes a plateau (Serra da Ibiapada) which rises from about 500 m altitude in the west to some 800 m in the east where a steep escarpment separates the plateau from a low lying area with an altitude of about 200 m.

The average annual temperature and rainfall vary with the altitude. Temperatures average about 26°C in the lower areas and 22°C in the higher areas with little fluctuation during the year. Rainfall increases from less than 1,000 mm per year in the lowlands to 1,900 mm in the higher areas, with a heavy concentration (90%) during the period December to June. Soils in the area are variable but in general of moderate to low quality, dominated by deep but light sandy soils with low water and nutrient retention capacity and relatively high acidity. As a result of climate, topography and soil characteristics, the area can be divided into three land capability classes: the western part (carrasco) which covers about 70% of the area, with moderate to poor agricultural potential; the central part, commonly referred to as the humid and subhumid zone, corresponding to approximatley 20% of the area, with good agricultural potential; and the lower part (sertao) east of the escarpment, corresponding to about 10% of the area with very limited agricultural possibilities.

Socio-Economic Conditions

3.02 The population of the project area was estimated in 1976 to be about 194,000. Average population density is 40 per km^2. Approximately 80% (155,000) of the population is considered rural of which about 25% are farm owner-operator families, 9% nonowner-operator families (including sharecroppers) and the remaining 66% mainly farm laborers and their families. Between 1960 and 1970, the rural population grew by about 1.3% annually and the urban segment by 2.2%.

3.03 Educational and health standards of the population in the project area are very inadequate, and low in relation to the average national situation. Only about 45% of the adult population are able to read and write, and only about 30% of the school-age children are attending schools. Health problems are reflected in high rates of infant mortality (125 per 1,000) and of mortality from a variety of communicable diseases. Trachoma 1/ and leishmaniasis 2/ are endemic in the area.

3.04 The area's economy is almost exclusively based upon agriculture. About 80% of the economically active population are engaged in agricultural activities and some 10% each are employed in the secondary sector (largely small-scale agricultural processing) and in services. Regional product in 1971 was estimated at about US$30 million of which approximately US$23 million originated in agriculture. This would suggest a regional product of US$170 per capita and, assuming 85% of the regional product constitutes regional

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1/ Chronic infectious eye disease, in its later stages leading to visual disability and frequently to blindness.

2/ Disease which, in its cutaneous form, is characterized by ulcerated lesions of the face and, in its visceral form, is characterized by anemia, fever, liver and spleen enlargement and is fatal if untreated.

value-added, an average income of about US$140 per capita in 1971. These figures are estimated to have risen since then by about 10-20% especially due to an increase in agricultural and service activities which followed the construction of the main road system (para. 3.10). In the course of this latest development, open unemployment and the emigration of able-bodied people, which used to be very common in the area, have declined, and localized shortages of labor during the agricultural planting and harvesting seasons have occurred recently.

Agriculture

3.05 About 88% of the geographical project area, or some 423,000 ha, is estimated to be incorporated in farms. Roughly 55% of this farm area is actually used (29% crops, 21% pastures, 5% forest); approximately half of the unused farm land is considered potentiallly productive while the remainder is largely unsuitable for agriculture. There are some 9,300 farms in the project area. About 4,800 (52%) have less than 10 ha each and occupy a total of 6% of the land; 2,150 (23%), with between 10 ha and 24 ha, incorporate 11% of the land; 2,120 (23%), with between 25 ha and 200 ha, occupy 39% of the land; and some 230 (2%), with more than 200 ha, control 44% of all farm land. Although far from even, the land distribution is less concentrated than the general pattern in Northeast Brazil and most of the very large farms are located in the carrasco and sertao which have relatively lower quality land and low farm income. Some 88% of the value of agricultural output in 1971 related to crops (of which manioc, 37%; cane, 27%; bananas, 9%; coffee, 7%; beans, 5%), 8% to livestock (of which beef, 46%; pork, 39%; milk, 9%) and 4% to forestry extractions.

3.06 Since 1971 both the level and structure of agricultural production have changed as a result of improvements to the trunk road system in the project area, an active Government credit policy, and the coffee development program carried out by the Brazilian Coffee Institute (IBC). Although recent production figures are not available, there is evidence that crop production has increased considerably over the past five years. In particular, production of coffee, bananas and vegetables is now playing a much more prominent role than in 1971.

3.07 The prevailing farming systems vary with the ecological conditions of the area. In the high rainfall areas of the serra, farms are generally of small to medium size, and are mixed enterprises producing sugarcane, bananas, tropical fruits, coffee and some vegetables. Farms in the lower rainfall areas of the carrasco and sertao are usually larger and simpler in their organization, producing mainly manioc, sorghum and livestock, with some subsistence crops, including vegetables, if irrigation possibilities exist. In general, the farming systems are extensive. Substantial parts of the farms are unused, and the cropping intensity of the utilized parts is low. The use of improved farm practices and inputs is limited to a relatively small number of farms and, so far, to only a few crops (notably coffee and some vegetables). There are, however, indications that an intensification of land use is taking

place and the use of improved farming practices in spreading. However, productivity, output and, consequently, farm incomes are still significantly below the area's physical potential. At present, the average annual output per hectare of land in farms is equivalent to about US$50.

3.08 Supporting services available to the farmers are precarious at best, except for supply of agricultural inputs and to some extent credit. Especially weak are extension, crop research, agricultural education, marketing and all social services. Prior to the proposed project, agricultural extension was mainly provided by some ten extension agents from the State Extension Agency (EMATER-CE) and the Brazilian Coffee Institute (IBC). The effectiveness of that service has been low because of low service density (1 extensionist for about 1,000 farmers), inadequate training of the extension personnel, very poor support services, isolation from research and an overwhelming orientation to credit supervison at the expense of technical assistance. Agricultural research, mainly carried out in the past by the State University, has not produced a great deal of know-how relevant to the project area. Agricultural education is virtually nonexistant in the project area either through specific training or the formal education system. Marketing relies almost exclusively upon the private middle-man to whom the farmer sells either at the farm-gate or at the weekly markets in the municipal centers. The system has had relatively high primary assembly costs, mainly because of very poor rural roads. Recently, a produce trans-shipment market was established to help facilitate collection and shipment.

3.09 Agricultural inputs are available throughout the project area at competitive prices, mainly from private suppliers, but also from the State Supply Agency (CODAGRO) and from other public agencies. With the recent introduction of coffee and vegetable production in the area, suppliers now offer a variety of chemical fertilizers. Three banks, through five branches, provide agricultural credit for the area, using mainly special credit lines made available by the Central Bank. Coverage is still small, however, in comparison to the region's potential credit demand.

Infrastructure

3.10 The project area is well connected with the national highway system by federal highway, BR-222, which passes through the center of the project area in an east-west direction. In addition, a newly paved state highway, CE-75, runs in a north-south direction through the humid zone of the project area, connecting very adequately all but one of municipal centers with each other and with inter-state BR-222. These two roads constitute an excellent, but still under-utilized, trunk road system for the area. The rural hinterland is served by some 1,200 km of earth tracks, by-and-large of very poor quality and impassible during the rainy season.

3.11 All the municipal centers in the project area have electricity and are served by the national postal service. All but one of these centers have telephone service, and each has a limited public water supply system and a small hospital. The rural population lacks these services, and access to the

centers is limited due to poor transportation conditions. Most of the rural primary schools in the area are one-room schools, in many instances in the teachers' houses. Five out of the seven municipal centers have secondary schools. Improved facilities are sorely needed, as are improvements in the training of rural primary school teachers and substantial increases in teachers' salaries.

IV. THE PROJECT

Objectives and Approach

4.01 The POLONORDESTE program has as a principal overall objective the improvement of the incomes and the standard of living of the rural population in Northeast Brazil, and the reduction of the disparities in economic and social development between the rural Northeast and much of the rest of the country. The proposed Serra da Ibiapaba project embodies this objective, as it does the important parallel objectives of strengthening the permanent planning and project execution and coordination capacity of the agencies responsible for different aspects of rural development in the state, and defining cost effective means to sustain and broaden that development.

4.02 The project would have a regional focus, concentrating on opening more fully one of the relatively high potential food production areas in Ceara. It is intended as the first of several regional projects the state hopes to carry out under the POLONORDESTE program and, as such, should provide important experience relevant to subsequent projects. It also represents a vehicle for helping achieve the state's target of slowing the rural-urban migration (particularly from the hinterland to Fortaleza, where the development of urban services and employment opportunity has lagged behind the population pressure, or to other cities outside the state) by promoting the accelerated development of areas in the interior of the state. Within the selected project area, the project activities would be directed particularly at improving the conditions of small-scale farmers and the low-income rural population.

4.03 The project strategy would be to achieve parallel coordinated improvements in infrastructure and services in several critical sectors. Given the project's principal objectives and the area's resource base, project interventions would concentrate on increasing agricultural production and related employment and income through on-farm investment and the provision of the improved agricultural services (including extension, credit, experimentation and mechanization) required for the introduction of improved farming techniques and an expansion of the area cultivated. These activities would benefit particularly some 5,800 low-income farm families (including around 1,000 sharecroppers) operating less than 200 ha each, still a relatively "small-scale" operation in terms of income, particularly in the drier and less fertile carrasco portion of the project area. Project interventions beyond those considered directly agricultural--namely the improvement of feeder-roads, expansion of rural electrification, development of nonformal adult education and gradually improved rural primary education, and expansion of health care and

sanitation services--would support the overall development of a broad section of the rural population. The project will build upon initial POLONORDESTE-funded activities and investments begun in 1976, which included construction of a produce trans-shipment market, some feeder roads and electrification facilities, the creation of a research station and the early recruitment and training of project staff.

4.04 Although multi-sectorial, the project would not provide for an all-inclusive package of development actions. In the first place, it is complementary to several important recent investments as well as to other separately-financed programs now underway (e.g. coffee expansion) or planned (e.g., construction of a storage facility and of a private alcohol refinery). Furthermore, technical, financial and administrative constraints limit the number of components that can be executed with reasonable efficiency. Hence, some potential activities such as livestock and small-scale irrigation development, comprehensive improvement of the upper grade level in rural primary education and of secondary education, promotion of rural industries, and the like, would be gradually pursued by the state at a later stage. Project monitoring and evaluation (para 6.07) and an annual review mechanism to be followed in setting and adjusting the detailed project plans (para 6.04) will help assure that, should particular complementary or additional activities become urgent for the project's success, the state will be made aware of the needs in a timely manner.

Brief Description

4.05 The project would consist of:

(a) the strengthening of extension services;

(b) the development of a field experimentation program;

(c) the intensified agricultual development of some 5,800 farm operations of less than 200 ha, and the provision of investment and incremental working capital credit required for the increased production of manioc, sugarcane, miscellaneous vegetables, oranges, peanuts, passion fruit, avocados, beans, annato (a food coloring) and corn;

(d) the provison of land purchase credit to some 450 sharecroppers, tenants or owner-operators with insufficient land;

(e) the development of other complementary agricultural support services such as administrative and technical assistance to agricultural cooperatives and provision of certain mechanized land clearing and cultivation services;

(f) the construction and/or upgrading of about 370 km of feeder roads and improvement of rural road maintenance capabilities;

(g) the installation of rural electrification facilities to serve some 5,000 new rural customers;

(h) the provision of improved health facilities and services for some 25,000 families, the development of simple village water supply systems and the execution of pilot programs for provision of latrines and distribution of water filters;

(i) the construction and equipping of 8 multi-purpose community learning centers and 50 rural primary schools, the provision of non-formal courses for a total of about 6,800 farmers and 10,000 women and young adults, and the upgrading or retraining of 478 primary school teachers and supervisors; and

(j) the provision of organizational support for project administration, monitoring and evaluation; and

(k) the preparation of soil surveys, water resource development studies and soil conservation studies to help provide the basis for rural development projects for several of the other POLONORDESTE priority areas in Ceara.

4.06 The project would be executed by existing federal, state and local agencies with overall project coordination and policy guidance provided by a management council made up of high level representatives of the principal executing agencies, and day-to-day project coordination provided by a special full-time project support unit and project manager located in CEPA-CE (paras 6.01-6.07). The project would include activities and investments undertaken during a 5-year period beginning in April 1977.

Detailed Features

Agricultural Extension

4.07 The project would include the expansion and reorientation of extension services provided in the project area by EMATER-CE, the state extension company. It would provide technical assistance to some 5,800 small-scale farmers previously not assisted or inadequately assisted (prior to the project, the area had only one extensionist per 1,000 farmers). The proposed agricultural extension methodology will contrast with the traditional pattern in the area in that the transfer of technology to small farmers will be mainly through small groups of farmers in the fields of "contact farmers" where demonstration plots will also be installed. The groups should allow greater extension coverage as well as help lay the groundwork for improved cooperative action. In some cases, the groups could help form the basis for more efficient assembly of production for marketing and/or storage, and more efficient use of mechanization services. A second innovation will be that responsibilities for credit-related activities and for purely technical assistance activities will be assigned to separate, but closely collaborating, extension agents. This will allow the latter type of agent (agricultural field extension specialists) to concentrate solely on know-how dissemination and demonstration, with another type of agent (agricultural credit specialists) to add specialized assistance in helping plan, prepare and supervise agricultural credit.

4.08 The expanded extension staff would receive special pre-service as well as in-service and field training and would be composed of field extension agents, agricultural credit agents, cooperative organization agents, social assistance agents and several higher level subject matter specialists. While the field extension agents and the social assistance agents will each work principally through 8-10 contact farmers or families (thereby reaching eventually up to 200 and 450 families per agent, respectively), the credit agent would deal directly with the individual farmers (eventually up to 300 per agent) and the cooperative agents with cooperatives. The field staff will be coordinated and supervised by a regional extension office, with local extension offices in each of the project area municipalities. The project costs include the costs of equipment and vehicles, incremental materials and operating costs, salaries of the incremental staff during the five year project period, training costs, and the costs of establishing and maintaining demonstration plots.

Agricultural Research and Experimentation

4.09 At present there is only a very low usage of available improved farming practices and inputs both because of the lack of broad awareness of the benefits and lack of guidance. Hence, intensified extension can make a significant initial impact by promoting wider application of practices already used by the area's better farmers or developed in other similar regions. The project, however, also calls for the diversification of cropping patterns and the introduction of several relatively new crops such as passion fruit, annato (a food coloring) and peanuts. As a result, agricultural experimentation will have to be geared both to sustain the development of new or improved practices for existing crops and to adapt know-how for new crops to local conditions. The state research company (Empresa de Pesquisa Agropecuaria do Ceara, EPACE) has already begun, at a new research station near Tiangua, a preliminary program of controlled adaptive research related to the project area. This research is being executed with EMBRAPA (the national agricultural research institution) support and guidance, and is part of the overall development of the state's research capacity and program. During negotiations, assurances were received from the state that it would continue to maintain and develop research at the Tiangua station adequate to the project needs.

4.10 To supplement the ongoing research at Tiangua (which would not be financed by the proposed loan), the project would provide for the development of satellite experimentation carried out on some 10 experimentation sites of about 10 ha each. These sites will be developed within the project area during the five year project period and will be managed by EPACE, out of its Tiangua station. Technological packages, based initially on results of research in other areas, would be tested in the local rural milieu on fields rented for this purpose from farmers, with their active participation. To start, this experimentation would focus on five crops (beans, peanuts, manioc, sugarcane and annato), with work on other crops added as administrative and technical capacity is developed. To help assure continued local interaction between the extension and research services, the area's new experimentation programs will be defined jointly by EPACE, the extension service and the project management team. The actual experimentation will be the responsibility

of EPACE, while subsequent transmission and application of the recommended technological packages on small farmer demonstration plots will be the responsibility of the extension service. The project costs of the field experimentation scheme would include direct costs such as equipment, materials and production input costs, as well as salaries of the related technical and administrative personnel during the project period.

Agricultural Credit for On-Farm Development

4.11 The proposed increases in agricultural productivity and expansion of the area under production will require substantial farmer investments as well as increases in working capital. Agricultural credit would be provided to approximately 5,800 farmers in the project area with less than 200 hectares (including about 1,000 sharecroppers and renters). In 1975, a total of just under US$3 million in agricultural credit was extended to about 1,000 farmers in the entire project area, but about two-thirds of this was absorbed by farm operations over 25 hectares. Hence, it is expected that the large majority of the expected project participants will be receiving institutional credit for the first time. Agricultural credit would be made available to help finance on-farm investments (mainly land clearing and establishment of permanent crops, but also including small equipment or tools, fencing, etc.) and incremental working capital requirements (for laborers, fertilizer, seeds, pesticides, and other seasonal production costs). It is estimated that farmers will be able to tap some of their own resources and usually contribute 10-15% to development costs.

4.12 Credit would be extended by the Banco do Brasil (BB) agency and the Banco do Nordeste do Brasil (BNB) agency in the project area and two additional BB branches near the project area. The Central Bank has opened credit lines with these participating banks making funds available for application in the project to cover 100% of sub-loans to farmers. The participating banks are required to repay the Central Bank in line with repayment dates of sub-loans made, and are allowed to retain a spread of 5% to cover administrative costs, etc. (terms and conditions to farmers are described in paragraph 4.13 below). When possible, credit would be channelled through one of the 4 area cooperatives. In those cases the cooperative, which would assume part of the administrative burden of the credit operation, would receive a 2% spread, leaving the participating banks with 3%. Preliminary experience under the POLONORDESTE program in the Northeast suggests that (especially in view of the more intense technical assistance from the extension service to the small farmer and the somewhat simplified credit procedures outlined in Annex 3) the spread to banking intermediaries appears sufficient to cover costs as well as provide incentive for engaging in this business. However, the adequacy or relative importance of this incentive, taking into account the fact that the banks are Government controlled institutions acting under Government instructions, cannot yet be clearly established. For this reason, the adequacy of the interest spread will be one of the several items to be subject to special annual review (see para. 4.15).

4.13 The agricultural credit terms to the farmer, established by the Government for the POLONORDESTE program, provide for a nominal interest rate of 7%, unindexed, for both investment and seasonal working capital credits, with the exception of credit for fertilizer purchase which carries no interest charge. Credit for "semi-fixed" investments (work animals, light equipment, etc.) would have a final maturity of up to 8 years, including up to 4 years grace, and for "fixed" investments (land clearing, establishment of permanent crops, small-scale irrigation, etc.) up to 12 years, including up to 6 years grace. Given Brazil's inflation rate, the interest rates adopted by the Government for POLONORDESTE projects are negative in real terms. However, the large majority of beneficiaries would be low-income farmers. Furthermore, credit would be closely supervised and would be made only to farmers also receiving technical assistance. Hence, the chance of mis-allocation of resources is very small. While a substantial subsidy element exists in credit conditions to be applied under the proposed project, the Government did recently eliminate the previous 40% subsidy on the price of credit-financed fertilizer purchases, and the previously available interest-free credit for "modern" production inputs other than fertilizer. During negotiations, assurances were received from the Government that the Central Bank would maintain its arrangements with BB and BNB to act as intermediaries for the credit component, that credit funds under the project would be lent on the terms and conditions of the POLONORDESTE program and that the Government would advise the Bank promptly of any changes in these terms.

4.14 Several aspects of the proposed project should help assure that credit coverage is expanded. Agricultural extension services directed toward the small farmer will be intensified. Also, the Government has instructed the participating banks to give priority to small-scale and landless farmers in utilizing available POLONORDESTE funds, and, for loans under 50 times the Maximum Reference Value (MVR, a periodically adjusted amount equivalent to about the minimum monthly wage, or now roughly US$60), not to require property guarantees, thereby reducing the loan application time and the bank's processing costs for small loans. Sharecroppers or tenants, who with the permission (though not guarantee) of the landowner may now secure institutional credit, have already begun to participate, as was evidenced by initital POLONORDESTE credit results in the project area in 1976. To help assure that the project credit reaches a large number of beneficiaries, Bank disbursements would be limited to sub-loans in which the outstanding seasonal and investment credits for the farmer do not exceed 100 MVR (or about US$6,000). Also, to help assure that the project credit allocations are incremental to and not replacement for existing institutional credit, Bank disbursements for seasonal production credit in a particular year of the project would be made only against amounts of credit in excess of the amount extended during the previous year. Since the amount of incremental working capital credit required during the first year of the project is expected to be quite small, Bank disbursements for this item would begin during the second year.

4.15 The procedures and initiatives established by the Government for expanding credit coverage for small-scale farmers under POLONORDESTE projects have only recently taken effect and should be monitored closely. It is possible that other mechanisms (differentiated or revised interest spreads to banks

to help cover higher administrative costs for small loans; further modifications to loan application procedures or to the role of the extensionist; new bank branches; establishment of compulsory credit insurance or of a guarantee fund for bad debts, etc.) may have to be developed to help ensure that, in fact, substantial increases in the number of small farmers served are achieved. During negotiations, assurances were received from the Government that the effectiveness of the credit promotion, processing and delivery activities would be subject to systematic annual reviews, that the findings and recommendations for any necessary modifications would be provided to the Bank for discussion by November 30 each year, in line with the timing of the preparation of annual project work plans (para 6.04), and that it would carry out such actions as are agreed following the exchange of views.

Land Purchase Credit

4.16 Some 1,000 landless farmers and even more very small-scale owner-operators are expected to participate directly in the extension and production credit aspects of the project. The Government intends to encourage at least some of the participating landless or very small scale farmers to take advantage of the Government's land purchase credit program and thereby benefit to a greater extent from the production increases foreseen under the project. This initiative, which is intended as a means to sharpen the focus of the land purchase credit mechanism as a tool of income redistribution, would be innovative in Brazilian rural development experience as it would be carried out with the support of other aspects of the rural development program and would be closely linked to extension services and cooperative development activities. It would build upon the important recent policy decision taken by the Government to make land purchase credit terms for the small farmer more attractive, and would provide a controlled test of the effectiveness of broader use of the credit by small farmers. Land purchase credit (which, though included in the project costs, would not be subject to disbursements from the proposed Bank loan) would be channelled through local BB and BNB branches. The POLONORDESTE land purchase credit terms and conditions (12% interest, unindexed, with repayment over up to 20 years including up to 6 years of grace, and covering up to 100% of the purchase price) would be applied. It is expected that about 450 (around 10%) of the nonowner-operator farmers or very small-scale owner-operators would benefit over the project period, with individual plots generally ranging in size from 5 ha in the humid zone to 30 ha in the drier carrasco zone. 1/ The credit would be available both directly to individuals purchasing land privately and, particularly for the smaller plots in the humid zone, through cooperatives, which could purchase larger blocks of land for distribution to members. The use of cooperatives as intermediaries and the setting of a modest target number of recipients (allowing the component to be carried out with a relatively low profile) should help avoid land speculation.

1/ 30 ha is the amount of land ("module") defined by the National Institute for Colonization and Land Reform, INCRA, to be the minimum necesary to generate a farm income of four times the annual minimum wage in the average (carrasco) part of the project area. The maximum amount of land that could be individually purchased with POLONORDESTE credit is 6 "modules."

Cooperative Support

4.17 The project will provide for the development and execution of a program of technical and financial assistance to strengthen and enable the expansion of the 4 agricultural cooperatives operating in the project area. At present, they are receiving periodic technical assistance from the area banks (mainly BNB), but they are still mostly in precarious financial condition; membership totals about 1,200 farmers, of whom only about one-fourth are active members. Their generally weak organization and management have precluded the development of potentially broader roles of the cooperatives in such matters as provision of inputs, storage or marketing of produce, in addition to the current activity of credit distribution. A study will be carried out with the assistance of consultants, to define a medium-term program of technical assistance, training and financial assistance (e.g., credit for investments or working capital) suited to the specific needs of the individual coops. Agreement was reached during negotiations that disbursements from the proposed Bank loan be made initially only up to US$25,000 against the costs of the cooperative support component (covering principally the study but also some continued administrative assistance to the cooperatives) with disbursements for the second phase contingent upon agreement between the Government, Bank and State on the action program defined as a result of the study.

Mechanization Services

4.18 The project's production increase will be derived agriculturally from both improvements in yields and significant increases in the area cultivated. The region has relatively higher agricultural potential than most other parts of the state and, with the provision of improved feeder roads and other services, quite dramatic increases in the use of available cultivable land can be achieved. This is evidenced by recent experiences in the area following the opening of several improved roads. However, not all of the necessary land clearing and initial soil preparation requirements are suitable for labor intensive techniques. Also, peak season requirements would exceed the available local labor supply. It is therefore estimated that, while over half the land clearing and initial soil preparation requirements would be met by family and hired labor, the remainder would have to be met through partial mechanization. The number of privately owned farm tractors and amount of related equipment in the project area is still very small. As production and incomes increase, individual farmers will begin to purchase their own equipment, in some cases also selling services to neighboring farmers. Private contractors entering the area as a result of the accellerated overall development can also be expected to provide such services as demand increases. However, to help assure adequate machinery availability during the project's early years and as an interim measure, the project would provide CODAGRO, the state-owned Ceara Agricultural Development Company, with a small stock of equipment (mainly farm tractors and related implements but including several crawler tractors as well for heavier land clearing jobs) to meet part of the early estimated demand by project participants for mechanization services. CODAGRO, which already operates input supply stores in the project area municipalies, has in the past provided mechanization services elsewhere in Ceara, but mostly

with heavy equipment for larger jobs and at a somewhat subsidized price. The state is planning to eliminate the subsidy, and CODAGRO, the state extension company and the project coordination unit are jointly defining means to use, for example, the informal groups of farmers formed for extension purposes as a means to bulk the mechanization requirements of concentrations of smaller farmers and thereby help assure their access to mechanization services. During negotiations, assurances were received from the state that it will enter into an agreement with CODAGRO under which the latter agrees to provide appropriate services, with priority, to the project participants and that it will promptly establish (and make timely adjustments to reflect inflation) user charges covering full operating and maintenance costs (including overhead) and recovery of capital over a reasonable period.

Rural Electrification

4.19 The project would provide for the reinforcement and extension of rural electrification facilities in the Ibiapaba area. Though expected partly to meet traditional household requirements, the investment would serve principally productive uses. Over 75% of the estimated load to be connected would be small motors (used variously for sugar and manioc milling and small scale irrigation). The component would consist of the installation of about 30 km of 69 kV subtransmission lines from the present terminus in Ibiapina north to Tiangua and south to Sao Benedito, with 2.5 MVA substations at each of the latter two cities, and the provision of about 1,000 km of primary (13.8 kV) and low tension distribution lines, transformers, meters and other equipment to serve some 5,000 new rural customers. The facilities would be installed by COELCE (the state electricity company, which is also a beneficiary of part of the proceeds of Bank Loan 1300-BR for the Northeast Power Distribution Project) and contractors. COELCE would retain ownership of and operational responsibility for the subtransmission and primary distribution facilities. CERPI (the recently formed Ibiapaba Rural Electrification Cooperative) would have ownership of and operation and maintenance responsibilities for the low-tension distribution facilities.

4.20 Customers would be required to pay the cooperative a membership fee covering the pro rata share of the low-tension system cost, payable over a 16 year period, including 2 years of grace, with interest of 12% unindexed (the standard terms established by the Government for projects of this type). The Government funding to COELCE and CERPI would be grant assistance. Tariffs for electricity purchased by COELCE from CHESF (Companhia Hidro Eletrica do Sao Francisco, the Government's principal electricity generating company in the Northeast) and sold to CERPI for resale to consumers would be set according to the state's electricity tariff structure which is established to assure COELCE and CERPI continued adequate financial performance and to provide for some cross-subsidization among customers, with slightly lower rates to the smaller, generally lower income, consumer.

4.21 The average investment cost per consumer, about US$1,300, is relatively high, although comparable to similar recent works in Northeast Brazil. Because of these generally high costs, ELETROBRAS (the Government's Electricity Holding Company) agreed in conjunction with Bank Loan 1300-BR to undertake

studies analyzing methods of reducing, within safety limits, total installed costs of rural distribution facilities. During negotiations assurances were received from the state that it would secure COELCE's agreement to apply relevant findings of the study, when available, to any remaining project electrification works. Also, because COELCE does not have adequate experience in international competitive bidding, assurances were received from the Government during negotiations that COELCE would retain suitable consultancy services to assist in the preparation of specifications and bidding documents and bid evaluation for the equipment to be procured through international bidding (see para 5.04). It is expected that COELCE will continue to use for this purpose the services of CAEEB (Companhia Auxiliar de Empresas Eletricas Brasileiras), which it contracted to assist in procurement for the Northeast Power Distribution Project (Loan 1300-BR).

Feeder Roads

4.22 The system for feeder roads in the project area, currently composed largely of poorly drained dirt tracks, would be upgraded to reduce transport costs, assure in many cases year-round usability, help facilitate the proposed modernization and expansion of agricultural production and help increase access to improved social services. The component would include: construction or rehabilitation of about 370 km of earth tracks, 231 km of which would be improved to all-weather standards and the other 139 km provided only with essential drainage and surface improvements but remaining basically dry-season roads; consulting services, satisfactory to the Bank, to assist in the preparation of design, bidding documents and supervision of construction; and the provision of road maintenance tools and equipment.

4.23 The design and construction of the roads would be contracted by the Ceara Highway Consortium (Consorcio Rodoviario), the state controlled company which is responsible for most road construction in Ceara. The design standards would be consistent with those established by the National Economic Development Bank (BNDE) and the National Highway Department (DNER) for the nation-wide feeder road program which is being partly financed by the Bank (Loan 1207-BR). The maintenance equipment would be provided to the State Highway Department (DAER), which is responsible for maintaining state roads and providing mechanized maintenance of rural municipal roads. Tools for other labor intensive maintenance (grass-cutting, cleaning ditches and culverts) would be provided to the municipalities who would continue to be directly responsible for executing this aspect of maintenance. During negotiations, assurances were received from the Government that the project roads would be constructed in line with design standards satisfactory to the Bank; and that, although most of the construction can be expected to be carried out on existing rights-of-way, timely provision of any additional rights-of-way will be made. Assurances were also received that, prior to the construction of the project roads, the state would secure the agreements of the municipalities to provide adequate funding for the continued maintenance of the rural roads in the project area.

Health and Sanitation

4.24 The project would provide for the development of a low-cost, integrated health service delivery system serving the rural population. It would include development of: (i) a system of village health posts (minipostos), intermediate health centers for referral services, and improved existing hospitals, all to strengthen basic medical care and to provide the structure through which public health and nutrition services can be channelled; (ii) an endemic disease control program to reduce the incidence of trachoma and leishmaniasis; (iii) improved water supply and sanitation services; and (iv) health manpower training and administrative support. Implementation of the component would be supervised by the State Secretariat of Health. Other agencies would participate in various facets of the component--SUCAM (the Government's Superintendency for Medical Campaigns) in the endemic disease control program; CAGECE (the Ceara Water Supply and Sanitation Company) and SOEC (the Ceara Superintendency of Works) in the village water supply program; FSESP (a Government Foundation for Special Public Health Services) in the pilot program of latrine distribution and installation; FUNRURAL (the Government's Assistance Fund for Rural Workers) in funding operating costs in the rural health system; and EMATER-CE (the state extension agency) in helping promote the creation of community health committees (which would act as a mechanism for mobilizing community interest and contributions to construction and for recovering from beneficiaries part of the cost of health services and the operating and maintenance costs of the water supply systems) and collaborating in the health and nutrition education efforts of local health workers.

4.25 The proposed loan would help finance the equipment for and the construction or upgrading of 62 village health posts and 7 health centers; the equipment and vehicles required for the epidemiological surveillance system and vector control (mainly house-spraying) program for endemic disease control; the execution of a village water supply study which, among other things, would help complete the inventory of existing wells, locate exact sites for new wells, develop technical norms and standards and annual investment plans; the phased construction and equipping of about 62 simple water supply systems including the provision of community standpipes; the provision of a small stock of maintenance equipment and spare parts for CAGECE's water supply maintenance facility serving the Ibiapaba area; the initiation of pilot programs for the installation of pit latrines and distribution of water filters; the training of health workers; and the costs of staff salary supplements and materials required during the project period for a special health component administration and coordination unit in the Health Secretariat.

4.26 The project health component is one of the Government's initial efforts to integrate the program of various health-related agencies under its new national program to improve health and sanitation services in rural areas (PIASS). The improved health and sanitation conditions, which should benefit a total of about 150,000 people, will play an important complementary role to other project efforts to improve the productivity of the rural poor. The success of the component depends, however, on the active participation of a relatively large number of agencies and the generation of active community

participation. The phasing of project works in individual communities will be closely linked to the interests, needs and commitments of local health committees to be formed. During negotiations, assurances were received that the village water supply survey would be completed and provided to the Bank for comment by December 31, 1977 along with the manual to be prepared by CAGECE for training the local sanitation auxiliaries to be hired by the community health committees to operate and maintain the village water systems. Agreement was also reached that water supply systems would be constructed only in communities (i) where at least 100 families would benefit directly, thereby helping assure a reasonably low investment cost per family and a broad enough consuming public to allow full recovery of operating and maintenance costs; and (ii) where community health committees had already been established and where the committee had agreed to contribute labor and/or materials to the construction of the systems and to maintain and collect user payments to cover operating and maintenance costs.

Education and Community Training

4.27 The project will provide adult nonformal training for farmers and their families, as well as improve and expand formal rural primary education. The project would include funding for the construction and equipping of 8 multi-purpose community learning centers (which would include facilities for nonformal training and a total of 1,280 double shift places for rural primary students) as well as 50 two-classroom rural primary schools (providing an additional 7,000 double shift student places for the first 4 years of primary education); the training of the staff of each community center and of MOBRAL literacy instructors, and the training or retraining of 478 rural primary teachers and supervisors; instructor salaries, materials and transport costs for the adult non-formal training courses during the project period; a special baseline education survey (the terms of reference of which were discussed during negotiations and found acceptable); and salary complements, materials and operating expenses during the project period of a small project execution and coordination unit for the component in the Secretariat of Education. The component will be executed by the State Secretariat of Education with the collaboration of several other agencies, including EMATER-CE (the state extension service) for special agricultural courses for farmers, and gardening, home economics and nutrition courses for their families; MOBRAL (Brazilian Literacy Movement) for adult literacy courses; MEB (the privately operated Basic Education Movement) for artisan craft courses; and PIPMO/ Primary Sector (the Ministry of Labor Intensive Program for Labor Force Preparation, which is now being absorbed into the Ministry's National Service for Rural Training) for occupational courses in masonry, electricity, carpentry and the like.

4.28 Direct beneficiaries of the education and training component would include some 6,800 farmers, 10,000 women and young adults and 8,280 children. The increase in the share of the 7-10 age group in the project area enrolled in primary school would increase from about 30% now to just over 60% by 1981. The quality of primary education should also increase significantly. Currently, only about 10% of the rural teachers in the area have completed

primary school themselves. Although this situation cannot reasonably be expected to be fully corrected immediately, the teacher upgrading program, improved rural education supervision and more rigorous teacher hiring practices to be introduced under the project (and affecting both new and existing rural primary schools in the area) represent a very important first step in improving the area's educational system. The enrollment increase is relatively modest but, together with the necessary increases in rural teachers' salaries to assure adequate compensation for the upgraded teacher qualifications, it would nevertheless result in a significant increase in the recurrent costs of rural primary education. The municipalities, which are normally responsible for financing rural primary education, would not be able to bear the financing burden immediately. The Federal Government therefore intends to participate, on a declining scale over about a 10-year period (initially mainly with POLONORDESTE funds and subsequently mainly with Ministry of Education budgetary resources), in financing the recurrent costs of rural primary education in the project area.

4.29 During negotiations, assurances were received from the State that, prior to starting construction of project primary schools in a particular municipality, it would obtain from the municipality commitments that: (i) the primary school teachers who successfully complete the project teacher upgrading program would be given first priority for employment on a full-time basis (four-hour shift daily) in either the project-financed schools or other rural primary schools in the municipality area and would receive remuneration appropriate to their new level of qualifications according to the prevailing state teachers' salary scales; and (ii) a minimum of 75% of all new rural primary teachers hired by the municipality in the project area would, at the time of entrance, already have at least the minimum qualifications required by the state for teachers it hires. Assurances were also received from the Federal Government that (i) it would provide adequate funding to maintain and operate the facilities provided under the project (see para 5.03); (ii) by December 31, 1977 it would provide, for the Bank's approval, a site plan for all 50 primary schools, taking appropriate account of population densities, existing school infrastructure and other planned project activities; (iii) with respect to the nonformal training subcomponent of the project, by December 31, 1977, the details of the various home economics and vocational training course programs would be provided to the Bank for comment; and (iv) construction of the respective community centers would not be started before the center director is hired (to allow time for training), and the agricultural technicians (who will provide agricultural courses to primary school students) for each center would be appointed and trained before completion of construction. A condition of disbursement for the overall education and training component would be the provision to the Bank of evidence of the acquisition of sites for the community learning centers. Thereafter, disbursements against the phased construction of the individual primary schols would also be conditioned upon provision to the Bank of evidence of the acquisition of the respective sites.

Project Administration, Monitoring and Evaluation and Special Studies

4.30 Though the project would be executed by existing institutions, a special project unit would be maintained in CEPA-CE to coordinate the planning, implementation and control of finances of the project (para 6.02). In addition, a separate unit to monitor and evaluate the project (para 6.07) would be established. The costs of equipping, staffing and providing necessary materials for those units during the five year project period is included in project investment costs. Provision is also made for an estimated total of 42 man-months of consultancy services for technical assistance to the project unit and the monitoring and evaluation unit for specialized requirements such as data analysis or interpretation. During negotiations, assurances were received from the Government that the qualifications, experience, and terms and conditions of employment of the consultants would have to be satisfactory to the Bank.

4.31 The project would also include the execution of semi-detailed soil surveys and water resource development studies in parts of several of the POLONORDESTE "priority areas" in sertao or semi-arid parts of Ceara, and the development of soil conservation studies and recommendations for all POLONORDESTE priority areas in the state. The water and soil surveys would help provide the basis for the definition of rural development projects to be prepared by the state over the next 3-4 years, and the soil conservation work would help assure that appropriate soil conservation techniques are introduced together with the intensified agriculture which forms the core of POLONORDESTE projects. The studies will be contracted to SUDEC, the state's development superintendency, which has experience in this type of work. SUDEC's capacity will, however, require strengthening, particularly in the organization and detailing of work programs and supervision of study execution. Assurances were therefore received that SUDEC would contract consultancy services, satisfactory to the Bank, to assist in the studies. Assurances were also obtained that the detailed work plans for the studies would be provided to the Bank for approval by December 31, 1977. The study costs would include those of incremental staffing, equipment and materials for SUDEC as well as consultancy and other specialized services (aerial photography, etc.) to be sub-contracted.

V. PROJECT COSTS AND FINANCING

Cost Estimates

5.01 The total project cost over the 5 year project period (April 1977-March 1982) is estimated at US$55.8 million which includes physical contingencies 1/ equivalent to 6% of the baseline cost, and price contingencies 2/ equivalent to 24% of the baseline cost plus physical contingencies. Baseline costs have been estimated at appraisal prices 3/. The estimated foreign exchange component is US$10.9 million or about 20% of total project costs. Cost estimates are summarized overleaf, and the phasing of investments is shown in Annex 5.

1/ Physical contingencies of 5% were added to the mechanization component; 7% to the extension, experimentation, and project administration and study components; 10% to the cooperative support, rural electrification, feeder road and education components; and 15% to the health and sanitation component.

2/ Price contingencies were calculated in US$ terms as follows: for civil works, 10% in 1976, 9% per year in 1977-79 and 8% per year thereafter; for equipment, 8% in 1976, 7.5% per year in 1977-79 and 7% per year thereafter; for other materials and supplies, credit, salaries, etc., 9% in 1976, 8% in 1977 and 7% per year thereafter.

3/ Late 1976 Cruzeiros converted to US$ at rate of US$1.00 = Cr$ 11.80.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Total Project Costs
(US$ millions)

	Local	Foreign	Total	% of Total Baseline Costs	% Foreign Exchange
Agricultural Development	11.33	1.94	13.27		
On-Farm Investment	8.29	1.03	9.32	22	11
Incremental Farm Working Capital	3.04	0.91	3.95	9	23
Land Purchase Credit	0.65	0.00	0.65	1	0
Productive Support					
Agricultural Services:	4.93	0.86	5.79		
Agricultural Extension and Demonstration	4.06	0.53	4.59	11	12
Field Experimentation	0.21	0.02	0.23	1	10
Cooperative Support	0.25	0.05	0.30	1	15
Mechanization Services	0.41	0.26	0.67	2	38
Infrastructure:	8.48	3.98	12.46		
Rural Electrification	4.58	1.97	6.55	15	30
Feeder Roads	3.90	2.01	5.91	14	34
Social Infrastructure	4.76	1.03	5.79		
Health and Sanitation	2.05	0.48	2.53	6	19
Education and Community Training	2.71	0.55	3.26	8	17
Project Administration and Studies	3.79	0.42	4.21		
Project Coordination Unit	1.37	0.15	1.52	4	10
Evaluation Unit	0.47	0.05	.52	1	10
Studies for Preparation of Future Projects	1.95	0.22	2.17	5	10
TOTAL BASELINE COSTS	33.94	8.23	42.17	100	20
Physical Contingencies	2.13	0.51	2.64	6	20
Price Contingencies	8.81	2.13	10.94	24 1/	20
TOTAL PROJECT COSTS	44.88	10.87	55.75	132	20

1/ Price Contingencies as percentage of baseline costs plus physical contingencies.

Financing

5.02 The financing of the project costs would be shared as follows:

	Farmers		Government		Bank		Total
	US$mln	%	US$mln	%	US$mln	%	US$mln
	(up to ....)						
Agricultural Development (and credit)	1.6	12	7.6	57	4.1	31	13.3
Land Purchase Credit	-	-	0.6	100	-	-	0.6
Productive Support	-	-	12.7	69	5.6	31	18.3
Social Infrastructure	0.5	9	3.5	60	1.8	31	5.8
Administration/Studies	-	-	2.9	69	1.3	31	4.2
Contingencies	-	-	9.4	69	4.2	31	13.6
Total	2.1	4	36.7	66	17.0	30	55.8

5.03 The proposed Bank loan of US$17 million to the Federative Republic of Brazil would finance 30% of total project costs, up to about 4% of project costs being financed by participating farmers and the balance by the Federal Government under its POLONORDESTE program. The loan would be for 15 years including 3 years of grace. It would cover the project's full foreign exchange costs of US$10.9 million equivalent, as well as US$6.1 million or 14% of the local costs. In a country like Brazil, which is making a vigorous effort to mobilize domestic resources, it would be appropriate for the Bank to give some assistance in financing the local currency expenditures on projects which, as the proposed Ceara project, have very high priority and yet have a relatively low foreign exchange content (in this case 20%). The situation typically arises in agriculture and rural development projects in Brazil in view of the high capability of the Brazilian economy in the production of the inputs required for investments of this type. If the Bank is to be effective in supporting a project of this kind, it seems reasonable for it to finance at least 30% of the costs even though this entails financing some local currency expenditures. During negotiations, assurances were received from the Government that adequate funds would be made available for the effective and timely execution of the project. The Government also agreed to operate and maintain appropriately the facilities and services developed under the project and to assure adequate funding for that purpose.

Procurement

5.04 Farm inputs would be procured by individual farmers through local trade channels. The major items of equipment and materials required for the rural electrification component (around US$2.2 million) would be grouped into sizeable packages for bulk purchasing, and procured through international competitive bidding. Manufacturers of equipment procured through such bidding, whose bid contains components manufactured in Brazil equal to at least 50% of the value of the bid, would be given a margin of preference of 15% or the applicable import duties, whichever is lower. As Brazilian manufacturers of the items are quite competitive, however, few if any foreign suppliers are likely to participate and Brazilian firms are expected to win virtually all contracts. Other miscellaneous equipment and materials (poles, etc.) for the electrification works would be procured through competitive bidding advertised nationally. Equipment for road maintenance, which would be limited to several pieces each of a small number of types of equipment, would be procured by the state highway department also through competitive bidding advertised nationally, taking into account local spare part availability and consistency with currently available maintenance equipment. Tractors and farm implements for the mechanization service would be procured similarly. The total procured in this way over the project period would amount to about US$3.6 million. The various other materials and equipment (including vehicles) required for the extension, experimentation, health and sanitation, education and training and project administration components are also locally produced and readily available. Such items (amounting to a total of roughly US$1.1 million) would be procured in accordance with local procurement and bidding procedures, which are acceptable. Assurances were received from the Government during negotiations that all necessary licenses or permits for items which need to be imported would be granted in a timely manner.

5.05 Construction works (totalling US$4.8 million) for the feeder roads would be divided into three packages (one per year). Contracts for these packages and for the civil works required for the community training centers and rural primary schools (an additional US$2.3 million) would be awarded to prequalified bidders on the basis of competitive bidding advertised locally and in accordance with satisfactory procedures. Brazil has a competitive local construction industry capable of carrying out the project works. Since the individual construction works are relatively small, foreign contractors are not expected to be interested, though they would not be excluded from bidding. All of the other construction works included in the project (for health posts, water supply and latrine installation and the like, and totalling some US$1.9 million) would be of very minor size and varied design and would be geographically dispersed. Consequently, these would be carried out through a combination of self-help, force account and local bidding.

Disbursements

5.06 The proposed loan, which would finance 30% of total project costs, would be disbursed against all project expenditures except land purchase credit. Bank disbursements would, therefore, be equivalent to 31% of expenditures for each component other than land purchase. Disbursements would be made to the Central Bank of Brazil, the fiscal agent for the POLONORDESTE

program, against withdrawal applications covering statements of expenditures initiated by the various implementing agencies under the project and certified by the Project Unit in CEPA-CE. Supporting documentation for credit, salaries, administrative expenses and minor construction under force account would not be submitted to the Bank but would be retained by the Project Unit and made available for inspection by the Bank during the course of project supervision missions. Standard documentation covering civil works, vehicles and equipment and technical assistance would be submitted to the Bank. Details of the documents required were reviewed during negotiations. Disbursements are expected to occur over about five years. The estimated disbursement schedule is given in Annex 6.

5.07 To help assure a prompt start of the project, various activities such as the recruitment and training of staff for the project unit and extension service, the engineering design of feeder roads and hydrological surveys to locate water supply sources, the initiation of on-farm investments and provision of credit will have begun during the first half of 1976. For this reason, retroactive financing of up to US$500,000 equivalent is proposed to help cover eligible expenditures after March 31, 1977, but before the loan is signed.

Accounts and Auditing

5.08 Each of the participating agencies would maintain accounts of its project expenditures, which would be audited annually by Government auditors (Inspetoria Geral das Financas, IGF) according to standard Government practice for POLONORDESTE projects. Both Banco do Brasil and BNB are audited by the Central Bank's auditing unit (Divisao de Auditoria da Contadoria Geral) and BNB is also auditied by satisfactory independent auditors. The state POLONORDESTE technical unit would maintain accounts of its own project expenditures as well as statements of expenditures by each participating agency. Copies of the audited statements of project accounts of the various participating agencies and of the audited statements of the participating banks and of their lending under the project would be provided to the Bank through the state POLONORDESTE technical unit, within six months of the end of their fiscal year. During negotiations, assurances were obtained to that effect.

VI. ORGANIZATION, MANAGEMENT AND IMPLEMENTATION

Overall Project Administration

6.01 The various investments and actions included in the project would be executed by existing agencies (EMATER-CE, the participating banks, EPACE, CODAGRO, the State Secretariats of Public Works, Health and Education, COELCE, etc.) as described in paragraphs 4.07-4.29. To help assure the continued full collaboration of each agency in this and eventually other POLONORDESTE projects in Ceara and to provide overall policy guidance and general control, the state government had created a special Management Council (Conselho Diretor) composed of high level representatives of the principal agencies involved (see Annex 4).

6.02 To provide day-to-day coordination of the different project activities, to integrate the annual project operating plans of the participating agencies and to monitor and evaluate project progress, the management council depends on specially appointed teams located in CEPA-CE, the state's agricultural planning commission. The teams' work is generally supervised by the manager (General Coordinator) of CEPA-CE, who reports to the management council through the State Secretary of Planning. However, as the responsibilities of the General Coordinator of CEPA-CE include other agricultural planning activities in the state, a full-time technical coordinator for the state's POLONORDESTE program has been appointed to direct and supervise day-to-day activities. The technical coordinator heads a unit which includes: (i) specifically for the Ibiapaba project (and separately for each of the other POLONORDESTE sub-regional projects in the state), a project manager who would have a team of 3 assistants, working respectively with agricultural components (extension, experimentation, etc.), production support components (marketing, credit, etc.) and social infrastructure components (education and health), and a field project coordinator living in the project area; and (ii) a very small "in-house" support unit or pool of technical advisors in specialized areas such as marketing, storage, mechanization, rural electrification, feeder roads and other areas as necessary, to act as liaisons with the various specialized executing agencies in the conceptualization and coordination of all the POLONORDESTE projects in the state, and a small general financial control staff also to service all of the projects. In addition, a separate monitoring and evaluation unit, again to work with all POLONORDESTE projects in the state is being established in CEPA-CE, but it will answer directly to the General Coordinator of CEPA-CE. This general scheme is outlined in Chart 3 of Annex 4. Although the POLONORDESTE staff is located in the state agricultural planning commission it will not be involved in the other agricultural planning functions of CEPA-CE. The main positions in the pool of support specialists and all of the positions in the Ibiapaba project team have already been filled. Agreement was reached during negotiations that the State would adequately support the various state agencies participating in the project and, more specifically, would take all steps necessary to support and maintain the state POLONORDESTE technical unit as described above.

6.03 The state hopes within the next several years to have prepared and begun execution of projects in several of its POLONORDESTE priority areas. It would be very difficult (e.g., to find staff) and also inefficient to create large separate coordination units for each project. While actual execution of the various project interventions should remain the function of existing agencies and those agencies should become increasingly prominent in the planning both of long term project objectives and yearly operating plans, a strong overall project coordination is nonetheless nescessary to assure consistency and appropriate timing of each project's activities. Furthermore, although the relevant administrative headquarters (and, hence, much of the decision-making) of most of the participating agencies are in Fortaleza, the project area is some 300 km away, thereby necessitating project coordination in the field as well as at the state level.

6.04 Since the overall project covers a wide number of related activities, and the timing and scope of some will undoubtedly require adjustment as experience is gained, a certain amount of flexibility in project execution will

need to be maintained. For this reason, and to help assure continued timely budgetary support, each participating agency would prepare jointly with the Project Manager and his team an annual plan detailing the activities and expected expenditures under the project for next year. The yearly planning period will correspond to the April 1 - March 31 fiscal year for POLONORDESTE. The integrated package of annual plans, as reviewed and approved by the state POLONORDESTE Management Council (Conselho Diretor) is submitted to the regional and federal POLONORDESTE commissions as the basis for the yearly budget allocations. Agreement was reached during negotiations that the annual plans -- which provide the critical operational detail needed to implement, and as necessary adjust, the initially defined longer term project actions -- would be submitted to the Bank by November 30 each year for review and comment.

Operating Agreements

6.05 Consistent with a commonly used system in Brazil, the state would enter into convenios or written agreements with certain of the executing agencies to specify their respective responsibilities under the project and help assure timely project completion. Such convenios are normally utilized in POLONORDESTE projects: (i) when the executing entity concerned is not directly part of or responsible to the Ministry of Agriculture or the State Government, the principal channels for POLONORDESTE funding other than credit; (ii) when the executing agency is largely autonomous; or (iii) when special responsibilities (e.g., counterpart funding, adoption of new procedures) need to be spelled out. In the proposed project, convenios will be a particularly useful tool in assuring adequate participation of and coordination among the numerous entities participating in the health and education components (both of which also require special counter-part actions by the local municipalities), and will also be used for the feeder road and mechanization components. Draft convenios for these components have been reviewed by Bank staff and are satisfactory. During negotiations, assurances were obtained from the state that it would enter into and maintain during the project execution period all such agreements as are necessary to assure active cooperation of the various agencies participating in the health, education, feeder road and mechanization components. Receipt by the Bank of the respective signed agreements would be a condition of disbursement for each of these components.

Implementation Schedule

6.06 The phasing of project activities is summarized in Annex 4. Activities under the extension, experimentation, on-farm development, land purchase, rural electrification, health and sanitation, and education and training components will be executed over the entire five year project period. Construction of feeder roads will be concentrated in the first three-and-a-half years and of the community learning centers over the first two years. The purchase of machinery for mechanization services and the execution of the cooperative support component would also be during the first half of the five-year project period.

Reporting, Monitoring and Evaluation

6.07 Based on the targets outlined in the respective yearly operating plans, each executing agency will prepare quarterly progress reports. The

project manager will compile these reports and submit them to the regional POLONORDESTE commission for review. These reports would also be provided to the Bank. In addition to these periodic reporting arrangements, handled by the state POLONORDESTE technical unit, CEPA-CE will maintain a special monitoring and evaluation unit which will focus particularly on evaluating the impact of various project components in the project area and the performance of the participating agencies, and on helping identify modifications which might need to be introduced in the project. The monitoring group, which would be staffed with several full-time professionals with social and economic research experience and a small administrative support staff, would work closely with the project management team, although it would not have direct project administration or coordination responsibilities. The monitoring and evaluating unit would be assisted by consultants as necessary in work design, data-processing, analysis and interpretation. The monitoring and evaluation effort takes on additional importance in view of: (i) the state's intention to use experiences from the Ibiapaba project in helping guide formulation and execution of POLONORDESTE projects in other parts of Ceara; and (ii) the desirability of being able to identify quickly (and adjust the project to take account of or offset) any unexpected side effects of the project, as the project will stimulate significant changes in the project area economy.

VII. BENEFITS AND JUSTIFICATION

Incremental Production

7.01 The incremental production by project participants at full development of the project (excluding the incremental coffee production induced by the parallel IBC program), or by about year 13, would amount to over US$ 14 million equivalent per year, compared to pre-project production estimated at some US$3.4 million (also excluding coffee). In terms of value, approximately 20% of the increased production is accounted for by beans; about 14% by manioc; about 12% each by sugarcane, passion fruit and peanuts; about 10% each by vegetables and citrus; and the remainder by avocado, corn and annato. The overall production increases (some 45% generated in the humid zone and 55% in the carrasco zone) reflect gradually improved yields and a phasing into production over some 8 years of a substantial amount of new land.

7.02 The estimated yield increases (see Annex 7) vary considerably by crop. Initial improvements in production techniques would be based on simple recommendations largely reflecting the practices already adopted by better farmers in the project area. The recommended "technical packages" (including use of improved seeds, better timing of planting and better plant spacing, appropriate application of organic and inorganic fertilizer and of variously required pesticides and fungicides, etc.) would be disseminated through an expanded and improved extension service and also an extensive system of demonstration plots. The packages would be improved gradually with results from the project experimentation program, and, over the longer run, reinforced by the adaptive research program already begun by EPACE at its new research station in the project area. In most cases -- and especially

for several crops such as manioc, avocado and citrus -- adoption of relatively simple improvements in management practices and application of improved inputs (more readily available with increased credit penetration and more widely recognized as a result of technical assistance and demonstration) should result in significantly improved yields.

7.03 Both the yield improvements and the increase in the area cultivated are closely linked as well to certain key off-farm investments. The development of an improved feeder road network, for example, is expected to have much the same impact as would the construction of such roads in a settlement project. Production increases near several recently constructed roads in the project area have already demonstrated the rapid rate at which the area's farmers are prepared to respond to the important incentive of easier access to inputs and especially to better markets. This incentive is being further strengthened by the recent construction of a produce trans-shipment market in the project area, and planned improvements in local storage and processing capacity (see para 7.05). The planned provision of certain mechanization services should also help overcome the physical limitations to increased cultivation.

Markets and Prices

7.04 The proposed project would involve the participation of a large proportion of the farmers in the project area, and, as a result, the overall project area production of some crops (particularly fruits, vegetables and peanuts) would increase several-fold. However, with the exception of peanuts, which so far have been produced on only a small-scale in the state, incremental project output would represent for most of the crops concerned well under 10% of existing state-wide production and a much smaller percentage of nation-wide production. In the case of peanuts, production would be mainly for oil processing, and the state already produces cotton seed and castor oil. It is expected that most of the project's incremental production would serve consumption centers outside the project area in the state of Ceara and in the neighboring states of Piaui and Maranhao. Several major urban areas (including Fortaleza, Belem, Terezina, Sao Luis and Sobral) are among the terminal markets. Only annato would be exported directly from Brazil by wholesalers buying in the project area. However, the project production of peanuts (to be processed for oil) and sugar would also, at the margin, affect the balance of payments through an increase in Brazil's exportable vegetable oil and sugar and a reduction in petroleum imports (much of the sugar may be converted to alcohol and used as an additive to gasoline).

7.05 The marketing process in the project area (see Annex 7) has traditionally depended heavily on an intricate network of middlemen, farmer-merchants, truckers and municipal "open markets". The relatively high assembly and transport costs of the system have been reflected in considerable margins between farmgate and wholesale prices (the latter 25-100% higher than the former). Sugar and manioc are traditionally processed locally in numerous small and very simple on-farm mills scattered throughout the area. The principal changes foreseen over the next several years in the marketing patterns and facilities in the project area include: an increased use of the recently completed transshipment market at Tiangua for the sorting and assembly of fruits

and vegetables for shipment to population centers for fresh consumption or to (mainly) Fortaleza for processing by one of the several food processing firms currently with excess capacity but already beginning to buy produce from Ibiapaba; processing of a large part of incremental sugarcane production in a new private mill for alcohol production already approved by the Brazilian Sugar and Alcohol Institute (IAA) for construction (with BNB financing now being arranged by the private interests concerned) by 1979/80 in Ibiapina in the project area; the shipping of peanuts from the project area for use in oil processing facilities in Ceara and other states; and the use by project area farmers of a new 3,000-ton storage facility to be built in the area by CIBRAZEM (the Government's storage company) in 1977 for seasonal storage of bean and peanut production.

7.06 Since the incremental project production represents a relatively small part of the total supply of the broad (state- and region-wide) markets to be served, the additional production is not expected to have a negative effect on prices. The project improvements to feeder roads, together with parallel improvements in marketing facilities and immediate markets (e.g., assembly and sorting services at the transshipment market, storage at the CIBRAZEM warehouse, sugar processing eventually at the new alcohol plant at Ibiapina) and hence reductions in marketing costs should help protect the farmer from unforeseen decreases in farmgate prices and in some cases could result in increased farmgate prices. However, the projected market prices assumed (see details in Annex 7) in the analyses of representative farm models were conservatively based largely on average farmgate prices over the 1974-76 period which, with one main exception (peanuts), were consistent with Bank world-wide commodity price projections. In the case of peanuts, it was projected that recently high local prices would decline to prices consistent with the Bank's projections for that product.

Producer Income and Employment

7.07 The estimated 5,800 participating farmers would derive substantial income benefits from the project investments in on-farm development and in improved agricultural services and infrastructure support. These benefits would include increased family employment, improved subsistence and increased cash revenue from marketed production. Taking into account the proposed development pattern, the project would generate increased agricultural employment opportunities equivalent to some 6,020 worker-years annually. The producer income and employment benefits would be complemented by significant non-quantifiable social benefits to the rural population as a whole arising from the project-initiated improvements in health, education and training services in the project area.

7.08 Financial rates of return to the farmer ranging from 22% to over 50% have been calculated (see Annex 8 for details) on the basis of 8 illustrative farm models representative of production patterns on different sized operations in the two principal ecological zones of the project area. For one of the 8 models (a sharecropping operation), alternative models were prepared to allow a comparison between the sharecropper's situation buying land and not buying land.

The analyses considered as costs the on-farm investments (for land clearing, initial soil preparation, purchase of small equipment, etc.), the expected incremental operating costs of the farm, and, in the cases in which previous sharecroppers would buy land, the cost of the land purchase. Benefits included all incremental production. In the case of the sharecropper purchasing land in the carrasco or dry zone, where Government-financed land purchases would have to exceed the regulated minimum of 30 ha and the sharecropper is unlikely to be able to use for some years nearly that amount, benefits included a roughly estimated rent income for a small portion of the land which it is assumed the new owner-operator will rent out or have sharecroppers farm. Prices for inputs, hired and family labor and production sold were assumed to be prevailing local market price averages (with the exception of peanuts and fertilizer for which local prices are expected to decline). Testing the viability of the models as to price and cost sensitivity under various assumptions gave the following results:

	Carrasco Zone				Humid/Sub-Humid Zone				
	producing mainly beans, manioc, peanuts and annato				producing variously beans, corn vegetables, sugarcane, coffee and fruits				
					Sharecropper				
Financial Rate of Return	Sharecropper Buying 30 ha	Owner-Operators with up to 10 ha	10-25 ha	25-200 ha	Not Buying Land	Buying 5 ha	Owner-Operators with up to 10 ha	10-25 ha	25-200 ha
Best Estimate	22	23	28	38	>50	47	>50	>50	>50
With Costs Up 10% and Production Down 10%	11	10	9	16	48	34	>50	>50	41

7.09 Table 11 in Annex 8 summarizes the producer benefits and Tables 2 through 10 provide detail of the calculations by model. Because coffee production will be particularly important for some of the farmers in the humid zone, coffee production activities were included in two of the representative farm models (though the related costs and production benefits of the separately financed IBC coffee expansion program were then excluded from the calculation of total project costs and the overall economic rate of return on the project). Prior to the project, the average annual family income (including assumed family labor income) from agricultural activities on the prospective participant farms was about US$425 (ranging from a weighted average of about US$110 in the carrasco zone to US$1,015 in the humid zone). Of the some 5,800 expected participants, less than 10% are currently estimated to have incomes above the relative poverty level in Brazil (around US$1,600 per family or US$300 per capita). Within about nine years of participating in the project, the families are expected to have increased their incomes to a weighted average of about US$3,860 (ranging from a weighted average of about US$1,255 in the carrasco zone to about

US$8,760 in the humid zone). 1/ These income increases, although they appear very high, are in part due to the fact that some of the crops to be produced (especially fruits and vegetables) provide unusually good returns and have very good market prospects. The estimated increases in cash income could even be understated to the extent that conservative estimates have been assumed for farm-gate prices (para 7.06), and the real debt service burden to the farmer would be deflated since credit would not be indexed to offset inflation (para 4.13). Also, particularly the participants with smaller operations are likely to have some additional income by working as laborers on other farms. On the other hand, in cases where incomes are expected to reach quite attractive levels more quickly (namely, farmers in the humid zone who expand production of "project crops" and coffee), the proposed limitation of Bank loan disbursements against agricultural credit only to sub-loans up to an equivalent of about US$6,000 outstanding per farmer (see para 4.14) would help limit the extent to which the proposed Bank loan would be providing subsidized credit; once a farmer's operations reach a size requiring credit in excess of about US$6,000, the Government would have to finance the credit with its own resources. Overall, the relatively high financial rates of return to participating farmers reflect the importance of improved production inputs and practices (rather than high on-farm investments) and of critical off-farm investments (especially feeder roads and marketing facilities) in generating the production increases.

7.10 It should be noted, of course, that the cases analysed are only representative models to help approximate the impact of the project on individual farmers and to help estimate project costs. The individual situations of farmers in the project area vary widely in practice, among both owner-operators and sharecroppers. Particular care must be taken in making generalized assumptions regarding the situation of sharecroppers, since numerous different arrangements in sharing costs and benefits exist. For example, although only one model is shown for the sharecropper from the carrasco zone (that model assuming land purchase), many of the expected sharecropper participants will not buy land or necessarily be responsible for providing all of the investments or production inputs required. As a result, the total project cost estimate for land purchase credit provides for land purchase by only a portion of the sharecroppers and very small-scale owner-operators.

Economic Analysis

7.11 Various aspects of the project, particularly social investments (see para 7.14), would have significant benefits which are not readily quantifiable; for those parts of the project, an economic rate of return was not calculated. However, for the agricultural components, the economic rate of return is estimated at 21%. The details of the cost and benefit streams are given in Annex 9.

1/ Excluding coffee activities, the overall weighted average incomes would be about US$365 (US$845 in the humid zone) pre-project, increasing at full development to about US$2,050 (US$3,550 in the humid zone).

The benefit stream includes all of the incremental project crop production of the project participants. The cost stream includes all on-farm project investments and incremental operating expenditures as well as, for certain other project investments and continued operating costs, that estimated proportion of the costs linked to the quantified agricultural benefit stream. This adjustment reflects the fact that some project investments and costs would contribute to important but difficult to quantify benefits (increases in non-project production of livestock, coffee or other crops generated as a result of improved overall farm management, increases in production of "non-participating" farmers through demonstration effects, improved social welfare and nutrition, etc.) in the project area or in projects in other areas. Therefore, the costs incorporated in the cost stream for the economic analysis of the Ibiapaba project were those roughly estimated to be linked with the quantified benefits, and included 90% of extension costs, 70% of field experimentation, feeder road construction and maintenance equipment, initial equipment for mechanization services, cooperative support, and project administration costs; 50% of project monitoring and evaluation costs; and 20% of the soil conservation study costs. The economic rate of return of the rural electrification component (see para 7.13) was calculated separately.

7.12 In general, it was assumed that market prices for inputs, labor (including family labor) and production closely reflected the efficiency or accounting price, although foreign exchange costs and benefits were adjusted upward by 25%. The effect of the efficiency pricing of foreign exchange was, however, marginal (using market prices the rate of return is 19%), since, for the agricultural aspects of the project, the foreign exchange component of the cost streams is relatively small and not widely different from the foreign exchange component of the benefit stream. The economic rate of return on the agricultural components would decrease to 16% with a 10% decrease in production or a 10% increase in all on-farm and off-farm costs; to about 11% with a combined 10% increase in costs and 10% decrease in benefits; and to about 14% if 100% of all off-farm costs (excluding investments in social services) were charged to the quantified benefit stream even though that stream does not capture all of the likely, but very difficult to quantify, benefits of the project investments. The combined economic rate of return for the agricultural and rural electrification components (the calculation incorporating some 72% of total project costs since costs of social components and of parts of other components with non-quantified benefits were excluded) is about 19%.

7.13 The economic justification of the rural electrification component, for which benefits separable from those purely agricultural can be quite readily identified, rests primarily in the net savings to be gained in the conversion from use of diesel powered motors to the use of electrically powered motors in such activities as sugar and manioc milling and small scale irrigation. The economic benefit is accentuated by the fact that Brazil is a heavy importer of fuel, but has relatively abundant hydro-electricity resources. A second principal type of benefit to the some 5,000 expected new customers would be that associated with additional domestic consumption (for lighting, ironing, etc.), its value measured (as a minimum) at the retail value of the electricity used for this purpose. Discounting the cost and

identifiable benefit streams at efficiency prices (foreign exchange at 25% above the official rate), the internal economic rate of return would be about 17%, dropping only to 13% with an increase in the costs of the investment and the purchased electricity by 20%. These estimates are probably understated since, for example, conservative assumptions on the number of customers per kilometer of line were used; the retail price of electricity probably understates the real value to households; possible tax receipts (imposto unico) on consumption of over 30 kWh/month were not quantified in the benefit stream; and the costs of equipment were not reduced by their tax components because of the difficulties in making a meaningful estimate.

7.14 The benefits of the social infrastructure components which would accrue to the area's some 150,000 rural population are very difficult to quantify. However, it can be assumed that the training activities will play a significant part not only in helping achieve the project production targets but also in improving the income prospects and social welfare of the area's population. With respect to the improved health and sanitation services, it is apparent that they too will not only contribute to social welfare but will also be highly complementary to the directly productive investments of the project. Better health would increase labor availability and productivity, improve learning ability and avoid treatment costs. In addition, improvements in the health services are perceived by rural communities as priority needs and thus afford opportunities to organize the community through participation in their development. This in turn is likely to facilitate acceptance of other components of the rural development package. In addition, in both the training and health components, emphasis on community participation and low-cost design (project investments, including contingencies, averaging about US$170 per potential benefitting family for education and training and about US$130 per benefitting family for health and sanitation) should help allow replicability in other areas.

Fiscal Impact

7.15 The costs of the project's agricultural investments and services over the five-year implementation period (including contingencies) would average roughly US$4,500 per direct beneficiary family. This, however, overstates the cost to the extent that the agricultural activities would generate important demonstration and employment benefits to area residents outside the core agricultural target group of 5,800 families. The sum of all other project investments (mainly physical and social infrastructure) will benefit the area's rural population as a whole, at an average per family cost of some US$1,200. The bulk of the project beneficiaries have incomes below the relative poverty level in Brazil (which was roughly US$300 per capita in 1976). Of the estimated US$37 million total in "off-farm" project costs (i.e., those other than on-farm investment, incremental farm working capital and land purchase), it is expected that around US$12 million (about one-third) will be recovered through a combination of direct financial contributions by beneficiaries (particularly in the health and sanitation component) during the execution period, connection charges for electrification services and various direct and indirect user charges and taxes. The extent to which on-farm project costs will be recovered in real terms is, however, very difficult to estimate because of the current inflationary environment in Brazil and the

Government's policy to provide unindexed agricultural credit. Assuming a gradually declining though continuing moderate inflation, real recovery of on-farm project costs could well be less than half. On the other hand, either a more rapid decline in inflation or a continuation of the gradual reduction in the size of agricultural credit subsidies (a process in which initial, though still marginal, steps were recently taken by the Government) would result in higher real cost recovery. Although the increased production of the beneficiaries of the project would probably enable them to bear the the burden of positive real interest rates for credit received, the Government has so far chosen, particularly in view of the relatively low incomes of the target beneficiaries for programs such as POLONORDESTE, to maintain a considerable subsidy element in the agricultural credit component.

7.16 Following the disbursement period, the project investments would give rise to additional recurrent costs to the Government on the order of US$2.06 million per annum. These expenses would be incurred principally for agricultural extension and experimentation, but would also include some residual project administration costs as well as the continued operating costs of the improved health system and the training and formal education facilities. The additional recurrent expenditures are expected, however, to be largely offset by additional revenues of roughly US$1.86 million annually generated as a result of the ICM and FUNRURAL taxes which would apply to incremental production from direct participants in the agricultural components of the project. The costs of continuing other project-related services (electricity, mechanization, etc.) would be recovered by direct user charges.

Ecological Impact

7.17 As a result of the project, the area under cultivation in Serra da Ibiapaba by project participants (around 60% of project area farmers) would increase considerably, though about 28% of new lands placed into production would be planted in permanent or tree crops. Land management would, in general, be improved as a result of the intensified technical assistance and encouragement of cultivation systems providing for erosion control. This improvement would be further reinforced by the improved soil conservation techniques which should gradually emerge from the soil conservation studies included in the project. The village water supply and other aspects of the health component should make a considerable contribution to improved public health and sanitation in the project area.

Project Risks

7.18 The project's success will depend on the timely implementation of a wide variety of investments and activities in various sectors by numerous agencies. The risk of not achieving adequate coordination and active participation should, however, be lessened by the arrangements already made by the state to involve directly high level officials of the principal participating agencies in the state's POLONORDESTE management council and to establish a special project administration unit. Another type of risk lies in the fact that the experience of the participating agencies (e.g., extension service, banks) in carrying out large programs directed specifically and intensively at small-scale farmers are relatively recent. Hence, it is possible

that, for example, the steps proposed to achieve greater extension and credit coverage will prove to be inadequate or not fully appropriate. The preparation and review of detailed annual work plans with each participating agency and the carrying out of project monitoring and evaluation should help resolve problems which might arise in this regard. The economic return of the project is relatively sensitive to changes in production costs and produce prices, though it is believed that adequately conservative estimates have been made to minimize the probability of substantially lower than expected returns. Overall, the potential of the project to benefit some 30,000 lower income people with its directly productive components and up to 150,000 with improved health or education services, and to strengthen the project execution capacity of institutions which serve the rural poor make the project risks well worth taking.

VIII. RECOMMENDATIONS

8.01 During negotiations, assurances were obtained from the Federal Government that:

(a) project credit would be lent through Banco do Brasil and BNB under POLONORDESTE terms and conditions and the Government would advise the Bank promptly of any changes in those terms (para 4.13);

(b) it would review annually the effectiveness of the project credit promotion, processing and delivery activities, provide the Bank with its findings by November 30 each year for an exchange of views and subsequently carry out such actions as are agreed (para 4.15);

(c) it would provide the Bank, for agreement, the details of the medium term cooperative assistance program to be proposed after completion of the special cooperative study (para 4.17);

(d) consultants for assisting in the international procurement for the electrification component, the design, contracting and supervision of road works, project administration and evaluation, and the organization and supervision of execution of special soil and water studies would be contracted on terms and conditions satisfactory to the Bank (paras 4.21, 4.22, 4.30 and 4.31);

(e) project feeder roads would be constructed according to agreed design specifications (para 4.23);

(f) insofar as additional land or rights-of-way for project works prove necessary, it will assure timely provision thereof (para 4.23);

(g) by December 31, 1977 it would provide to the Bank, for comment, the report on the village water supply survey and feasibility study and the draft training manual for village-level sanitation workers (para 4.26);

(h) the village water supply works would be carried out only in communities satisfying specified selection criteria (para 4.26);

(i) by December 31, 1977, it would provide the Bank, for comment, the detailed plans for the home economics and vocational training courses, and, for approval, the site plan for the 50 new primary schools (para 4.29);

(j) prior to construction of the respective project community learning centers, qualified center directors would be contracted, and, prior to completion of construction of each center, the agricultural technicians who would be on the staff of the center would be hired and trained (para 4.29);

(k) by December 31, 1977 it would provide the Bank, for comment, the detailed terms of reference and work programs for the soil and water resource and soil conservation studies (para 4.31);

(l) it would provide adequate funding to assure timely and effective execution of the project and adequate operation and maintenance of the facilities and services developed under the project (para 5.03);

(m) it would provide, in a timely manner, any required import permits or licenses (para 5.05);

(n) it would provide the Bank with appropriate periodic audit statements (para 5.08);

(o) by November 30 each year, it would provide the Bank for review and comment the project work program for the following year (para 6.04); and

(p) it would provide the Bank quarterly project progress reports (para 6.07).

8.02 During negotiations, assurances were obtained from the state of Ceara that:

(a) it would maintain and develop agricultural research activities at the Tiangua station adequate to the project needs (para 4.09);

(b) it would cause CODAGRO to develop mechanization services appropriate to the needs of the participating small farmers and to establish satisfactory user charges (para 4.18);

(c) prior to the installation of project rural electrification works, it would secure COELCE's agreement to apply to project works, as appropriate, the results of the ELETROBRAS study to reduce rural electrification costs (para 4.21);

(d) prior to the construction of project feeder roads, it would enter into agreements with the respective municipalities defining maintenance responsibilities (para 4.23);

(e) prior to construction of the project primary schools, it would enter into agreements with the respective municipalities assuring priority placement of project-upgraded teachers, appropriate salaries for upgraded teachers, and minimum standards for new teachers hired (para 4.29);

(f) it will adequately maintain the project administration unit and support the other state agencies participating in the project (para 6.02); and

(g) it will enter into and maintain all such special agreements as are necessary to assure full and active cooperation of the various agencies participating in the health, education and feeder road components (para 6.05).

8.03 A condition of disbursement for the overall education and training component would be the provision to the Bank of satisfactory evidence of the acquisition of sites for the community learning centers and a condition of disbursement for rural primary schools would be the provision to the Bank of satisfactory evidence of the acquisition of the respective sites (para 4.29). A condition of disbursement for the health, education, feeder road and mechanization components would be the provision to the Bank of the agreements between the state and the agencies participating in the respective component (para 6.05).

8.04 Subject to the above assurances and conditions, the project would be suitable for the Bank loan of US$17 million equivalent with a term of 15 years, including a 3 year grace period.

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

PROJECT AREA SUMMARY DATA

1. This annex supplements the information given on the project area in Chapter 3 of the report. It includes additional statistical background on physical and climatic features, demographic aspects, employment and agriculture. Additional statistical information on social and economic infrastructure and services is given in the respective annexes dealing with those subjects (Annexes 2-3 and 11-16).

I. PHYSICAL AND CLIMATIC FEATURES

A. Physical Characteristics

2. The Serra da Ibiapaba is a plateau of about 4,785 km^2 in area of which a strip 10 to 20 km wide forms a distinct ecological unit called the Humid Zone. West of this zone lies the second major ecological area of the region termed the Scrubland (Carrasco) Zone. The topography of both areas is largely flat to rolling and the altitude varies between 500 and 800 meters.

B. Climate and Rainfall

3. The average temperature is 26°C in the lower areas and 22°C in the higher ones; relative humidity is 70% to 75%. Rainfall in the project area is relatively high, reaching a maximum of 1,900 mm/year in the southern part of the humid zone while a minimum rainfall of 1,100 to 1,300 mm/year occurs towards the eastern and western boundaries of the project area. The months of heaviest rain are March and April and 88% of the annual rainfall occurs in the five month period, January to May.

4. A special analysis was made of rainfall data gathered over a period of 56 years at three of the meteorological stations existing in the Project Area. The stations included the Viscosa do Ceara, Ibiapina and Guaraciaba do Norte stations (representing the northern, central and southern parts of the project area, respectively). A calculation of the minimal probable precipitation average showed that in 75 out of 100 years the annual average rainfall was equal to or higher than 1,045 mm in Viscosa do Ceara (annual average 1,318 mm), 1,212 mm in Ibiapina (annual average 1,524 mm) and 722 mm in Guaraciaba do Norte (annual average 1,242 mm). The analysis showed that the inter-yearly rainfall variation is relatively low, that rainfall is relatively homogenous and occurs with regular yearly punctuality. The low rainfall variation was also confirmed by the yearly rainfall variation coefficients which were found to be as follows: Viscosa do Ceara, 32.5%; Ibiapina, 35.0%; Guaraciaba do Norte, 45.7%. More details are given in the following table.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Precipation and Evapotranspiration

Station	Month	J	F	M	A	M	J	J	A	S	O	N	D	Year
Viscosa do Ceara	Precipitation (P)													
	average	140	254	335	283	152	53	17	6	3	8	15	52	1,318
	quantil (0.75%)	68	147	233	199	58	13	0	0	0	0	0	0	1,045
	Evapotranspiration (ETp)	139	109	99	90	93	99	116	134	144	154	148	147	1,472
	P - ETp	+1	+145	+236	+193	+59	-46	-99	-128	-141	-146	-133	-95	-154
Ibiapina	Precipitation (P)													
	average	156	266	371	348	188	61	25	12	7	9	23	58	1,524
	quantil (0.75%)	72	152	226	227	96	22	3	0	0	0	0	3	1,212
	Evapotranspiration (ETp)	113	89	81	72	76	80	94	109	117	126	120	129	1,206
	P - ETp	+43	+177	+290	+276	+112	-19	-69	-97	-110	-117	-97	-71	+318
Guaraciaba	Precipitation (P)													
	average	113	201	316	305	156	56	21	8	2	5	18	41	1,242
	quantil (0.75%)	13	99	167	169	65	3	0	0	0	0	0	0	722
	Evapotranspiration (ETp)	171	134	122	111	115	121	143	165	177	190	182	181	1,812
	P- ETp	-58	+67	+194	+194	+41	-65	-122	-157	-175	-185	-164	-140	-570

Sources: 1. Precipitation: SUDENE DRN - Dados pluviometricos mensais "en Natura."
2. Evapotranspiration: HARGREAVES, G.H. "Potential evapotranspiration and irrigation requirements for Northeast Brazil."

C. Soils

4. The humid zone, accounting for 20% of the project area, has the best potential for agriculture. About half of this area is composed of Red Yellow Dystrophic Latosol soils which are deep, porous, friable soils with good internal drainage. Their main limitations are low natural fertility, high acidity and, due to their porosity, low water retention capability. The other half of the humid zone consists of Red Yellow Equivalent Eutrophic Podzolic soils which are sandy, deep, moderately well drained, lightly acid or neutral in reaction, with medium to high fertility.

5. The scrubland zone accounts for about 70% of the project area and can be classified as presenting restrictions to agricultural development. The predominant soil types of this zone are the Dystrophic Quarzite Soils. They are deep, sandy textured, freely draining, with little water or nutrient retention capability. As a result they have low fertility. The remaining area (10% of the total) is covered by the Lowland (Sertao) Zone and is situated at the foot of the escarpment to the east of the humid zone. In this area no agricultural development under the project is comtemplated. The existing pattern of extensive cattle ranching is expected to continue.

II. DEMOGRAPHIC DATA

Table A: Population, Density, Growth Rates

Population (1970)

Country	Total	Urban		Rural		Density	% Growth Annually (1960/70)	
	(000)	(000)	%	(000)	%	Hab/km^2	Urban	Rural
Vicosa do Ceara	33.9	5.3	15	28.6	85	26.3	2.3	2.4
Tiangua	26.2	7.9	30	18.3	70	30.6	3.7	1.8
Ubajara	17.7	3.6	20	14.1	80	46.0	0.7	0.1
Ibiapina	14.9	2.1	14	12.8	86	44.6	1.5	1.0
Sao Benedito	41.1	6.9	17	34.2	83	71.8	0.4	1.4
Carnaubal	9.6	2.9	30	6.7	70	25.9	5.0	3.0
Guaraciaba N.	32.1	5.1	16	27.0	84	32.5	4.5	0.8
IBIAPABA	175.5	33.8	19	141.7	81	36.6	2.2	1.3

Source: Fundacao IBGE

Table B: Age Structure (1970)

	0 - 6		7 - 14		15 - 69		> 70 1/	
	(000)	%	(000)	%	(000)	%	(000)	%
Vicosa do Ceara	8.6	25	7.4	22	16.9	50	1.0	3
Tiangua	6.4	24	6.0	23	13.1	50	0.7	3
Ubajara	4.2	24	4.2	24	8.9	50	0.4	2
Ibiapina	3.6	24	3.5	24	7.4	49	0.4	3
San Benedito	10.1	25	9.2	22	20.8	51	1.0	2
Carnaubal	2.5	26	2.2	23	4.7	49	0.2	2
Guaraciaba N.	8.0	25	7.4	23	15.9	50	0.8	2
IBIAPABA	43.4	25	39.9	23	87.8	50	4.4	2

Source: Fundacao IBGE
1/ Including persons of unknown age.

III. EMPLOYMENT

Economically Active Population (1970)

	Ec. Active (000)	% of Total	Sectorial Distrib. (%) Prim.	Sec.	Ter.
Vicosa do Ceara	9.8	29	92	2	6
Tiangua	6.9	26	79	6	15
Ubajara	4.2	24	85	5	10
Ibiapina	4.6	31	88	5	7
Sao Benedito	11.3	27	71	18	11
Carnaubal	2.3	24	85	5	10
Guaraciaba N.	9.0	28	83	7	10
IBIAPABA	48.1	27	82	8	10

Source: Fundacao IBGE

IV. LAND USE

Table A: Land Capability Classes

Class 1/	Acreage (ha)	Distribution (%)
3s	66,162	13.8
3t	18,804	4.0
4s	288,328	60.3
4t	55,458	11.5
4st	31,784	6.6
5st	18,064	3.8
TOTAL	478,600	100.0

Source: SUDENE/DRN
1/ According to Benema - Camargo adjustments to classification of U.S. Bureau of Land Reclamation.

Table B: Land Use (1972) 1/

	ha	%
Total geographic area	478,600	131
Area in Farms	365,000	100
Actually used	202,000	55
Crops	106,000	29
Livestock	77,000	21
Forest	19,000	5
Unused	163,000	45
Unsuitable for agric.	87,000	24
Forest reserve	5,000	1
Suitable for agric.	71,000	20

Source: INCRA, Recadastramento 1972.
1/ This data does not coincide exactly with that given in para 3.05, which is based on adjustments by CEPA-CE.

Table C: Land Distribution (1972)

Farm Size (ha)	Farms N°	Farms %	Total Farm Area 1,000 ha	Total Farm Area %	Farm Area Used 1,000 ha	Farm Area Used %
less than 1	270	3	0.2	-	0.2	-
1-2	846	8	1.1	-	1.0	-
2-5	2,143	22	6.9	2	5.4	3
5-10	1,889	19	13.4	4	9.8	5
10-25	2,319	23	36.9	11	24.6	13
25-50	1,219	12	41.9	12	25.5	13
50-100	721	7	49.7	14	28.3	15
100-200	331	3	45.6	13	24.6	13
200-500	149	1	45.5	13	24.6	13
500-1,000	52	1	34.5	10	18.4	10
1,000-2,000	20	(1)	26.9	8	14.0	7
Over 2,000	9	( )	45.8	13	16.6	8
Total 1/	9,968	100	348.4	100	193.0	100

Source: INCRA
1/ This data does not exactly coincide with that given in para 3.05, which is based on adjustments by CEPA-CE.

Table D: Land Tenure (1970)

	Farms N°	Farms %	Acreage 1,000 ha	Acreage %	Average Size ha
Owner-operated	9,178	75.5	262.2	71.8	28.6
Tenant-operated	159	1.4	2.3	0.6	14.4
Sharecropper	1,886	15.5	63.2	17.3	33.5
Squatters	927	7.6	37.3	10.3	40.2
Total	12,150	100.0	364.9	100.0	30.0

Source: Fundacao IBGE

V. AGRICULTURAL PRODUCTION

Table A: Cropping Pattern (1971)

	Acreage (ha)	%
Manioc	21,532	33.8
Sugar Cane	12,595	19.8
Sorghum	7,258	11.5
Beans	6,808	10.8
Coffee	3,942	6.2
Cashew	3,100	4.9
Tobacco	3,033	4.8
Papaya	2,243	3.5
Avocado	1,102	1.7
Banana	1,065	1.7
Others 1/	1,031	1.3
Total	63,709	100.0

Source: DEE-CE

1/ Including rice, oranges, peanuts, tomatoes, cotton and potatoes.

Table B: Livestock Population 1/

Type	N° of Head
Cattle	27,900
Horses	15,000
Goats	15,600
Sheep	10,200
Pigs	20,500
Hens	199,300

1/ Average 1970, 1971, 1972 according to three different sources (FIBGE, DEE-CE, INCRA).

Table C: Agricultural Production (1971)

	Production		Distribution	
	1000 tons	1000 Cr$	%	%
Crops	-	152,463	100	88.1
Manioc	437.2	56,833	37.3	
Sugarcane	619.3	40,874	26.8	
Sorghum	8.5	6,531	4.3	
Beans	4.0	7,992	5.2	
Coffee	2.3	10,622	7.0	
Cashew	13.5	1,892	1.2	
Tobacco	2.3	5,171	3.4	
Papaya	2.4	1,865	1.2	
Avocado	4.4	2,425	1.6	
Banana	40.9	13,510	8.9	
Others	n.a	4,748	3.1	
Livestock Products	-	14,504	100	8.4
Beef	0.7	6,723	46.3	
Pork	0.9	5,630	38.8	
Other meats	0.1	819	5.7	
Milk (1000 lt)	1.1	1,332	9.2	
Forest Products	-	6,080	100	3.5
Timber (1000 m^3)	825.0	5,813	95.6	
Other	603.0	267	4.4	
TOTAL	-	173,047		100.0

Source: DEE-CE

Table D: Farms, Target Group and Beneficiaries of the Agricultural Component by Ecological Zone and Tenure Conditions

	Total Farms 1/	Target Group 2/	Expected Beneficiaries 3/	
			N°	%
Humid/Subhumid Zone	2,791	2,771	2,010	35
Non-owner operators	682	682	340	6
Owners 0-10 ha	1,014	1,014	810	14
10-25 ha	548	548	440	8
25-200 ha	527	527	420	7
> 200 ha	20	-	-	
Carrasco	5,489	5,230	3,780	65
Non-owner operators	1,342	1,342	670	11
Owners 0-10 ha	1,488	1,488	1,190	21
10-25 ha	949	949	760	13
25-200 ha	1,451	1,451	1,160	20
> 200 ha	259	-	-	
Sertao	1,023	-	-	0
Non-owner operators	250	-	-	-
Owners 0-10 ha	328	-	-	-
10-25 ha	186	-	-	-
25-200 ha	215	-	-	-
> 200 ha	44	-	-	-
Project area	9,303	8,001	5,790	100
Non-owner operators	2,274	2,024	1,010	17
Owners 0-10 ha	2,830	2,502	2,000	35
10-25 ha	1,683	1,497	1,200	21
25-200 ha	2,193	1,978	1,580	27
> 200 ha	323	-	-	-

Source: INCRA-CEPA/CE

1/ Based on adjustments by CEPA/CE to INCRA cadrastral data.
2/ Farms located in the humid/subhumid and Carrasco zones.
3/ Number of beneficiaries corresponds to 50% of the non-owner operated farms and 80% of the owner operated farms of the target group.

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

AGRICULTURAL EXTENSION

I. EXISTING SITUATION

Historical Background

1. Technical assistance and rural extension activities in Brazil have in the past been fragmented, with responsibilities spread among several institutions, some of which have provided commodity services in only selected geographic areas. The most important of these institutions until mid-1974 was the Brazilian Association of Credit and Rural Technical Assistance (ABCAR), which was primarily responsible for disseminating agricultural technology to farmers. ABCAR operated through some 20 separate state associations (ACARs), all of which functioned as non-profit civil corporations, technically and administratively independent. Five training centers (in Ceara, Pernambuco, Minas Gerais, Espirito Santo and Santa Catarina) were part of the ABCAR network, providing basic and advanced training for technical and auxiliary personnel in the rural extension services. The ABCAR system, however, proved unsatisfactory becuase of several major problems, namely:

(a) The ability to transfer technology to farmers was impaired by the weak financial and institutional structure of the extension system;

(b) Research provided few results that were relevant to the needs of large segments of the farming sector, especially the small farmers in the Northeast;

(c) Extension activities were generally limited only to those farmers who were actually receiving credit, the main objectives being to assess the creditworthiness of the client and to ensure that he undertook the technical recommendations necessary to make his enterprise a success;

(d) Coordination among institutions providing technical assistance in agriculture remained at a low level, which resulted in an increased unit cost of providing such assistance, as well as a waste of scarce trained manpower available for extension activity because of duplication of effort;

(e) Although ABCAR was supported by public funds, it did not always adequately interact with other Government insitutions. Most technical assistance agencies lacked long-term planning and objectives, but in the case of ABCAR, the situation was further complicated when different sponsoring organizations pressured ABCAR into pursuing sometimes inconsistent objectives; and

(f) Overall planning was hampered because of the instability and short-term nature of the funding provided by the various agencies.

2. The Government recognized the need to improve matters, particularly in regard to better and more assured financing, and in mid-1974 created the Brazilian Corporation for Technical Assistance and Rural Extension (EMBRATER) to replace ABCAR. EMBRATER, an administratively autonomous entity linked to the Ministry of Agriculture, has primary responsibility for formulating and implementing policies pertaining to technical assistance and rural extension, and for promoting, stimulating and coordinating technical assistance programs. The staff of the former ABCAR system (about 4,700 technicians and 3,600 administrative personnel) was absorbed by EMBRATER and its state affiliates, which were also converted into "Empresas" or state companies (EMATERs). These state technical assistance and rural extension companies are operationally autonomous but are still linked to EMBRATER, since the latter participates in the share capital and in the selection of board members, acts as the channel for all federal funding for extension, participates in the planning of extension work, and assigns headquarters (EMBRATER) staff to the state affiliates for consultation and training purposes.

Extension in Ceara

3. Extension work in the state is the responsibility of EMATER-CE. For administrative purposes the state is divided into ten regions, one of which is the project area of Ibiapaba. In 1976 total extension staff available for all ten regions numbered 485, of which 230 were university graduates, 170 were high school graduates (with diplomas), and the remaining 85 were administrative support staff.

4. Currently the entire Ceara state extension service reaches very few people, the ratio of extensionists to farmers being in the order of 1:1,500 (1:1,000 in the project area). Moreover the limited staff available mainly service larger farmers receiving credit made available by the private and state banking system. One of the prime reasons why there is emphasis on the larger farmer is that they are the recipients of most of the credit, and EMATER-CE receives an annual supervision fee from the banks equivalent to 2% of the value of the credit. Hence the extension agents are in effect mainly credit supervisers. The smaller farmers, who for various reasons (see Annex 3) do not participate in the formal credit system, do not receive very much technical assistance. A further problem is that there is little specialization of function within the extension service, so, being short staffed, with the emphasis on credit supervision, and due to a lack of back-up facilities and research data, the extension staff have had little factual knowledge to pass on to the farmer (both big and small).

Extension in the Project Area

5. The Regional Extension Office for Ibiapaba is situated at Ubajara. The office coordinates the extension activities in the project area through seven local extension offices situated one in every municipality (Tiangua,

Ubajara, Vicosa do Ceara, Ibiapina, Sao Benedito, Guaraciaba do Norte and Carnaubal). Prior to initiation of the project, there were four high level technicians (university graduates), three medium level technicians (high school graduates) and seven administrative assistants. In addition, the IBC (Brazilian Coffee Institute) maintains in the project area six high level technicians and three medium level technicians advising solely on coffee. BNB (Bank of the Northeast), which has a branch in Sao Benedito, also has a specialized agricultural credit technician working directly with the farmers in the Ibiapaba area.

II. PROPOSALS FOR EXTENSION UNDER THE PROJECT

General Approach

6. Under the project the extension services would be substantially increased in size (from a staff of 14 to a staff of 107) and, more importantly, innovations would be introduced in the structure of the service and the techniques used that could have far reaching implications for the state as a whole. The main innovations will be the specialization of function within the service, the provision of subject matter specialists to back up general extension staff, the introduction of the "contact farmer" and "contact family" approach to extension work, and the wide scale use of farm demonstration plots. There will also be much more emphasis on pre-service and in-service training for extension staff than has been customary in the past.

7. Instead of each field agent being a generalist concerned largely with credit supervision, and serving mainly the larger farmers in the area, staff will be divided into four semi-specialized disciplines, namely, general agricultural advisory work, credit matters, assistance to cooperatives, and social service (home economics) activities. The revised structure is outlined in Chart 1 of this Annex. The transfer of agricultural knowledge will be the responsibility of field extension agents, utilizing a system of "contact farmers" to work princially with groups of farmers rather than with individuals. These agents will be advised by subject matter specialists attached to the Regional Office in Ubajara. The planning and supervision of agricultural credit will be done by special credit agents, who will work directly with individual farmers in the project area. The cooperative agents will work mainly with existing and new coperatives, while the social assistance agents will provide advice on home economics, family health and nutrition, also through "contact families".

8. Receptive farmers of recognized ability will be chosen by the field extension agents in every municipality as "contact farmers" and will serve as foci for the extension effort. In order to help the Field Extension Agents (see para. 10) to select the most suitable "contact farmers" and the Social Extension Agents (para. 13) to select "contact families," selection procedures (including, among other things, observation of informal leadership patterns, location, etc.) will be developed with the guidance of the Regional Extension

Office (para. 9) and studied and discussed during training periods (paras. 15-16). Small demonstration plots will be sited in the contact farmers' fields, which will also serve as meeting places for small groups of farmers living near by. Improved agricultural practices (technical packages), which will concentrate initially on the diffusion of existing knowledge, will be demonstrated in these plots by the agents with the active participation of the farmers. All cash production costs of the demonstration plots (seeds and other inputs) will be borne by the extension service. The farmer's labor contribution would be remunerated with the production of the plot. The technical packages will encourage the gradual introduction of simple and inexpensive changes which should increase crop yields and farmers' net incomes. The changes will be introduced over a number of years. Every "contact farmer" will be the contact for some 20-25 farmers, depending on the density of the rural population. These small groups of farmers may eventually be linked in informal farmer associations, and may eventually develop into formal and bigger associations or cooperatives as they graduate from being subsistence farmers to commercial producers. If successful, this entire approach might be extended throughout the state.

Regional and Area Extension Offices

9. The Regional Extension Office and the seven Local (municipio or county) Extension Offices will remain, but special emphasis will be placed on improved coordination. The Regional Extension Officer, who will be assisted by a Regional Extension Coordinator, will be responsible for extension activities undertaken by EMATER-CE within the region. He will also be responsible for coordinating extension activities provided by other agencies (such as IBC) in the region, and for integrating research activites with extension work. He will also coordinate and supervise the work of the subject matter specialists, attached to his Office but working in the Local Offices. These specialized technicians, who will be agronomists of high level, will train and advise the local extension agents in their various specialities. A part of these specialists have already been recruited for the project, and the remainder will be recruited from among the best agents of EMATER-CE and/or from the Federal University of Ceara. At the municipal (county) level, each Local Extension Office is headed by a Local Extension Officer and has a team of Field Extension, Credit, Cooperative and Social Extension Agents, each responsible for particular extension activities in part of the county. These local agents will be technically advised by the subject matter specialists who will visit the local extension office and the field at least once every fortnight.

The Field Extension Agent

10. The field extension agent will be an agronomist of intermediate level (agricultural technical school graduate). He will work directly with "contact farmers" whom he will visit on a fixed schedule, i.e. on a specific day every second week. Farmers wishing to consult with him will be familiar with the "contacts" and will seek the agent at their farms. The area extension agent will be able to deal with 8 - 10 contact farmers during the

first years of development, and, through them, with eventually up to about 200 farmers, depending on distances between farms. Every other week the field extension agents will spend one full day at the local extension office, or at another appointed meeting place. This working day would be divided between reporting to superiors, consulting with subject matter specialists on particular problems, and receiving specific instructions related to the work during the next fortnight. During those weeks when field extension agents do not meet together, they would either be visited by one of the subject matter specialists or be available for farmers wishing to consult with them at appointed meeting places.

The Credit Agent

11. A prime objective of the project being to provide credit to the small farmer (see Annex 3), and methods will be introduced to reduce the administrative burden on the banks and simplify borrowing procedures. The credit agent will be a charge of farm management advisory work and planning and supervising on-farm investments and agricultural credit. He will be an agronomist of intermediate level (agricultural technical school graduate) with special training in credit planning and supervision. Group loans (i.e. to cooperatives) will be provided whenever possible to reduce the administrative burden on the credit agent as well as on the lending organization. This method should also reduce risk. The credit agent will deal directly with the farmers of his area (i.e., not through contact farmers) and will have a fixed visiting schedule, visiting a certain region on a regular day so that farmers wishing to receive credit could seek him out there. The credit agent will help plan and supervise credit for up to 300 families per year during the first years of development.

The Cooperative Agent

12. The cooperative agent will be an agronomist of high level (university graduate) with special training in cooperative management and supervision. He will deal with cooperatives in various fields, such as produce marketing and input supply. He will work closely with the banks as well as with entities dealing with marketing and the provision of inputs. Whenever necessary this agent will assist a cooperative to organize its various activities, such as accountancy, administration, elaboration of work programs, etc. Each agent will probably deal with one or two cooperatives. Due to the present weak situation of the cooperatives in the project area, the cooperative agent will collaborate with the special program for studying and helping define the long-term development path for the cooperatives in the area.

The Social Assistance Agent

13. The Social Assistance Agent will be an extensionist specialized in home economies and social work, and will deal with the coordination of health and nutrition, education and family gardening activities. This agent

will work directly with carefully chosen "contact families" in an area, and will also have a fixed work schedule similar to that of the area extension agent. This agent should be able to deal with about 400-500 families during the first years of development, assisting them in forming village health committees and providing health and nutritional education (see Annex 15), training (see Annex 16), community activities and youth organization.

Staffing Requirements

14. The full staffing requirements, at the sixth year after inception of the physical development of the project, will be 16 high level specialists, 71 medium level technicians and 20 administrative assistants. Taking into account the pre-project personnel available, the incremental needs will be 12 high level specialists, 68 medium level technicians and 13 administrative assistants (Table 1). This staff will deal directly with about 5,800 farm families and will be recruited gradually.

Training of Extension Personnel

15. The training of the extension service personnel, which will be planned, implemented, supervised and evaluated by EMATER-CE, will include pre-service training adapted to the project needs and continuous on-the-job upgrading and training by the subject matter specialists and others. New extension personnel for high level positions will be recruited among graduates from local agricultural colleges or universities. The medium level agricultural technicians will be graduates from local agricultural high schools. The social assistance agents will be high school graduates with special training in home economics and related fields.

16. The pre-service training of the extension agents will be divided into three parts. The first will be a 3-week general orientation course, the second a general field orientation course, and the third a technical training course. The initial orientation course will familiarize trainees with programs and institutions involved in rural development (POLONORDESTE, EMBRATER, EMBRAPA, etc.), rural development strategies, supporting services, and rural extension methods and communication methodology. This course will be followed by six weeks in the field for the agents to get acquainted with the rural milieu and local problems. During this period, tight follow-up, guidance and assistance will be provided by senior extension agents. Thus, at the end of this stage, the trainee should be able to prepare a program providing a diagnosis of the situation, definition of priorities, strategy of action, activity chronogram, and proposed methodology of extension in his specific working area. These programs will then be studied and analysed by the group as a whole. The field course will be followed by special technical training courses geared to the problems the agents may encounter in the field and will not be too theoretical in nature. These courses, which will be of about five weeks duration, will be tailored to the special needs of the extension workers. For instance, field extension

agents will concentrate on production systems and agrotechnical packages adapted to the crops grown in the area; credit agents will concentrate on economics, rural administration, financial projections, and credit planning and supervision; cooperative agents will concentrate on cooperative administration, accountancy and long- and short-term work programs.

17. During the agricultural growing season, extension agents will also receive once every fortnight special training on the crops being grown in the area and the current problems. This training will be given by the subject matter specialists. They will also participate, after the harvest season, in work evaluation sessions and in short refresher courses whenever necessary.

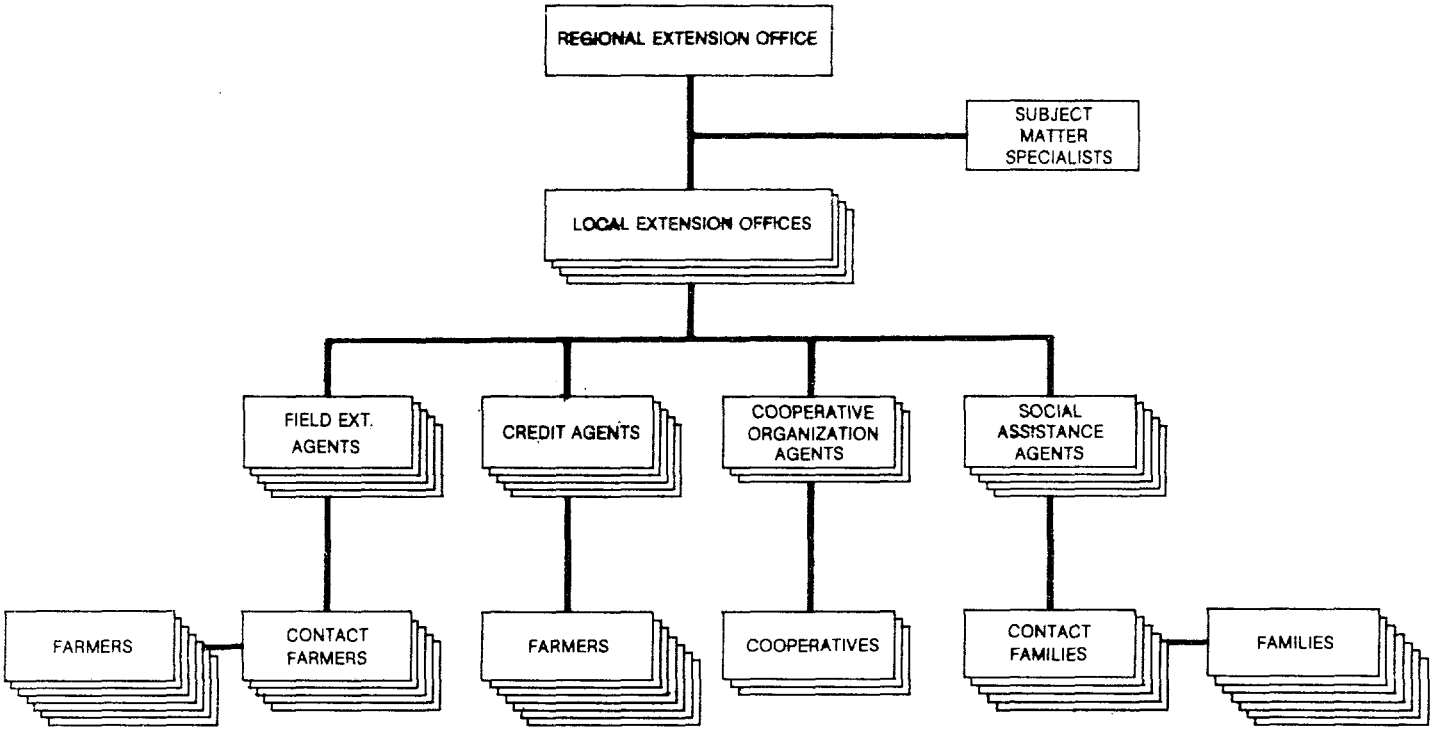
Costs

18. The total costs for the existing extension program, as well as the expansion of the program over the 5-year project period (1977-81), are estimated at about Cr$ 65.5 million (US$5.6 million), broken down as follows:

	Item	Cr$	US$	%
1.	Personnel costs (salaries, etc.)	39.3	3.3	60
2.	Equipment, materials and installations	5.7	0.5	9
3.	Operating costs (fuel and office supplies, etc.)	12.4	1.1	19
4.	Demonstration plots	1.3	0.1	2
5.	Training	6.8	0.6	10
		65.5	5.7	100

19. Assuming that only capital costs, incremental operating costs, and the costs of incremental staff can be considered for Bank financing, the "project costs" would be Cr$ 54.2 million (US$4.6 million). Tables 3, 4, 5 and 6 provide further details.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT – IBIAPABA
CHART No. 1: PROPOSED AGRICULTURAL EXTENSION SERVICE DELIVERY SYSTEM



World Bank—16903

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 1: Yearly Extension Coverage

Development Year	I	II	III	IV	V
1. Incremental number of farmers.	500	1,160	2,310	1,820	-
2. Total number of farmers.	500	1,660	3,970	5,790	5,790
3. Farmers attended by:					
- One field extension agent	100	150	200	200	200
- One credit agent	150	200	250	300	300
- One social assistance agent	150	250	350	450	450

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 2: Total Yearly Extension Personnel Requirements

Development Year	Present Situation			I			II			III			IV			V		
	Tech. Level		Admin.	Tech. Level		Admin.	Tech. Level		Admin.	Tech. Level		Admin.	Tech. Level		Admin.	Tech. Level		Admin.
Function	High	Medium	Assistants	High	Medium	Assistants	High	Medium	Assistants	High	Medium	Assistant	High	Medium	Assistant	High	Medium	Assistant
Regional Extension Officer	1	-	-	1	-	-	1	-	-	1	-	-	1	-	-	1	-	-
Regional Extension Coordinator	1	-	-	1	-	-	1	-	-	1	-	-	1	-	-	1	-	-
Subject Matter Specialists	1	-	-	2	1	-	3	1	-	4	1	-	4	1	-	4	1	-
Local Extension Officers	-	-	-	7	-	-	7	-	-	7	-	-	7	-	-	7	-	-
Field Extension Agents	1	3	-	-	5	-	-	15	-	-	33	-	-	42	-	-	33	-
Credit Agents	-	-	-	-	4	-	-	10	-	-	23	-	-	30	-	-	25	-
Cooperative Organization Agents	-	-	-	2	-	-	3	-	-	3	-	-	3	-	-	3	-	-
Social Assistance Agents	-	-	-	-	4	-	-	10	-	-	22	-	-	26	-	-	18	-
Administrative Assistants	-	-	7	-	-	15	-	-	15	-	-	20	-	-	22	-	-	20
Total	4	3	7	13	14	15	15	36	15	16	79	20	16	99	22	16	77	20

ANNEX 2
Table 2

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 3: Extension Service Costs
(in Cr$ '000)

ITEM	Development Year I	II	III	IV	V	Total	Annual Recurrent Costs 8/
1. Personnel							
Salaries and social charges 2/	3,295	5,094	8,228	9,618	8,157	34,391	7,320
Per-diem costs	216	331	583	626	531	2,287	476
Special fund 3/	246	380	617	717	608	2,568	546
Sub-total	3,757	5,805	9,428	10,960	9,296	39,246	8,342
2. Operating costs							
Transportation 4/	340	866	1,972	2,122	2,122	7,422	2,122
Other costs 5/	796	871	1,066	1,144	1,143	5,020	1,143
Sub-total	1,136	1,737	3,038	3,266	3,265	12,442	3,265
3. Equipment							
Vehicles	495	1,265	1,100	1,100	1,100	5,060	1,100
Office Equipment	230	-	81	10	-	321	13
Supplies	176	39	107	21	-	343	15
Sub-total	901	1,304	1,288	1,131	1,100	5,724	1,028
4. Extension personnel training 6/	2,324	1,807	1,112	837	769	6,849	769
5. Demonstration set-up 7/	60	165	340	360	360	1,285	360
Total costs	8,178	10,818	15,206	16,553	14,791	65,546	13,864

1/ See unit costs in Appendix 1
2/ Social charges equivalent to 32% of base salaries.
3/ To be utilized whenever help for special projects development, to extension service personnel will be found necessary.
4/ Includes maintenance as well as other costs such as insurance costs.
5/ Includes buildings maintenance, travel and other operating costs.
6/ Details are given in Table 5, first year costs include also some Cr$1,264,000 pre-project costs.
7/ Unit cost calculated at Cr$1,500 per demonstration plot per year.
8/ Average yearly costs from year six and onwards.

ANNEX 2
Table 4

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 4: Extension Service Total and Project Costs
(in Cr$ '000)

Development Year	Year I	II	III	IV	V	Total	Annual 2/ Recurrent Costs
ITEM	1. Total Costs						
Personnel	3,757	5,805	9,428	10,960	9,296	39,246	8,342
Operating costs	1,136	1,737	3,038	3,266	3,265	12,442	3,265
Equipment	901	1,304	1,288	1,131	1,100	5,724	1,028
Training	2,324	1,807	1,112	837	769	6,809	769
Demonstration set-up	60	165	340	360	360	1,285	360
Total costs	8,178	10,818	15,206	16,553	14,791	65,546	13,864
	2. Project Costs 1/						
Personnel	2,510	4,558	8,181	9,713	8,049	33,011	7,095
Operating costs	13	656	2,048	2,291	2,290	7,298	2,290
Equipment	901	1,304	1,288	1,131	1,100	5,724	1,028
Training	2,324	1,807	1,112	837	769	6,849	769
Demonstration set-up	60	165	340	360	360	1,285	360
Total project costs	5,808	8,490	12,969	14,332	12,568	54,167	11,542

1/ Project costs include only incremental costs generated by project implementation.

2/ For sixth year and onwards.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 5: Extension Personnel Training Costs
(Cr$)

Development year and training costs / Stage or course	Pre-Project		I		II		III		IV		V		Total Costs
	No. of Trainees	Costs 2/	No. of Trainees	Costs	No. of Trainees	Costs	No. of Trainees	Costs	No. of Trainees	Costs	No. of Trainees	Costs	Cr $ 000'
						1. Pre-service training 1/							
Pre-service stage I	35	147,000	32	134,400	58	243,600	28	117,600	10	42,000	10	42,000	726.6
Field stage	35	14,700	32	13,440	58	24,360	28	111,760	10	4,200	10	4,200	72.7
Pre-service stage II	35	147,000	32	134,400	58	243,600	28	117,600	10	42,000	10	42,000	726.6
Salaries 3/	35	697,450	32	501,410	58	824,320	28	403,290	10	271,440	10	271,440	2,965.3
Social Charges	35	258,060	32	185,520	58	305,000	28	149,220	10	100,430	10	100,430	1,098.7
Sub-total	-	1,264,210	-	969,170	-	1,640,880	-	799,470	-	460,070	-	460,070	5,593.9
						2. In-service training							
Short Courses	-	-	14	42,000	25	75,000	48	144,000	58	174,000	47	141,000	576.0
Supplementary or Refresher Courses	-	-	7	49,000	13	91,000	24	168,000	29	203,000	24	168,000	679.0
Sub-total	-	-	-	91,000	-	166,000	-	312,000	-	377,000	-	309,000	1,255.0
Total	-	1,264,210	-	1,060,170	-	1,806,880	-	1,111,470	-	837,070	-	769,070	6,848.9

1/ Pre-service training is provided before the agricultural year and to some 30% more than needed personnel in order to allow for inadecacy, leaves, drop-out , etc.
2/ Average unit cost of pre-service stages was calculated at Cr$4,200, of field stage at Cr$420; of short course at Cr$3,000 and of in-service stages at Cr$7,000.
3/ Salaries for the 15 weeks pre-service training were calculated at regular extension staff salaries and according to trainees technical level.

ANNEX 2
Table 5

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 6: Extension Service Unit Costs

1. Yearly Salaries	Cr$
Regional Extension Officer	143,000
Regional Extension Coordinator	143,000
Subject Matter Specialist	143,000
Local Extension Officer	104,000
Field Extension Agent	52,000
Credit Agent	52,000
Cooperative Organization Agent	104,000
Social Assistant Agent	39,000
Administrative Assistant	13,000

2. Other Main Unit Costs	
Vehicle	55,000
Calculating Machine	7,000
Slide Projector	5,400
Typewriter	5,000
Car Insurance (yearly rate)	4,300
Monthly Transp. Allocation	3,150
Desk and Chair	3,000
Book Case	1,800
Motor Oil (liter)	30
Gas (liter)	5

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

CREDIT

I. GENERAL BACKGROUND

Rural Credit in Northeast Brazil

1. Institutional, or commercial banking, credit to farmers in Northeast Brazil is channelled principally through federal (over 95%) and state-owned banks. Banco do Brasil (BB) has traditionally been the most important, accounting for some 80% of agricultural loans disbursed, followed by Banco do Nordeste do Brasil (BNB) at around 12%, with the National Cooperative Credit Bank (BNCC) and state banks accounting for most of the remainder. 1/ About 80% of the funding for rural credit in the Northeast is derived from Central Bank refinancing or on-lending facilities in several special lines of credit. The remainder of funding is from banks' internal resources (usually with special compensation from the Government to cover interest rate subsidies), though the bulk of such internal funding is from BB. Apart from institutional rural credit, there are important non-institutional suppliers of short-term credit such as marketing intermediaries and landlords. While there is little data to indicate the scale of such lending, the implicit interest rates are normally higher than those of banks, and the credit recipients are normally smaller scale farmers.

Credit Lines and Terms

2. In 1972 the Government began a program named PROTERRA (Program for the Redistribution of Land and Stimulation of Agro-Industrial Development in the Northeast and North of Brazil) through which it intended to stimulate agricultural development in general with a massive infusion of heavily subsidized credit to finance investment, use of modern inputs and land transfers. The low nominal interest rates, together with an inflationary environment, eventually contributed however to a predominant use of PROTERRA funding for the purchase of land and the building-up of investment in livestock herds which provided attractive forms of asset holding. The program was not

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1/ For a detailed analysis of agricultural lending in Northeast Brazil, the reader is referred to "Rural Development Issues and Options in Northeast Brazil," June 23, 1975, Report No. 665a-BR. Also, BB and BNB are previous Bank borrowers for grain storage (Loan 857-BR of September 27, 1972 and Appraisal Report No. PA-135a of August 2, 1972) and industrial credit (Loan 656-BR of February 16, 1970 and Appraisal Report No. DB-52a of December 19, 1969), respectively.

accompanied by significant efforts to improve the access by small farmers to institutional credit or to break the traditional bias of the banking system toward making the more lucrative large-scale loans; hence, the bulk of PROTERRA funding was absorbed by larger scale farm operations and agro-industries.

3. In late 1974, the Government created a new program, POLONORDESTE, intended specifically to increase the incomes and standard of living of small-scale farmers and the rural poor in the Northeast through, inter alia, integrated rural development projects. In 1975 the Government defined special credit arrangements to be applied in new POLONORDESTE rural development projects through BB, BNB and BNCC. The POLONORDESTE credit program differed from PROTERRA mainly in that particular emphasis was given to reaching small farmers, renters or sharecroppers requiring loans of less than 50 times the maximum reference value (MVR, a reference value which is adjusted periodically to offset inflation and is now Cr$ 877.70 or about US$60, which is roughly equivalent to the minimum monthly wage). All POLONORDESTE loans must be coupled with technical assistance from an expanded extension service. Property collateral is required only on loans above 50 MVR (about US$3,000), as loans under that amount can be made on the personal guarantee of the borrower. The terms and conditions on POLONORDESTE credit (see para 5) for the most part were defined to be the same as, or very similar to, those offered under PROTERRA.

4. In late 1976 and early 1977 the Government made several additional modifications in the terms and conditions to be applied in its special rural credit programs in Northeast Brazil. These changes amount to:

(a) an elimination throughout Brazil of the 40% subsidy previously granted by the Government on the price of credit-financed purchases of fertilizer;

(b) an elimination of previous interest-free credits to finance certain other "modern" inputs such as insecticides or pesticides;

(c) the establishment of one interest rate (7%) for most working capital credit (credit for fertilizer purchase, which carries no interest charge, is the exception) under the POLONORDESTE program, compared to the 13-15% charged (depending on loan size) elsewhere in Brazil and the range of rates (0-15%) previously charged under the POLONORDESTE line;

(d) the establishment of a differentiated interest rate scale for POLONORDESTE investment credits, with the previous lower interest rates continuing to apply only to smaller loans; and

(e) the lengthening of the maximum repayment (from 12 to 20 years) and grace (from 2 to 6 years) periods for land purchase credits.

5. The resulting framework of credit terms and conditions under POLONORDESTE and relevant to the proposed Ceara project, is as follows:

POLONORDESTE Credit Terms (1977)

Type of Credit	Loan Size	Repayment Period: Maturity	Repayment Period: Grace Period	Interest Rate to Final Beneficiary
I. Supervised Seasonal Credit (for production inputs and subsistence costs)	Any	Depending on production cycle of crop produced		7% unindexed ***
II. Supervised Investment Credit	Up to 200 MVR*			7% unindexed
	200-2000 MVR			10% unindexed
	over 2000 MVR			12% unindexed
a) for "fixed investment" (land clearing, fences, establishment of permanent crops, small scale irrigation, etc.)		up to 12 yrs.	up to 6 yrs.	depending on loan size (see above)
b) for "semi-fixed" investments (work animals, light equipment, etc.)		up to 8 yrs.	up to 4 yrs.	depending on loan size (see above)
III. Land Purchase Credit	up to 100% of price of land up to 6 times size of INCRA module **	up to 20 yrs.	up to 6 yrs.	12% unindexed

*"Maximum Reference Value", a periodically adjusted reference value equivalent in June 1977 to Cr$877.70, or about US$60.

**A module is that amount of land defined by INCRA (the National Institute for Colonization and Land Reform) to be necessary to generate a farm income of four times the annual minimum wage. The size of the module varies from about 3 to 120 hectares depending on the region and type of potential production.

***With the exception of credit to finance fertilizer purchase, which is non-interest bearing.

6. For POLONORDESTE projects, the Central Bank will normally open credit lines with the participating banks making funds available for application in the selected priority project areas. Under these circumstances, the participating banks are required to repay the Central Bank in line with repayment dates of the subloans made, but retaining 5% remuneration. When lending is channelled through cooperatives, the cooperative would receive 2%, leaving the participating banks with 3%.

7. While recent revisions in agricultural credit terms and conditions in Brazil represented overall a positive move to reduce interest rate subsidies, the POLONORDESTE terms and conditions still result (given the inflationary environment) in substantially negative real interest rates. Although the justification for the Government's policy to subsidize interest rates is debatable (particularly since many small farmers who have had to resort to informal financial channels seem to have been able to operate with positive interest rates, either explicit or implicit), there may be a case for subsidization of the agricultural sector to help stimulate the opening of new land to production, or to offset the effects of pricing policies for some products and the bias in favor of industry implicit in various government policies and subsidies. Agricultural interest rate subsidies may not, however, be the most efficient means to subsidize the sector. There are, nevertheless, positive aspects in the recent Government decisions on credit policy. The subsidies have been reduced marginally, particularly for larger borrowers, thereby reducing the potential income-concentrating effect of agricultural credit; the earmarking of funds and the establishment of priority in the POLONORDESTE program for serving smaller scale farmers at least help assure that they are more likely to share in the subsidy than previously; and technical assistance and other development activities particularly for small farmers are being strengthened considerably in parallel so that the likelihood of misallocation of resources is reduced and a greater participation by small farmers in institutional credit is generated.

II. RURAL CREDIT IN PROJECT AREA

Banking System

8. There are currently three bank branch offices located in the project area: (i) a branch of BB in Ubajara which has operations in 6 of the 7 project area municipalities; (ii) a branch of BNB in Sao Benedito, which services all 7 municipalities in the project area as well as several outside the area; and (iii) a branch of the Banco do Estado do Ceara, BEC, in Vicosa do Ceara which services 6 of the project area municipalities. In addition, branches of BB in Ipu and Ipueiras (both outside the project area) do business in parts of the project area, and both BB and BEC are considering opening in the medium-term future new branches in Tiangua in the project area. Overall, at least one bank is operating in each of the project area municipalities, although distances, and the fact that only several cooperatives exist, still contribute to the difficulty of using institutional credit for many farmers.

Agricultural Credit Portfolio

9. In 1975, the most recent year for which complete statistics were available at the time of appraisal, the three banks made a total of 1,477 agricultural loans amounting to Cr$ 23.98 million (about US$2.95 million) to a roughly estimated 1,000 farmers in the project area. This compared to about 363 loans for a total equivalent to about US$240,000 in 1970. Of the loans disbursed in 1975, BB accounted for 64%, BNB for 30% and BEC the remaining 6%. The total outstanding agricultural credit portfolio at the end of 1975 in the project area was Cr$ 42.3 million or about US$5.2 million (BB 69%; BNB 23%; and BEC 8%). During the last few years, BNB's agricultural lending has increased slightly more rapidly than that of BB and BEC. Arrears, as a percentage of the portfolio outstanding, were at the end of 1975 about 3.8% for BNB, 1.0% for BB and 0.2% for BEC. Though relatively higher than that of the other banks, the percentage of the BNB agricultural portfolio in arrears in Ibiapaba in 1975 had actually improved considerably from a level of around 10% in 1974.

10. Prior to appraisal of the proposed project, a survey was carried out by CEPA-CE on the nature of agricultural lending in the project area in 1975, covering nearly 100% of the loans made by BNB and BEC and a random sample of around a third of the loans made by BB. It was found that: (a) on average, loans of under 50 MVR (at that time around US$2,500) accounted for around 90% of the number of loans and about 50% of the value of loans, indicating that the concentration of lending amounts in relatively few operations is not excessively pronounced in Ibiapaba; (b) though varying somewhat by bank, around half of the number of loans and a third of the amount lent were directed toward farmers owning less than 25 hectares or to sharecroppers and renters, though these groups combined represent some three-quarters of the farm families in the project area; (c) around 34% of the loans were made only with the guarantee of the borrower's signature, 22% with co-signers, 14% with liens on crops or cattle, 29% with mortgages and 1% with a combination of these or other guarantees--the relatively high number of non-secured loans reflecting the relatively large number of credits of under 50 MVR; (d) on average, 42% of the value of credit disbursed in 1975 was for working capital or seasonal production purposes, 55% for investments and 3% combined; (e) the estimated area of crops financed in 1975 was about 3,500 hectares (coffee and sugarcane absorbing nearly 80% of the funds directed toward crops), as some 39% of total credit was directed toward crops, 22% toward livestock and 39% toward other farm investments. In general, credit coverage in the area is still quite low both in terms of area and number (10%) of farmers financed (particularly small and landless farmers).

Obstacles to Expended Coverage

11. Prior to the recent initiatives in the POLONORDESTE credit and rural development programs, the principal factors limiting expanded coverage of the credit system in Ibiapaba were, as in most of the rest of the Northeast, several and interrelated. On the one hand, there was a lack of effective demand for credit which was, in turn, a consequence of a relatively weak technical support from agricultural research and extension services, difficult collateral requirements for obtaining loans, complicated and time consuming loan application procedures, 1/ and long distances of many farmers from the nearest bank branches. In addition, the banks have, both because of costs and perceived risk, traditionally favored working with relatively larger farm operations. As no special funds were earmarked for the smaller farm operations, and there were no effective programs or mechanisms to help reduce risks or warrant simplification of lending procedures, banks had relatively little incentive to aggressively seek expanded business with small farm operations.

12. Under the POLONORDESTE program, several steps have been taken which should help expand credit coverage. First, the integrated project approach (together with complementary national research and extension programs) gives special emphasis to development of improved technical packages particularly for small-scale farmers, more intensive agricultural extension to that group and the reduction of physical infrastructure bottlenecks to increased production. Second, a variety of steps have been taken, within the credit system itself, to improve coverage of small farmers: (i) participating banks have been instructed by the Government to give priority, in onlending POLONORDESTE funds, to small scale and landless farmers; (ii) the application procedures for loans of under 50 MVR have been simplified and the Government has instructed banks to make such loans with only the signature guarantee of the borrower, which reduces the banks' processing costs for small loans and the time required by the farmer 2/; (iii) Government funding, independent of the size of individual loans, has been made available to the extension service to provide assistance to small farmers in preparing credit applications; and (iv) BB recently instructed its agencies in the Northeast to initiate periodic satellite banking activities for small loans in municipalities without permanent bank branches, giving priority for such activities in POLONORDESTE project areas.

1/ A case study survey carried out by the state extension agency, EMATER, prior to Bank appraisal of Ibiapaba project, showed that: (a) for land owners, "first time" loans required an average of 43 days for full processing--from confirmation of assets and registration of the land farmed through bank approval, contract signing and arrangements for disbursement--and repeater loans an average of 24 days; and (b) even for seasonal credits to non-land owners which do not require collateral, the processing time was an average of 36 days for "first time" loans and 33 days for repeaters.

2/ A sample survey of initial POLONORDESTE credit operations in the project area in 1976 showed that loan processing time had been cut by more than half.

III. THE PROPOSED CREDIT COMPONENT

General Description and Objective

13. The proposed credit component aims at an expansion of the use of the formal credit system in the project area as a means to help, in particular, small scale farmers increase their agricultural production and income through the adoption of improved farming techniques, the diversification of production and the expansion of areas cultivated. The component will include: (i) incremental seasonal production credit including credit to help cover the implicit costs of additional family labor; (ii) investment credits mainly for land clearing, the establishment of permanent crops and small equipment and tools; and (iii) land purchase credit for farmers currently not owning land or owning very small land units. It is estimated (see Annex 1) that credit will be received by about 5,800 farmers (including about 1,000 sharecroppers or renters), or 65% of the farmers in the area. About 450 of the currently landless or very small-scale owner-operators are expected to receive land purchase credit. The credit terms would be those described in paragraph 5. The proposed Bank loan would help finance credit disbursements for categories (i) and (ii) above. The Project credit would be channelled to farmers or cooperatives only through local branches of BB and BNB (which account for over 90% of agricultural credit in the project area), as only the federal banks are authorized by the Government to be financial intermediaries in the POLONORDESTE Program.

14. Notwithstanding the fact that the purpose of agricultural credit is to allow increases in investment and output and that there is normally a strong presumption against financing consumption, it should be noted that in the case of small farms a major input in the production process is the labor of the farmer and his family, and financing this input necessarily implies financing the farmer's consumption to carry him from one harvest to the next. Most institutional credit available in Brazil has in the past been tied to the purchase of "modern" inputs. Thus, the input mix used by large farmers allows them to have access to credit, while the input mix used by small farmers virtually precludes their utilizing institutional credit. Since the availability of credit, in and of itself, can make a significant contribution toward improving the economic well-being of small farmers, financing implicit family labor costs of the small farmers in the context of rural development projects would reduce the small farmers' dependency on intermediaries, giving them access to better market prices for inputs and their products. Such credit, by allowing the introduction of relatively simple improvements in cultivation practices (rather than emphasizing use of major additional inputs), can help stimulate significant increases in production.

Credit Actions and Procedures under Project

15. The participating banks will carry out credit operations with POLONORDESTE funds only if the farmer receives technical assistance from EMATER-CE, the state extension agency, without charge to the farmer or bank. Such technical assistance, to come from the EMATER-CE, must take the form of: (i) helping prepare a simplified farm plan; and (ii) giving technical guidance or orientation to the farmer.

16. The overall procedure for the development and processing of individual loans would begin with the farmer's request to the extensionist or banker for financial assistance. The bank then makes an initial review of the potential client's financial status, taking into account an updated survey of the farmer's assets ("ficha cadastral"). Assuming no special problems are found regarding the general financial status of the potential client, the banker authorizes EMATER-CE to go ahead with its assistance to the farmer in the preparation of a simple farm plan. If, at that stage, the extensionist finds that a technically viable farm plan cannot be developed, he advises the bank of his analysis and conclusion. Otherwise, the proposed plan and credit request is provided to the bank, which in turn may not introduce changes to the farm plan without the extensionist's agreement, but may reject the loan application if it finds some diversion from existing norms regarding banking practices. Once the loan is approved by the bank, the bank advises the local extensionist in order that periodic visits to the farm by the extensinist may be planned and carried out. At least once a year the extensionist must report to the financial agent on the progress of the project financed and the technical assistance rendered.

17. Use of the Government's voluntary PROAGRO crop/credit insurance would be encouraged among all credit recipients to reduce borrowers' risks associated with crop failure or droughts. Sub-borrowers who elect to use PROAGRO would pay a standard annual 1% on average loan volumes.

18. The project extension activities (see Annex 2) would focus particularly on reaching farmers with up to 25 hectares of land and farmers not owning land (sharecroppers or renters). However, farmers with up to 200 hectares would also participate in the project since, particularly in the carrasco, or western, part of the project area where soils and rainfall conditions are relatively unfavorable, current incomes on farms of this size are also quite low. Landless farmers, who would receive mainly seasonal production credits, would require the approval (a "carta de anuencia") though not the guarantee of their landlord. Landless farmers could also receive investment credits if the "carta de anuencia" specifies the time over which the sharecroppers will have rights to use the land concerned. Alternatively, the landowner could take direct responsibility for investment credit requirements arising through sharecropping agreements. Although the Government has instructed the participating banks to give priority to small farmers when lending POLONORDESTE funds, loans of a relatively large size (up to 15,000 MVR or about US$900,000) could theoretically still be made under the program and would benefit higher income farmers who already have access to formal credit. To help assure, therefore, that the additional credit funds made available as part of the proposed Bank loan reach as large a number of beneficiaries as possible and that the focus on the lower income farmers is achieved, Bank disbursements for the credit component would be limited to subloans in which the total outstanding seasonal and investment credits for the farmer do not exceed 100 MVR (or about US$6,000).

19. Land purchase credits (which, though included as part of project costs, would not be subject to disbursements from the proposed Bank loan)

would be extended under the revised POLONORDESTE terms and conditions (see para 5). The recently extended grace and repayment periods, the limitations in the size of tract financed, and the fact that up to 100% of the purchase price can be covered by the loan, should help enable an expanding number of rural families to take advantage of land purchase credit and, hence, benefit to a greater extent from production increases foreseen under the project. The land purchase credit would be available through cooperatives (which might purchase larger blocks of land and resell smaller blocks, without profit, to sharecroppers or to present owners of very small scale plots) or directly to individuals selected from participants in the extension and other credit components of the project. Current INCRA regulations generally require that, for the municipalities in this project area, official land purchase credit can be used only for the purchase of plots over 30 ha in size (this to avoid a proliferation of every small farms). As the minimum is based more on the income potential of the poorer (carrasco area) soils than on the better humid zone land, exceptions can be made (i.e., financing of smaller plots) in cases where fruit or vegetable production is planned. Nevertheless, even though it will be possible for a small farmer to get official financing for the purchase of, say, a 5 ha plot in the humid zone, the state (via the extension and cooperative support components) intends to work especially in helping cooperatives handle in packages the smaller plot transactions. Experience in other states in the Northeast (e.g., Sergipe) has, in fact, been that cooperative land purchase and sub-division efforts have provided a very useful vehicle in helping stimulate an overall strengthening of the cooperatives.

20. Overall, the procedures and initiatives established by the Government for expanding credit coverage under POLONORDESTE projects have only recently taken effect and will have to be monitored closely. It is possible that other mechanisms (differentiated interest spreads to banks to help cover higher unit costs for smaller loans; further modifications to loan application procedures or to the role of the extensionist; new bank branches; establishment of compulsory credit insurance or of a guarantee fund for bad debts, etc.) may have to be developed to help ensure that, in fact, substantial increases in the number of small farmers served are achieved. The effectiveness of the credit promotion, processing and delivery activities would be subject to systematic annual reviews by the Government which would provide its findings and recommendations for any necessary modifications to the Bank for discussion.

Estimates and Assumptions on Size of Credit Component

21. The available information on existing agricultural credit operations in the project area (see para 9) unfortunately provides only a rough baseline for determining the incremental credit requirements for the project. The value of new loans made in 1975 was Cr$ 23.98 million or roughly the equivalent of US$2.95 million. Assuming an increase of roughly 30% (in terms of US$ equivalent) in lending in 1976, a rate which would be roughly consistent with rates of increase in the project area for the last several years, total lending in 1976 would be roughly US$3.8 million. However, to reach an estimate of the existing level of project area credit operations relevant to the

project activities (i.e., only credit for farmers with less than 200 ha and for other than coffee or cattle production), adjustments need to be made in that figure.

22. Utilizing the results of the survey of 1975 operations, it was assumed that about 15% of the 1976 credit went to farmers with over 200 ha, that of the remaining credit roughly 50% could be classified as non-project credit (i.e. credit for coffee or livestock production and a representative proportion of the category of "other investments" not readily assigned to particular crops). This would leave a 1976 baseline of roughly US$1.6 million of which (having subtracted livestock and part of the other investment credits and assuming the 1975 pattern continued in 1976) about half would represent seasonal production credit and half investment credit. Of the investment credits, it can probably be assumed (given an average repayment term of 8 years including three years of grace and the fact that significant amounts of agricultural investment credit had really not been extended except in the past few years) that only a very small amount of outstanding investment credit funds would be repaid, and hence available for reapplication on project investments, during the project period. Furthermore, those funds had been drawn from a variety of previous credit programs and it would be virtually impossible to determine which might, in fact, be available for reapplication under POLONORDESTE. Repayments of investment loans made during the project period were, however, considered in calculating net project-generated investment credit requirements during the project's life. With respect to the baseline figure for seasonal credit (about US$0.8 equivalent or Cr$ 9.4 million in November 1976 prices), it should also be noted that, without the benefit of what would be a costly and time consuming survey of the details of actual 1976 lending, the figure is at best only a reasonable proxy. Since, on an average, the seasonal credits are repaid within a year and should be available for reapplication, and since (partly as a result of the Government's overall restrictions on the expansion of agricultural credit in 1977) the likely increase in project area working capital credit to small farmers is expected to be only marginal in 1977. Bank disbursements against incremental seasonal production credit would begin only in the 1978 POLONORDESTE fiscal year and would be made then only against working capital credit over and above the amount extended in 1977. In each following year, disbursements for working capital credit would also be made only against credit in excess of the amount extended during the previous year.

23. Detailed estimates and assumptions about rates and phasing of farmer participation and calculation of total seasonal and investment credit requirements are provided in Tables 1 and 2.

24. Insofar as land purchase credit is concerned, it is assumed that the principal target recipients would be, first, share-croppers and, second, farmers currently owning up to 10 ha. The former total about 2,000 (almost 700 in the humid/sub-humid zone and over 1,300 in the carrasco zone) and the latter about 2,500 (about 1,000 in the humid/sub-humid zone and 1,500 in the carrasco). Relatively less land is available in the humid/sub-humid zone than in the carrasco, but the size of plot necessary to enable a reasonable farm

income (given local standards) is also considerably smaller, probably around 5 ha in the humid/sub-humid zone compared to around 30 ha in much of the carrasco zone. Ranges of income on different sized units are demonstrated in the representative farm models in Annex 8, two of which (I-A and V) include land purchases. A comparison of models I and I-A demonstrate the potential improvements in income arising from the purchase of land by a sharecropper. Taking into account both the possible availability of land, and the fact that modest targets would also be dictated by the need to assure careful selection of recipients and adequate technical assistance, it is assumed that only around 10% of the farmers currently classified as sharecroppers or owners of up to 10 ha would purchase land. This would be about 450 farmers and would involve purchases of around 850 ha of land in the humid/sub-humid zone (averaging Cr$ 4,000, or about US$340, per ha) and 8,500 ha in the carrasco (averaging about Cr$ 500, or US$45, per ha). Sizes of individual plots will, of course, vary. It is assumed that the land purchase credit requirements would be phased over the project period roughly in accordance with the rate of increase in coverage by project extension services and, based on the above-mentioned assumptions, would total Cr$ 7.65 million (US$648,300).

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 1: Credit Requirements During Years 1 - 5

	Year 1	Year 2	Year 3	Year 4	Year 5
Number of Participating Farmers	500	1,660	3,970	5,790	5,790
(Incremental)	(500)	(1,160)	(2,310)	(1,820)	(-)
	(Cr$ '000)				
Total Seasonal Production Costs of Project Participants 1/	3,021	12,146	32,559	57,022	73,373
(of which above the pre-project level)	(738)	(4,199)	(13,847)	(29,911)	(46,650)
Seasonal Production Credit Requirements of Project Participants 2/	2,346	9,861	26,412	46,311	57,956
Total Investment Costs of Project Participants 3/	5,607	16,244	33,757	36,359	18,016
Total Investment Credit Requirements of Project Participants 4/	4,625	13,363	27,768	29,845	14,627

1/ Including both purchased inputs and family labor of project participants (the amounts reflecting the phased composite of participation) for crops other than coffee.

2/ Assuming that 100% of purchased inputs (including hired labor) is financed by credit and that the equivalent of family labor costs is financed at a declining scale of 80% in first year of the farmer's participation in the project, 60% in the second, 40% in the third, 20% in the fourth and 0% thereafter. This rate of financing was reduced slightly in several of the representative models for the carrasco zone in initial years so that expected production would exceed the amount of credit by at least 25%.

3/ Including all on-farm investments of project participants (the amounts reflecting the phased composite of participation) other than those directly related to coffee production.

4/ Assuming that 80% of the investments is financed by credit, with the exception of investments carried out in the initial years of several of the lowest income models in the carrasco zone, for which 100% financing is assumed.

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Table 2: Project Credit Component (Cr$ '000 of November 1976) 1/

	Before Project	Year 1	2	3	4	5	6	7	8	9	10
I. Seasonal Production Credit											
(a) Total Required by Project Participants 3/		2,346	9,861	26,412	46,311	57,956	61,810	63,274	63,998	65,032	66,362
(b) Total Required by Non-Participant Target Farmers 4/	9,440 5/	7,552	3,776	-	-	-	-	-	-	-	-
(c) Total Required by Target Farmers		9,898	13,637	26,412	46,311	57,956	61,810	63,274	63,998	65,032	66,362
(d) Incremental Seasonal Credit 2/		458	3,739	12,775	19,899	11,645	3,854	1,464	724	1,034	1,330
II. Investment Credit											
(a) Total Required by Project Participants 3/		4,625	13,363	27,768	29,845	14,627	8,819	4,088	2,142	-	-
(b) Cumulative Investment Credit Outstanding 6/		4,625	17,988	45,756	75,601	90,228	99,047	101,667	98,754	86,718	69,088
(c) Incremental Investment Credit		4,625	13,363	27,768	29,845	14,627	8,819	2,620	(2,913)	(12,036)	(17,630)
III. Total Project Credit (I(d) + II(c))		5,083	17,102	40,543	49,744	26,272	-	-	-	-	-
IV. Total Project Credit (Cumulative)		5,083	22,185	62,728	112,472	138,744	-	-	-	-	-

1/ Excluding credit related to coffee production.

2/ Assuming that seasonal credit is repaid, on average, within a year.

3/ Target group farmers participating in or benefitting from improved extension services and production practices (credit estimates derived from phased composite of participating farms of different models).

4/ Derived from assumption that, of the estimated 900 target group farmers previously receiving credit, about 20% would be included among the first year participants, 40% in the second year, and the remainder in year thereafter. Those not "participating" until year two or three, however, would continue to receive until then approximately the same level of credit as previously.

5/ Rough estimate of 1976 seasonal credit to target farmers (see paragraph 21, Annex 4).

6/ Net of repayments of principal, assuming (to help simplify this calculation) repayments according to phased composite of repayment schemes developed for individual farm models (i.e., farmer receiving equivalent of one investment loan for all project investment credit requirements over the first five years of participation, that loan being disbursed over up to 5 years and repaid over years 7-12). In reality, a wide variety of repayment schedules would be adopted for investment sub-loans, some undoubtedly involving partial repayments as early as the fourth or fifth year. These would, however, probably be very small in comparison to the total outstanding.

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

PROJECT ORGANIZATION AND IMPLEMENTATION, MONITORING AND EVALUATION AND SPECIAL STUDIES

I. PROJECT ORGANIZATION AND IMPLEMENTATION

Executing Agencies

1. The various project components will be executed principally by some 20 existing federal, state and private agencies and 7 municipal governments. A list of the entities and their main roles in the project is given in Chart 1, overleaf.

Implementation Schedule

2. A summary of the consolidated schedule of principal project activities is given in Chart 2.

Overall Coordination

3. With Decree No. 11.563 of November 17, 1975, the State Government of Ceara created a special Management Council (Conselho Diretor) to provide overall guidance and coordination for the integrated projects which might be implemented with funding from the Federal Government's POLONORDESTE program. The State Secretary of Planning, whose agreement is necessary for all state government budget allocations, was appointed head of the council, which also includes the State Secretaries of Agriculture, Health, Education and Public Works; the State Director of the Federal Ministry of Agriculture; the Regional (State) Director of SUDENE (the Northeast Development Superintendency); and representatives of Banco do Brasil, Banco do Nordeste do Brasil and Banco Nacional de Credito Cooperativo. The council normally meets monthly to review progress of POLONORDESTE activities and/or resolve policy issues, and is responsible for the yearly approval of the proposed operating plans for the POLONORDESTE activities of the various participating agencies in the state of Ceara.

4. Day-to-day management and supervision of all POLONORDESTE projects in Ceara, including the Ibiapaba project, will be one of the responsibilities of the General Coordinator (Chief Executive) of the State Agricultural Planning Commission, CEPA-CE, who will report to the Conselho Diretor, through the Secretary of Planning. He will be assisted by a full-time Technical Coordinator

CHART 1: PRINCIPAL EXECUTING AGENCIES

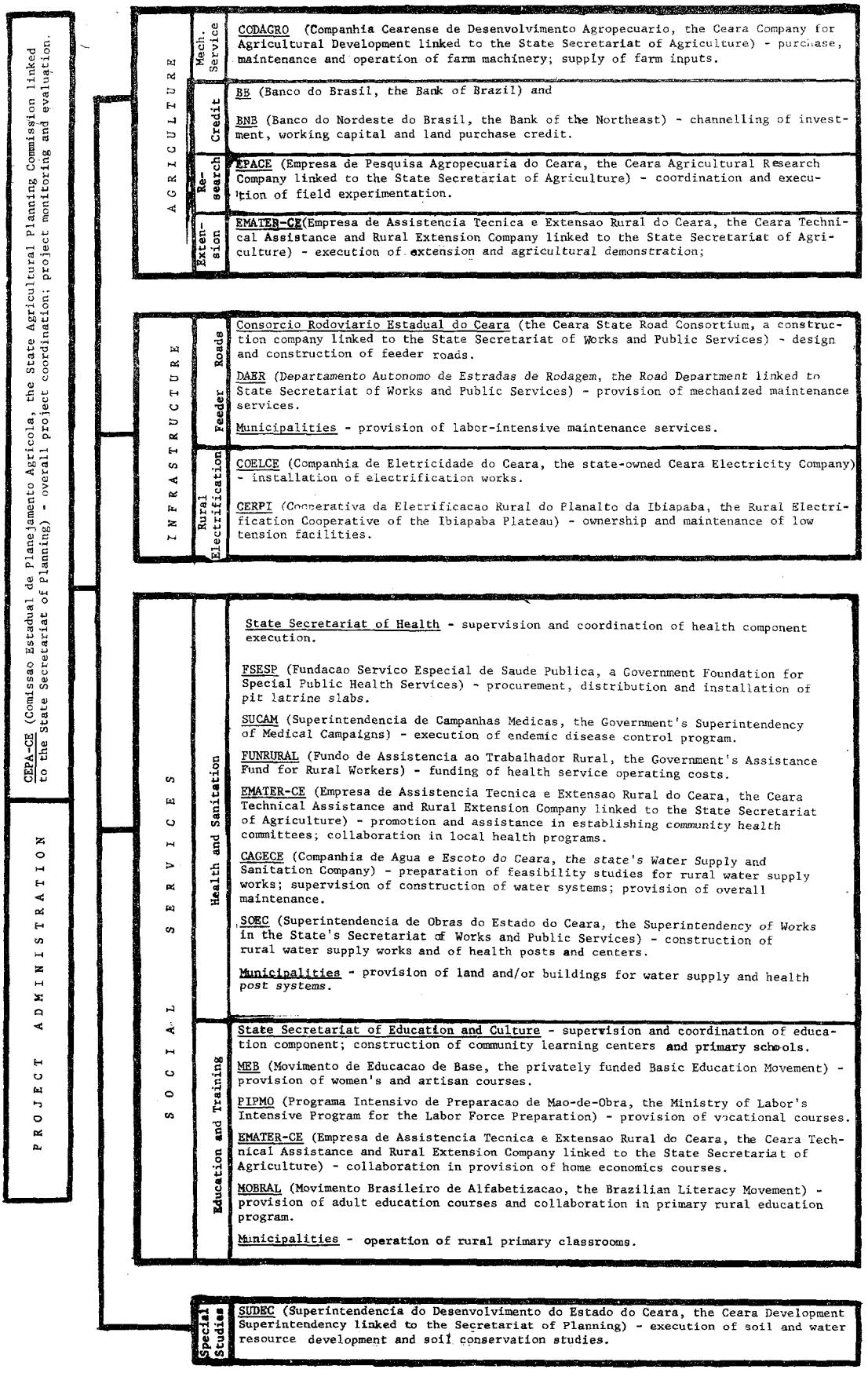
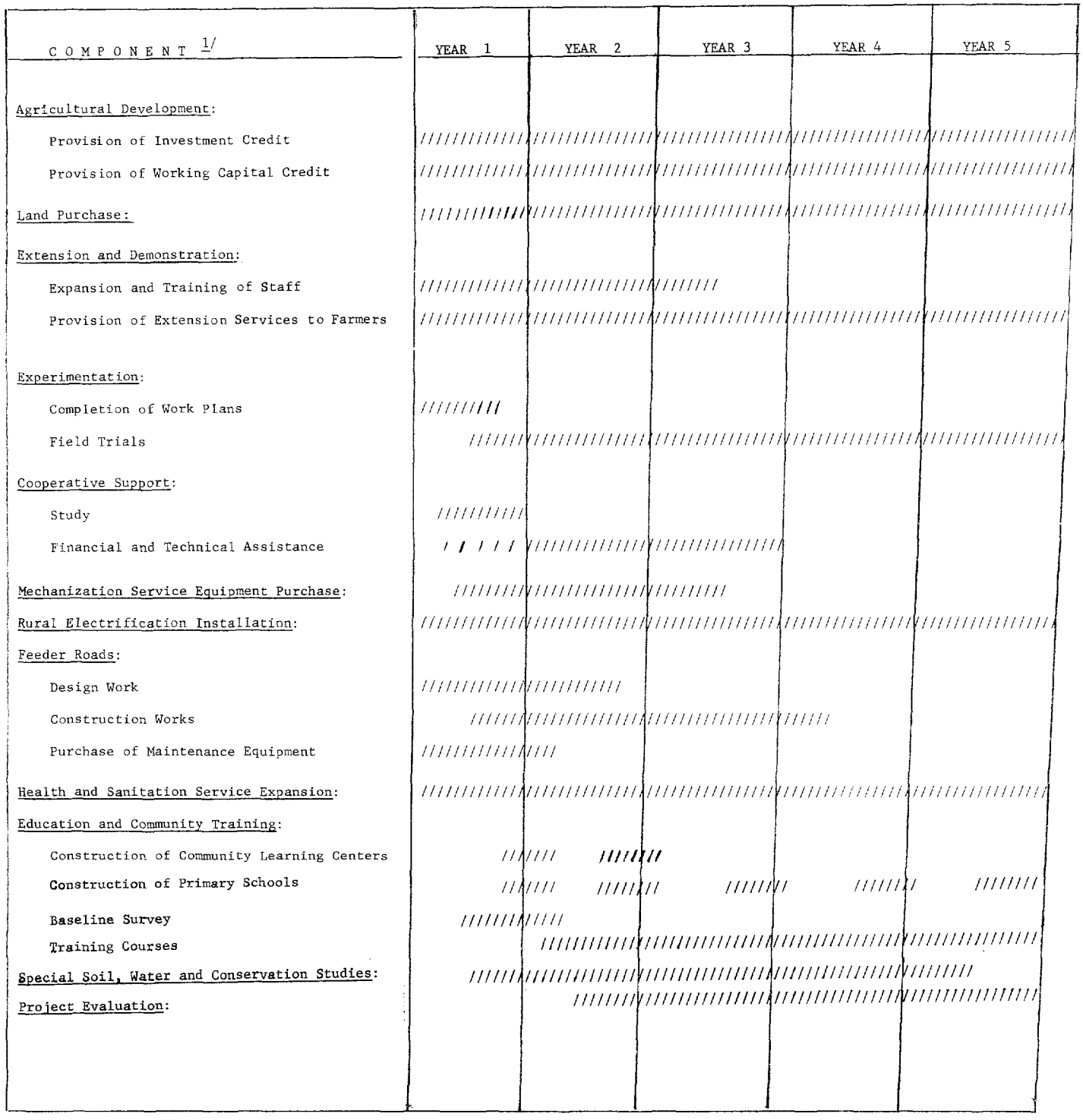


CHART 2: CONSOLIDATED IMPLEMENTATION SCHEDULE



1/ For institutional responsibilities, see Chart 1.

who would be responsible for supervising the work of: (a) project management units--composed of a full-time project manager, several advisors and a field representative--for each POLONORDESTE project in Ceara; and (b) a support unit, or pool of staff to provide specialized technical assistance and financial control for all of the project management units. The General Coordinator of CEPA will also be assisted by a separate monitoring and evaluation unit (see paras 11-13 below). The general project coordination arrangements are shown in Chart 3, overleaf.

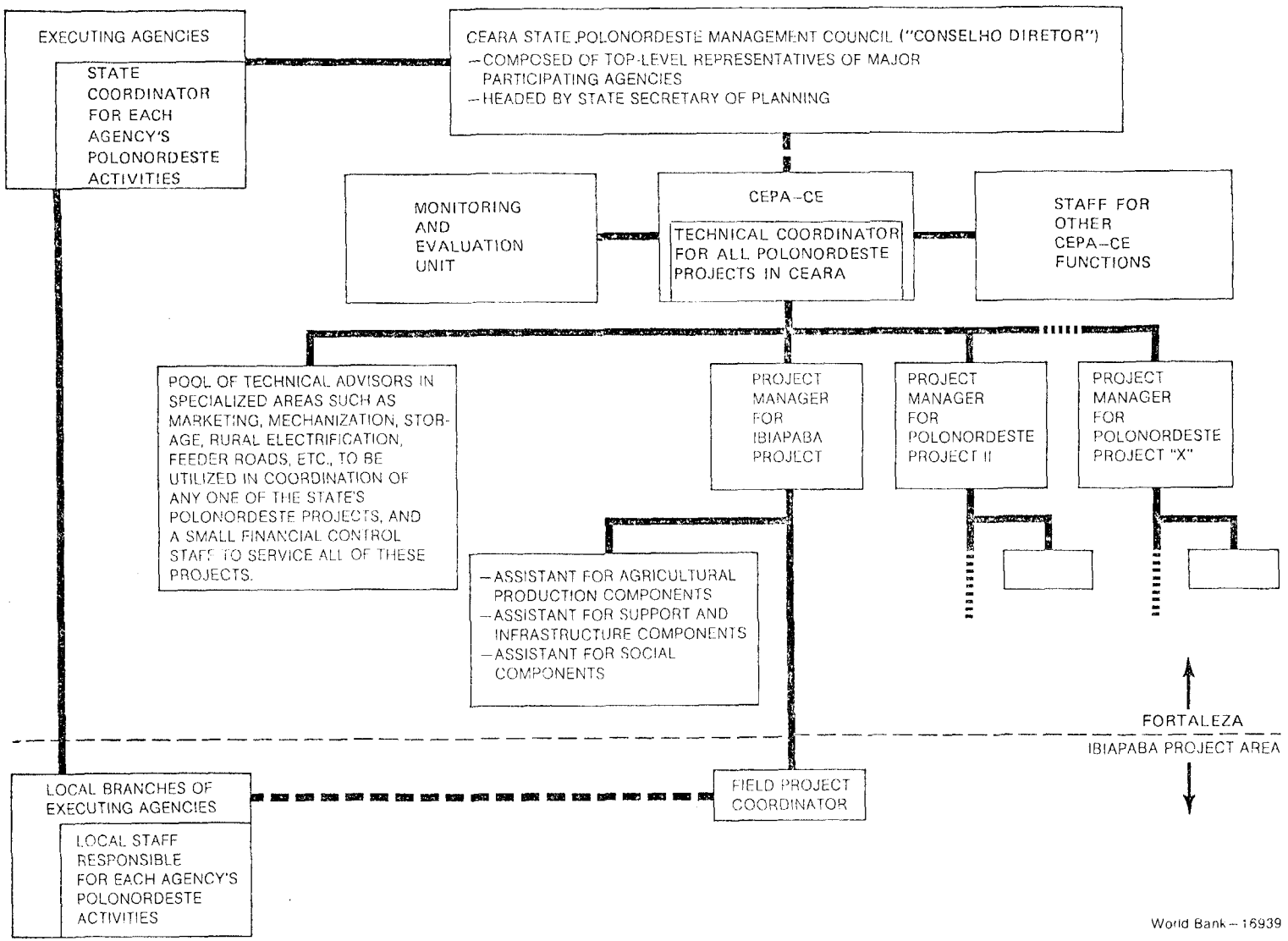
5. The Technical Coordinator would be responsible for: (a) supervising the work of the project management units and support unit; (b) advising the General Coordinator of CEPA-CE on matters of interest such as program progress, changes in project plans, agreements with participating agencies, contracting consultants, etc.; (c) reviewing annual work plans prepared by project management units and the respective participating agencies; (d) helping assure consistency and transfer of experience among the various POLONORDESTE projects in the state; (e) promoting the active cooperation of the various participating agencies; and (f) based on reports prepared by the Project Managers and participating agencies, reporting at least quarterly through the General Coordinator to the Conselho Diretor, on the details of project progress and problems.

6. The Support Unit would be composed of a small "in house" pool of specialists available to act as technical liaisons between the project coordination unit and the specialized executing agencies (for roads, electrification, etc.) and assist in the preparation or supervision of those aspects of the various POLONORDESTE projects which individually would not require a full-time specialist. It would include about 5 professional staff able to advise on matters such as feeder roads, electrification, storage, marketing, or project financial control. The financial control staff would be in charge of assuring the maintenance of adequate accounting and auditing records of project expenditure.

7. The Project Manager would be responsible full-time for: (a) the overall supervision of activities under the project; (b) arranging for and coordinating the preparation of annual work plans--targets, budgets, methods--with each participating agency; (c) keeping in close contact with participating agencies and reviewing project progress; (d) preparing consolidated quarterly progress reports, based on reports submitted to him by the participating agencies, for the Conselho Diretor and the relevant Regional and Federal POLONORDESTE officials; and (e) assuring that project experiences are adequately reflected in periodically revised project plans. The Project Manager for Ibiapaba (who would be located in Fortaleza) would be assisted in these tasks by three full-time professional staff (one advisor for agricultural production components, one for support and infrastructure components and one for social components), and administrative support staff. As most of the project's executing agencies have their state headquarters in Fortaleza, the project management team would also have to work out of Fortaleza.

CHART 3

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT—IBIAPABA
PROJECT ORGANIZATION AND COORDINATION



World Bank—16939

8. A field representative, however, would work out of Ubajara in the project area and would be responsible for: (a) maintaining close contact with and coordination between the field staff of the various participating agencies; (b) identifying, resolving and/or communicating to the Project Manager for further action day-to-day execution problems as they arise; and (c) especially, assuring that plans for project activities take into account actual field experiences.

9. A special provision for technical assistance would be made in the project for the contracting by CEPA-CE of up to about 19 man-months equivalent of specialized consultancy services to assist the technical coordinator, the Project Manager or the participating agencies in such matters as definition of technical packages, special training courses, revisions in project scope or execution arrangements, etc. Specific requirements would be identified as the project progresses.

Estimated Costs

10. The costs of overall project coordination and administration would include: the salaries and relevant social security charges for the Technical Coordinator and the Support Unit (who will eventually serve all 3 POLONORDESTE projects); the salaries and relevant social security charges for the Ibiapaba project manager and management team and field staff, office workers and motorists; per diem for travel expenses; vehicle operating and maintenance costs and office materials and supplies; one vehicle; miscellaneous office equipment; and consulting services. The detailed cost assumptions are given in Tables 1 and 2 of this Annex. The total cost for project coordination is estimated at Cr$17.9 million, or US$1.5 million equivalent.

II. MONITORING AND EVALUATION

11. As noted in paragraph 4 and Chart 3 in this Annex, the project would also provide for a monitoring and evaluation unit in CEPA-CE, separated from project execution responsibilities. It would be composed of two full-time professionals, with experience in social and economic research, and a minimum support staff.

12. While the participating agencies and the project manager (see para 7) would be responsible for the normal preparation of periodic reports describing physical progress toward achieving project targets, the evaluation unit would focus on: (a) periodic socio-economic studies to review the impact of the project on the target population and community at large--utilizing, for example, the base line farm survey taken before project appraisal and the baseline education survey to be taken as part of the education and training component as two points of departure for follow-up surveys--and to spot unexpected side-effects of the project on such things as access to land, functioning of the labor market, community stability, etc.; (b) independent evaluations of the performance of participating agencies in achieving project objectives; and (c) reviewing the appropriateness of the approach and organizational arrangements of the project. The evaluation unit would report to the General Coordinator of CEPA-CE.

13. Estimated costs for the monitoring and evaluation of the Ibiapaba project are detailed in Tables 1 and 2 to this Annex and include salaries and relevant social security charges, per diem for travel, materials and supplies, other operating costs (including computer rental) and the equivalent of roughly 35 man-months of specialized consultancy services to assist evaluation design, data processing and analysis. It is expected that much of this technical assistance would be oriented concurrently toward providing further training for the ealuation unit staff. Also, should it prove feasible as experience is gained, part of the expected consultancy services might be substituted by full-time staff. The estimated total cost of monitoring is Cr$6.2 million, or US$0.5 million equivalent.

III. SPECIAL STUDIES

Background

14. Since administrative, technical and financial constraints preclude the simultaneous initiation of project preparation and execution in each of the POLONORDESTE priority areas in Ceara (see Map No. 12315), the state and federal authorities concerned are adopting a phased approach. The Serra da Ibiapaba project is the first POLONORDESTE project to be executed in the state, and preparation is relatively advanced for projects in the Serra da Baturite (a highland area, similar to Ibiapaba, in the North-central portion of the state) and in the lower Jaguaribe river valley (an area in the eastern part of the state in which a combined development of irrigated and rainfed agriculture is being planned with the technical assistance of BNB, DNOCS and the Israeli Government). 1/ These project areas were selected mainly because of their agricultural potential and their rural employment generation potential. The Government has requested the Bank to consider financing in the future, as possible follow-ups to the Ibiapaba project, these or other POLONORDESTE projects in the state of Ceara.

15. In addition, the Government has requested that the Bank help finance, as part of the proposed Serra da Ibiapaba project, several basic studies upon which subsequent projects might be built in other priority areas in the state. The objective would be to strengthen the planning capacity of institutions working in the state, a process begun with the preparation of the Ibiapaba, Baturite and lower Jaguaribe projects, and to help assure an orderly and manageable phasing of sound rural development project proposals for the next several years. The studies, to be carried out over a three-four year period, are intended mainly to compile information on physical (soil and water) potential for agricultural development and would help provide the basis for the formulation of detailed production development proposals. The studies would include: (i) semi-detailed soil surveys in parts of several semi-arid areas--probably including Sertao de Quixeramobim/Medio Jaguaribe, Sertaneja

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1/ Project preparation work was also recently initiated for two large and ecologically difficult semi-arid areas called Sertao de Quixeramobim/Medio Jaguaribe and Sertaneja dos Inhamuns e de Salgado (see paras 16 and 17).

dos Inhamuns e de Salgado and Sertoes Cearenses; (ii) a water resource survey in Sertaneja dos Inhamuns e de Salgado; and (iii) soil conservation studies focussing on all priority areas in the state.

The Study Areas

16. Sertao de Quixeramobim/Medio Jaguaribe. This area includes some 27,400 km^2 in 14 municipalities (counties) in the central-eastern part of the state. In 1970 the rural population was about 370,000 and the total population 460,000. The state hopes eventually to define a rural development project to benefit directly some 27,500 of the area's farm families and indirectly an additional 36,500 families. The area corresponds to the semi-arid or sertao region around the middle reaches of the Jaguaribe River. For the most part, rainfall is irregular and averages only 600-800 mm/year, most of which is concentrated in a 4-month period. Except for some alluvial soils along the rivers, most of the soils have moderate to serious fertility and erosion problems. Currently, agricultural and livestock activities are carried out at very low levels of productivity, due partly to serious soil and water constraints, unequal distribution of land and poor technical support services. An estimated 63% of the value production in the agricultural sector is derived from crops and about 37% from livestock. Almost 80% of the value of crops produced is accounted for by cotton (37%), beans (21%) and corn (31%). Extensive beef production, the main livestock activity, is based on a cattle population of about 300,000 head (1972).

17. Sertaneja dos Inhamuns e de Salgado. This area represents the upper-middle section of the Jaguaribe River Valley. It covers some 22,200 km^2 to the South of Quixeramobim/Medio Jaguaribe, and includes 18 municipalities with a total population (1970) of about 420,000 of which about 305,000 are rural. Rainfall is about 600-800 mm/yr., the lower end of that range applying to most of the western part of the area where the rains are concentrated in only three months of the year. Very large parts of the area have soils with severe limitations on agricultural development. Vast parts of the area are flatlands covered with native scrub growth (caatinga) and agriculture centers almost entirely on livestock production and the growing of the cotton, beans and corn. Most of the cropping is concentrated in the eastern part of the area. Overall, livestock products contribute 35% of the value of agricultural production and crops 65%. Cotton represents about 53% of the value of crop production, beans 20% and corn another 10%. The cattle population in 1972 was some 200,000 head.

18. Sertoes Cearenses. This area covers some 25,600 km^2 of 15 municipalities in the semi-arid center of the state, to the west of the Jaguaribe basin and the east of the Serra da Ibiapaba area. The total population (1970) is about 431,000 of which 296,000 are rural. Rainfall patterns, the problems of poor soils and technical support services and very uneven distribution of

land ownership are similar to those in the sertao sections of the Jaguaribe basin. Cotton (32%), beans (30%) and corn (21%) represent the bulk of the value of crops produced although beef cattle provide the most important single source of farm income.

19. The sertao areas to be focussed upon (paras 16-18) in the special studies cover over half the area of Ceara and 35-40% of its rural population, have serious soil and climate restrictions to agricultural growth, and are roughly similar to the area covered in the Rio Grande do Norte rural development project (see Loan 1195-BR and Appraisal Report No. 921-BR of November 11, 1975). The proposed water and soil resource studies would, together with the technical experience gained in the Rio Grande do Norte project and the institutional development begun with the Serra da Ibiapaba project, help form the basis for future rural development activities in the sertao areas of Ceara.

Scope of Proposed Studies

20. Semi-Detailed Soil Studies. The proposed studies, which could cover parts of Quixeramobim/Medio Jaguaribe, Sertaneja dos Inhamuns e de Salgado and Sertoes Cearenses, would use as a starting point the results of the general exploratory survey already completed by the former Soils Research Unit (now part of EMBRAPA, the Brazilian Agricultural Research Company) of the Ministry of Agriculture and the SUDENE Department of Natural Resources as well as the aerial photographs (scale of 1:100,000) also prepared by SUDENE. The studies would cover each year (for a total of 3 years) 90,000 ha to be selected based on potential for intensified agriculture or irrigation. In general, the studies would include:

(i) the identification, classification and mapping of soils in the selected areas (to a scale of 1:25,000);

(ii) a review of the physical structure and chemical composition of those soils;

(iii) an evaluation of soil fertility and fertilization requirements.

The studies would generate soil maps (including soil series and phases); land classification maps for irrigation (consistent with United States Bureau of Reclamation standards); and land capability maps (consistent with United States Department of Agriculture criteria). The soil studies would follow guidelines established by the National Soil Survey and Conservation Service of EMBRAPA.

21. Water Resource and Use Survey. The general objective of the water resource survey is to collect and analyse, over a period of about a year, existing information on water resources in the Sertaneja dos Inhamuns e de Salgado area and to identify water use development possibilities for improving livestock operations or small scale irrigation. The study would include:

(i) the collection of existing data on precipitation, vegetation, geology, surface and underground water resources and the quality of the water, current water consumption, etc.; collection and organization of existing maps on these topics; and organization of a reference bibliography on available water, soil, vegetation and climate data;

(ii) collection and analysis of data on existing irrigation projects and other water uses;

(iii) execution of limited groundwater surveys to complement existing information as necessary;

(iv) development of consolidated revised maps of principal drainage basins and water resources in the region; and

(v) based on water, soil and climate data collected, the identification and analysis of potential improvements in management of water resources for agricultural and rural development and the preparation of a long-term water resource development program.

The alternatives studied would probably include the possible development of new storage reservoirs and/or means to better utilize existing reservoirs in highest potential areas for irrigation.

22. Soil Conservation Studies. With the exception of some recent work directed specifically toward improving soil conservation in coffee producing areas of the state, relatively little has been done to develop and promote the adoption of soil conservation measures. The exploratory soil survey already available for the state (see para 7) identifies the fact that the majority of the soils in the state urgently require measures to reduce soil erosion. The proposed study would, therefore, in conjunction with planned water resources and soil surveys, focus on the development of various soil conservation practices consistent with the more intensive agriculture as contemplated under the various POLONORDESTE projects in the state. The soil conservation studies would begin in the Serra da Ibiapaba area where the Soils and Geology Division of the National Resources Department of SUDEC (Development Superintendency of Ceara) is already executing semi-detailed soil studies under a special agreement with SUDENE. The work in Ibiapaba would, for example, help assure that adequate and timely measures are taken to prevent erosion and assure proper management of the substantial new land areas to be cleared and put into production as part of the proposed rural development project. It is intended as well that, partly to help define the priority and appropriate use of mechanization services provided under the project, the study results would be routinely reviewed with the project management unit and extension and research companies and incorporated into technical recommendations promoted by extensionists to individual farmers and developed, hopefully, with region-wide soil conservation and land use planning in mind.

Organization and Execution of the Studies

23. All of the studies would be executed through the Natural Resources Department of SUDEC, which is administratively linked to the State Secretariat of Planning. The Natural Resources Department of SUDEC receives technical assistance from, and defines much of its program in conjunction with, the Natural Resources Department of SUDENE (the Northeast Development Superintendency). Its work is also linked with the activities of EPACE, the state's agricultural research company, and the national research company, EMBRAPA. A management agreement (convenio) would be established between the state government and SUDEC, channelling POLONORDESTE funding to cover the costs of the staff required, specialized consultancy and other contracted services, materials, minor installations and equipment. The size of the proposed studies was set partly to take into account the estimated rate at which SUDEC could expand its activities efficiently, and at the same time take advantage of the experience SUDEC has in this area. SUDEC's capacity, however, still requires considerable strengthening, and SUDEC will require some specialized assistance in helping define the detailed work programs, organize work teams and supervise study execution. Assurances were obtained during negotiations that SUDEC would contract consultancy services satisfactory to the Bank for this purpose. The water resources survey would be carried out over about a one year period, the soil surveys over a three year period, and the soil conservation studies over a four year period. During the first six months, work would be concentrated on the completion of detailed work programs, the staffing of the study teams, and the initiation of secondary data collection. Agreement was reached during negotiations that the detailed work plans for the studies would be provided to the Bank for approval by December 31, 1977.

Estimated Costs

24. The total costs of the studies would be about Cr$ 25.6 million (roughly US$2.2 million) over a four year period (see Table 3). This would be equivalent to some 36 man-years of consultancy services, though it is likely that, with a relatively small amount of well-selected consultancy services, the bulk of the studies can be efficiently carried out by SUDEC with some additional staff to be contracted for the study period, thereby taking advantage of relevant experience and an existing infrastructure of support services.

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Cost Estimates for Project Administration and Evaluation Units 1/

(Cr$ 000 of November 1976)

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Project Administration						
Personnel 2/	3,003	3,003	3,003	3,003	3,003	15,015
Per-Diem for Travel	112	126	126	126	126	616
Equipment	123	-	-	-	-	123
Vehicle Operation & Maintenance	76	76	76	76	76	380
Mileage 3/	38	38	38	38	38	190
Office Supplies	50	70	70	70	70	330
Misc.Expenses & Rents	20	20	20	20	20	100
Consultancy Servs.	177	236	236	236	236	1121
Total(without contingencies)	3,599	3,569	3,569	3,569	3,569	17,875
(US$ 000 equiv.)	305	302	303	302	303	1,515
Monitoring and Evaluation						
Personnel2/	755	755	755	755	755	3,775
Per-Diem for Travel	14	42	42	42	42	182
Misc. Travel Expenses	10	15	15	15	15	70
Office Equipment	24	-	-	-	-	24
Office Supplies	10	14	14	14	14	66
Consultancy Services	177	295	295	295	295	1,357
Data Processing and Analysis	40	160	160	160	160	680
Total(without contingencies)	1,030	1,281	1,281	1,281	1,281	6,154
(US$'000 equiv.)	87	108	109	108	109	521

1/ Underlying assumptions detailed in Table 2 of this Annex.

2/ Including average of 32% over base salary to cover social security charges.

3/ When staff member uses own vehicle for work.

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Project Administration and Evaluation - Cost Assumptions

	Number	Unit Cost(Cr$)
I. Project Administration		
Personnel		
Technical Coordinator	1	234,000/yr.
Project Manager	1	208,000/yr.
Assistants to Project Manager	3	182,000/yr.
Technical Pool Specialists	5	208,000/yr.
Field Manager	1	143,000/yr.
Office Staff and Drivers	4	26,000/yr.
Social Charges:32% of salaries		
Per Diem	160-180/yr.	310-390/day
Equipment 1/	1 land-rover	89,000
	2 calculators	7,000
	2 type-writers	5,000
	1 projector & screen	7,700
	1 camera	2,500
Vehicle Operation and Maintenance	gas,oil,parts,tires, insurance,lubrication, etc.	76,000/yr
Mileage	1500 Km/mo	2.10/Km
Office Supplies	-	70,000/yr.
Consultancy Services	19 man-months	59,000/mo.
II. Project Evaluation		
Personnel		
Evaluation Specialists	2	182,000/yr.
Office Staff	2	26,000/yr.
Temporary staff	2 equiv.	78,000/yr.
Social Charges:32% of salaries		
Per Diem	20-60/yr.	310-390/day
Misc. Travel Expenses		15,000/yr.
Equipment 1/	2 calculators	7,000
	2 typewriters	5,000
Office Supplies	-	14,000/yr.
Consultancy Services	23 man-months	59,000/mo.
Data Processing and Analysis		
Computer Time	60 hours over 5 years.	4,000/hr.
Programming Assistance	approx. 12 man-months	36,000/mo.

1/ A variety of equipment already available through POLONORDESTE financing of pre-project costs in 1976.

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 3: Cost Estimates and Phasing of Special Studies
(Cr$ '000 of November 1976)

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Soil Surveys[1/]	3,040	4,050	4,050	1,010	-	12,150
Water Resource Survey (Inhamuns/Salgado)	2,200	1,500	-	-	-	3,700
Soil Conservation Studies	1,600	2,400	2,400	2,400	1,000	9,800
Total[2/] (without contingencies)	6,840	7,950	6,450	3,410	1,000	25,650
Total[2/] (US$ '000)	580	674	546	289	85	2,174

1/ Based on the assumption that semi-detailed surveys would be carried out for a total of 270,000 ha and the cost (including personnel, materials, equipment and specially contracted services) would average about Cr$ 45/ha.

2/ Includes, pro-rated among the studies, the equivalent of about US$ 100,000 for expert consultancy services (roughly 1-2/3 man-years equivalent) for assisting SUDEC in the definition of detailed work programs and teams and in supervising study work.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA
Summary Project Costs and Phasing (US$'000)

	Year 1 [1]	Year 2	Year 3	Year 4	Year 5	Total	Baseline Costs %	Foreign Exchange %
Agricultural Development								
On-Farm Investment	475.2	1,376.6	2,860.7	3,081.2	1,526.8	9,320.5	22.1	11.0
Incremental Farm Working Capital	62.6	293.2	817.7	1,361.6	1,418.6	3,953.4	9.4	23.0
Land Purchase Credit	76.3	148.3	190.7	148.3	84.7	648.3	1.5	0.0
Productive Support								
Agricultural Extension and Demonstration	492.2	719.5	1,099.1	1,214.5	1,065.1	4,590.4	10.9	11.6
Field Experimentation	28.7	36.8	45.0	61.2	61.2	232.9	0.6	10.0
Cooperative Support	80.0	110.0	110.0	-	-	300.0	0.7	15.0
Mechanization Services	224.4	264.1	181.0	-	-	669.5	1.6	38.4
Rural Electrification	1,637.0	1,958.0	1,104.0	1,127.0	719.0	6,545.0	15.5	30.0
Feeder Roads	1,420.0	2,670.0	1,710.0	110.0	-	5,910.0	14.0	34.0
Social Infrastructure								
Health and Sanitation	273.7	409.4	577.4	690.0	580.5	2,531.0	6.0	19.0
Education and Community Training	960.8	887.6	456.1	478.6	476.8	3,259.9	7.7	16.9
Project Administration and Studies								
Project Coordination Unit	305.0	302.0	303.0	302.0	303.0	1,515.0	3.6	10.0
Evaluation Unit	87.0	108.0	109.0	108.0	109.0	521.0	1.2	10.0
Studies	580.0	674.0	546.0	289.0	85.0	2,174.0	5.2	10.0
BASE COST [2]	6,702.9	9,957.5	10,109.7	8,971.1	6,429.7	42,170.9	100.0	19.5
Physical Contingencies [3]	566.5	766.0	580.7	413.3	320.3	2,646.8	6.3	19.5
Price Contingencies [4]	563.3	1,740.3	2,651.0	3,104.1	2,878.4	10,937.1	24.4	19.5
TOTAL PROJECT COST	7,832.7	12,463.8	13,341.4	12,488.9	9,628.4	55,754.8	132.2	19.5

1/ Year 1 of the project, for purposes of these cost estimates, corresponds to the full 1977 fiscal year of POLONORDESTE (April 1, 1977 through March 31, 1978), with each subsequent project year corresponding to the respective POLONORDESTE fiscal year.

2/ In prices at the time of appraisal (November 1976) converted to US$ at the rate of Cr$11.8=US$1.0

3/ Physical contingencies equivalent to 5% for the mechanization component; 7% for the extension, experimentation, project administration and studies components; 10% for the cooperative support, rural electrification, feeder road and education components; and 15% for the health and sanitation component.

4/ Price contingencies calculated as follows: for civil works, 10% in 1976, 9% per year in 1977-1979 and 8% per year thereafter; for equipment, 8% in 1976, 7.5% per year in 1977-1979 and 7% per year thereafter; for other materials and supplies, credit, salaries, etc., 9% in 1976, 8% in 1977 and 7% per year thereafter.

5/ Price contingencies as a percentage of base cost plus physical contingencies.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Estimated Schedule of Bank Disbursements

(US$ millions)

Bank Fiscal Year	Quarter Ending	Disbursed During Quarter	Cumulative Amount Disbursed	Balance of Loan
1978	Sept.30	0.0	0.0	17.0
	Dec. 31	0.6	0.6	16.4
	March 31	0.8	1.4	15.6
	June 30	0.8	2.2	14.8
1979	Sept. 30	0.8	3.0	14.0
	Dec. 31	0.9	3.9	13.1
	March 31	0.9	4.8	12.2
	June 30	1.0	5.8	11.2
1980	Sept. 30	1.1	6.9	10.1
	Dec. 31	1.2	8.1	8.9
	March 31	1.2	9.3	7.7
	June 30	1.0	10.3	6.7
1981	Sept. 30	1.0	11.3	5.7
	Dec. 31	0.9	12.2	4.8
	March 31	0.9	13.1	3.9
	June 30	0.8	13.9	3.1
1982	Sept. 30	0.8	14.7	2.3
	Dec. 31	0.7	15.4	1.6
	March 31	0.7	16.1	0.9
	June 30	0.6	16.7	0.3
1983	Sept. 30	0.3	17.0	0.0

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

AGRICULTURAL DEVELOPMENT, PRODUCTION TECHNOLOGY, PRODUCTION ESTIMATES, MARKETS AND PRICES

I. AGRICULTURAL DEVELOPMENT

Current Agricultural Conditions

1. Agriculture is by far the most important economic activity in the Ibiapaba region. As detailed in Annex 1, ecological conditions differ widely within the area. The most favorable agricultural conditions exist in the humid zone (up to 1,900 mm of rainfall per annum), less favorable conditions exist in the carrasco or scrubland zone (1,100-1,300 mm of rainfall per annum), while quite unfavorable conditions exist in the sertao or arid zone (usually less than 1,000 mm of rainfall per annum). It is hardly surprising therefore that a wide range of crops are grown within the area as a whole and that crop yields vary widely, depending on ecological conditions, levels of management, and individual soil types. In the humid zone the most widely grown are subsistence crops such as manioc, maize and beans, together with largely cash crops such as sugarcane, coffee, bananas, vegetables, citrus, avocado and mangoes. The most important of these cash crops is currently sugarcane, but coffee is assuming increasing importance, as are vegetables since market prospects improved with the introduction of a better basic road system. In the scrubland zone manioc and beans are widely grown, but sorghum in some cases is taking the place of maize. There is little emphasis in the scrubland zone on crops such as sugarcane, bananas and vegetables, although these may in fact be grown in scattered pockets where water is available. In the arid zone the emphasis is almost exclusively on extensive cattle ranching, but again small quantities of subsistence crops may be grown where water is available.

2. Generally speaking, agricultural practices are of a traditional nature and, where the farms are small, production is primarily oriented toward subsistence needs. Modern inputs such as fertilizers and pesticides have not, traditionally, been used on any scale. Agricultural practices are fairly primitive. Nor, for reasons that are elaborated on in Annexes 2 and 3, has the small farmer had much access to formal credit channels or to technical assistance. As a consequence, and due to the prevailing land ownership and sharecropping system, the general level of agricultural productivity is low (see Table 1 for estimated yields without the project).

3. Farming systems vary greatly within the area. Where the farms are larger the practice is to utilize sharecroppers (growing both subsistence and cash crops) rather than employ paid labor. Consequently, there are no clearly

defined cropping rotations. Instead, sharecroppers tend to practice a form of shifting cultivation whereby the land is cropped for three to four years consecutively before being left fallow for ten or more years. Where the farms are smaller, which usually coincides with better soils, cropping patterns are more intensive and there tends to be less fallow or partially used land. Overall, both because of the prevailing land tenure system and poor road access, substantial areas are at any one point in time under-utilized. Another contributing factor is that yields (and, hence, revenues) are low due to poor cropping practices. This overall pattern is, however, changing. Market prospects are improving, modern inputs are becoming easier to obtain, and there is more emphasis on increased cash cropping. The introduction of coffee and the increasing cultivation of vegetables are cases in point.

Proposed Agricultural Development Strategy

4. The serra area as a whole, but particularly the humid zone, has much more agricultural potential than the arid sertao which surrounds most of the project area. There is evidence that the area is beginning to "take off" in economic terms, primarily because of the building of the new access road and the better marketing opportunities that this presents. The agricultural development strategy employed under the project will therefore be to hasten the natural development process by improving the support services available to the farmers, thus enabling them both to improve yields of the traditional subsistence crops and to increase the production of the (potentially) very profitable cash crops such as vegetables, fruit, sugarcane and coffee in the humid zone and peanuts in the scrubland zone. Agricultural practices are currently not very sophisticated, but it is believed that a considerable amount of agricultural expertise already exists, which, if supplemented by experience in other parts of the state, and stimulated by improved support services and infrastructure, should result in substantially increased production. It is precisely because the area has this latent development potential that it has been chosen as the focal point for the project.

II. PRODUCTION TECHNOLOGY

General

5. As already mentioned, a wide variety of crops are grown within the project area and a considerable amount of agricultural expertise is already available, although it is not at present practiced universally. The available information is detailed below. All the crops mentioned are quite widely grown in the project area, the exception being peanuts, which is grown but on a limited scale. Initial trials suggest grounds for optimism with regard to peanuts, but it should be emphasized that, of all the the recommended crops, peanuts at present represent the biggest uncertainty. Crop yield estimates mentioned represent a composite result of local knowledge (particularly from EMATER staff) and appraisal mission findings. Cultural and management practices do not involve major departures from existing custom. Fertilizer

recommendations should be looked at as preliminary averages based on the best available (though incomplete) data on soil fertility levels, and on rudimentary "technical packages" developed by the extension services. During project implementation, recommendations will be improved and adapted on the basis of further soil fertility analysis and the results of the project's experimental program. Yield assumptions are for the most part conservative and are generally thought to be attainable by the time the project is fully implanted. Yield increases are phased over time, the details being provided in Table 1. Yearly input coefficients by crop are summarized in Table 2 and estimated input and output prices are given in Table 3. A tentative land use per farm type is given in Appendix 1.

6. Beans can be grown on the lighter soils of the humid zone, and more generally throughout the scrubland zone where the soils in any case are mostly very sandy. Soils with a pH of about 6.5 are to be preferred. The local variety (Mulatinho) is already widely produced and will continue to be grown. Planting should take place at the beginning of the rainy season, and the crop can be grown either as a pure stand or interplanted with other crops such as manioc or maize. When grown in a pure stand, the rows should be 40 cm apart with a spacing interval of about 20 cm within the row. The first weeding should be done when the plants reach about 20 cm in height, the second weeding about two weeks later. The recommended fertilizer usage would in general be about 60 kg urea, 40 kg of triple-superphosphate and 65 kg of potassium fertilizer per ha in the humid zone; and 75 kg of urea, 50 kg of triple-superphosphate, and 80 kg of potassium fertilizer in the scrubland zone. Harvesting would normally begin some 100 to 120 days after planting. Present yields in the humid and scrubland zones are approximately 450 kg per ha and 300 kg per ha, respectively. It is believed that these yields can be increased to 700 kg per ha and 500 kg per ha, respectively, with the introduction of recommended practices. These are fairly modest increases, and, where conditions are more favorable (i.e., in the humid zone), substantially higher yields are probably attainable.

7. Manioc can be grown on a very wide range of soil types. The crop is very responsive to good management and good growing conditions, but it is also capable of yielding satisfactorily where the soils are poorer and sandier as in the scrubland zone. It also tolerates more acid conditions and can be grown where the pH is as low as 5.0. The recommended varieties are the local strains of Joao Grande and Crateus, together with higher yielding varieties, which are presently being grown in the neighboring state of Pernambuco, such as Manipeba Branca, Jaloba and Tutano. The crop can be planted more or less any time during the rainy season, although preferably in the beginning of the rainy season. It is best planted on ridges 100 cm apart and 20 cm high, with the plants spaced 50 cm apart along the ridge. Cuttings 15/20 cm in length are the preferred planting material. Two or three weedings are required during the growing season. The generally recommended fertilizer practice is about 60 kg of urea, 115 kg of triple-superphosphate and 40 kg of potassium fertilizer per ha. Harvesting normally takes place 12 to 18 months after planting, the length of time depending on exactly when during the previous rainy season the crop was actually planted. Current yields average about 4 tons per ha, but it is believed, since the crop is very responsive to

improved nutrition (particularly nitrogen and phosphates), that yields of 14 tons per ha are attainable. Again, substantially higher yields than this can be obtained on the better soils under good management.

8. Maize can be grown on almost any soil type, except heavy clays with impeded drainage. Best results are, however, obtained in the humid zone on medium-textured, deep, well-drained soils with a pH of from 6 to 7.5. The recommended varieties are the local strains of Acteca and Maia, but it should also be possible to introduce selected hybrids from other parts of the North-east. The crop should be planted in February/March in rows 90 cm apart with a spacing interval of 25 cm along the ridges. Two weedings are generally needed, the first one about two weeks after planting and the second two weeks later. The generally recommended fertilizer practice is about 60 kg of urea, 45 kg of triple-superphosphates and 70 kg of potassium fertilizer per ha. Harvesting would normally begin at the end of the dry season, i.e., about the end of June. Present yields are very low, generally about 700 kg per ha, but it is believed that yields of 2 tons per ha are attainable.

9. Sugarcane can be grown on a wide range of soil types, but it is best grown in the humid zone on deep, well-drained soils having a pH of between 5.5 and 6.5. The recommended varieties are IANE-4421 and CO-419. The crop is best planted after the onset of the first rains in rows 80/100 cm apart with a spacing interval of 40/80 cm along the row. Generally two to three weedings are required in the first year. The recommended fertilizer rate is approxi-mately 120 kg of urea, 80 kg of triple-superphosphate and 140 kg of potassium fertilizer per ha. Up to 5 ratoon crops can be grown. Current yields average about 32 tons per ha, but it is predicted that this average can be increased to approximately 45 tons per ha relatively easily.

10. Peanuts prefer sandier soils that are well drained and have a pH in excess of 7.0. They are thought to be particularly well suited to the scrub-land zone. The recommended varieties are Tatui and Tatu. Planting should be done at the very beginning of the rainy season, in rows 60 cm apart with a spacing interval of 20 cm along the row. Generally two weedings are required, the first about two weeks after planting and the second some two weeks later. The recommended fertilizer practice is about 80 kg of urea, 50 kg of triple-superphosphate and 85 kg of potassium fertilizer per ha. Local varieties require about 120 days to mature. Current yields are estimated at about 500 kg per ha, but it estimated that this could be increased to approximately 1.2 tons per ha.

11. Oranges can be grown on sandy-clay, well-drained soils where the pH is between 6 and 7 in the humid zone. Local varieties would continue to be grown using a spacing of 7 x 7 m. The recommended fertilizer application would be approximately 120 kg of urea, 225 kg of superphosphate and 80 kg of potas-sium chloride per ha. Production would begin during the fourth year after planting, while average yields are expected to reach 20 tons per ha by full development.

12. Vegetables are best grown on level, well-drained medium textured soils, preferably where irrigation facilities can be provided. The following local varieties are recommended. For tomatoes--Santa Cruz; for carrots--Nantes and Kuroda; for beets--Precose Wonder; for green pepper--Avelar, Ikeda and Cascadura; for cabbage--Japanese hybrids; and for garlic and chuchu (a squash)--local varieties. Most vegetables may be grown throughout the year, but preferably during the dry season, especially in the humid zone. Fertilizer rates would vary depending on the type of vegetables grown but would average about 180 kg of urea, 120 kg of triple-superphosphate and 195 kg of potassium fertilizer per ha. Yields in the project area are presently estimated to average 20 tons per ha, but it is expected that these yields could increase to about 30 tons per ha at full development.

13. Avocado may be grown on the heavier, deeper and better drained soils in the humid zone. Local varieties, which originated in the West Indies, are recommended, together with imported varieties of Guatemalan origin, such as Polloch and Prince. Planting should be done from January to March, the recommended spacing being 8 x 8 m. Fertilizer rates should be about 75 kg of urea, 160 kg superphosphate and 75 kg of potassium fertilizer per ha. Production may be expected to begin during the fourth year after planting. Current yields are estimated to be 5 tons per ha, but it is believed that average yields of 16 tons per ha are attainable at full development.

14. Passion Fruit prefers the deeper, better drained soils with a pH of around 5.5 in the humid zone. The local variety (with a yellow fruit), which is widely grown in Ceara because of its disease resistance qualities, is strongly recommended. Propagation should be by seed or cuttings planted during the rainy season. The recommended spacing would be 4 x 4 m or 4 x 5 m with the plants being grown on trellises about 2 m high. The recommended fertilizer application would be about 200 kg of urea, 900 kg of triple-superphosphate and 300 kg of potassium fertilizer per ha. Production is expected to begin about the second year after planting with the plants being dug up and replaced every six years. Current yields are estimated at about 10 tons per ha, but it is believed that these could be increased to approximately 14 tons per ha after full development.

15. Annato may be grown in the well-drained, medium-textured soils of the scrubland zone. The crop (used to produce a food coloring or dye) is already grown, but not on a large scale, in the project area. Relatively little is known about the most suitable varieties but they would probably be local strains. The crop is best grown in pure stand in rows 4.5 m apart with a spacing interval of 4.5 m between plants. The recommended fertilizer practice is currently about 60 kg of urea, 40 kg of triple-superphosphate and 65 kg of potassium fertilizer per ha. Harvesting of the fruits begins 18 months after planting and yields of about 800 kg per ha per year can be expected.

III. PRODUCTION ESTIMATES

16. Based on a farm sample survey in the project area, the estimated pre-project crop production on beneficiary farms in 1976 was equivalent to about Cr$ 51.1 million (US$4.3 million) 1/ of which 37% was accounted for by sugarcane, 20% by coffee, 20% by various vegetables, 10% by beans, 7% by cassava (manioc) and the remaining 6% by citrus, avocado and peanuts.

17. The crop production development under the project has been projected based on eight illustrative farm models (see Appendix 1 and Table 4), reflecting different size, tenure status and ecological conditions of beneficiary farms. Excluding coffee, the incremental output would be equivalent to Cr$ 168.3 million (US$14.3 million) bringing the total production at full development to about Cr$ 209 million (US$17.7 million). The increase would result from an expansion of about 200% over about 8-9 years in cropped areas by the participating farmers and an average improvement of yields of about 50% over the respective pre-project levels. The area to be cropped by the project participants (excluding coffee) is estimated to increase by about 40,000 ha (from 19,000 ha at present to some 59,000 at full development) of which approximately 15% (6,000 ha) would be in the humid/sub-humid zone and 85% (34,000 ha) in the carrasco. The expected average yield improvement would correspond to an increase in output value per ha from about Cr$ 2,100 (US$180) to Cr$ 3,450 (US$290), not taking into account coffee developments. A summary of expected changes in yields, areas cropped and production by crop is given in Table 5.

18. The total annual production at full development of the project is estimated as follows:

	Incremental Production		
		Value	
	Tons	Cr$ Million	%
Beans	6,275	34.0	20
Corn	1,470	1.8	1
Manioc	135,515	24.4	15
Peanuts	10,185	20.2	12
Sugarcane	185,220	19.4	12
Vegetables	10,300	17.6	10
Passion Fruit	11,830	19.5	12
Citrus	18,900	17.0	10
Avocado	4,620	3.8	2
Annato	2,650	10.6	6
Total		168.3	100

1/ All production value figures in this chapter are based on average farm-gate prices between 1974 and 1976 expressed in constant terms of 1976.

19. As indicated, most of the additional output is expected to be in beans, manioc, peanuts, sugarcane, passion fruit, vegetables and citrus. This actual production pattern might of course change, if unexpected changes in relative output prices or technical breakthroughs occur over the project implementation period.

20. In addition to the production increase as a result of the project, it is expected that the coffee program implemented simultaneously by IBC in the project area would increase the area planted in coffee by project participants by some 5,700 ha (from about 4,000 ha at present to about 9,700 ha) and coffee yields from 0.3 tons/ha presently to about 1.8 tons/ha. As a result, coffee production by project participants is projected to increase from 1,200 tons at present to about 17,500 tons, equivalent to an increment of Cr$ 124.2 million (US$26.7 million).

21. The output projections for the project include only expected production increases on farms directly benefiting from the project's agricultural component. Effects on production through spill-over or demonstration from the agricultural component as well as from the feeder road component on other farms have not been quantified and are therefore excluded from estimated incremental project production.

IV. MARKETS

22. The significance of the incremental project output in terms of existing supply is indicated below:

	Incremental Project Output as % of	
	Current Local Production	Current Ceara Production
Beans	190	4
Corn	16	2
Manioc	31	7
Peanuts	*	*
Sugarcane	29	5
Vegetables	250 (approx.)	n.a.
Citrus	450 (approx.)	n.a.

*Current production negligible so comparison meaningless.

While the additional production is insignificant in the national context, the project would substantially increase the regional supply, especially of peanuts and annato and to a lesser extent manioc, sugarcane and vegetables.

23. Given the estimated supply/demand situation at the producer, local, state and national levels, it is expected that only a small portion of the incremental output, probably not exceeding 5%, would be absorbed by on-farm and local consumption, while the bulk would serve to meet demands in Ceara and the neighboring states of Piaui and Maranhao. 1/ Most of the peanut and a part of the vegetable and sugar (and/or derived alcohol) output would depend on national markets. Only annato (6% of total additional output) is expected to be directly exported. However, the project's peanut and sugar production would marginally influence national export trade through an increase in vegetable oil exports and in exportable sugar and/or reduction of oil imports (the alcohol is used as an additive to gasoline).

24. Some of the incremental sugarcane and fruit and vegetable production would be absorbed by the capacity of the existing processing industry. Presently, sugarcane is processed into cachaca (an alcoholic beverage) in some 135 small traditional on-farm mills and into rapadura (blocks of semi-refined sugar) in some 800-900 small mills. The efficiency of these mills is low and the capacity limited. Although some improvement would be expected as a result of the electrification provided by the project, the market for much of the proposed increase in sugarcane production would depend upon the planned expansion of large-scale milling capacity in the project area. Construction of a new mill to be located in Ibiapina has been approved by the Brazilian Sugar and Alcohol Institute (IAA) and financing is now being arranged with Banco do Nordeste do Brasil (BNB). The new mill (Companhia Agroindustrial da Serra da Ibiapaba, controlled by a private Brazilian concern, "Grupo Granjeiro") would have a daily cane intake capacity of about 2,000 tons and is expected to become operational in 1979/80. At full development the plant is expected to produce alcohol at a rate of 120,000 liters a day. It would have an annual cane intake of 300,000 tons and an output of 18 million liters of alcohol. This new mill, together with the planned further expansion of an existing mill, which produces rapadura in the Barbalha area, are expected to absorb the incremental cane production without difficulty. With respect to fruit and vegetables, it is expected that most will be marketed fresh (a good share through the new transshipment produce market in Tiangua in the project area) and the remainder would be absorbed by the existing fruit/vegetable processing firms, specifically Citia and Cajubras, which are located within 40 km of Fortaleza. Another fruit and vegetable plant is being planned in the project area by a coffee processing industry group. Both existing plants produce juices and marmalade from cashew, mango, passion fruit, guava and citrus, and tomato paste. Cajubrus has a daily capacity of about 600 tons and Citia, 100 tons (see Table 6). In 1976, they purchased 26,000 tons and 5,000 tons of fruits and vegetables, respectively. This intake is sufficient to run the

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1/ The more important consumption centers being Fortaleza (pop., 1.2 million; distance, 320 km); Belem (pop., 0.6 million; distance, 1,200 km); Sao Luis (pop., 0.3 million; distance, 720 km); Terezina and Sobral (comb. pop., 0.4 million; distance, 200 km).

factories for approximately two months only and the implicit underutilization reflects mainly supply shortages. Citia buys directly from farmers in Ibiapaba and sells most of its products in the Rio market. Cajubras buys through agents in Ceara, Pernambuco, Paraiba, Para and Rio Grande do Norte and sells its products in both the national and international market. Its exports in 1975 totaled US$2.0 million and in 1976, US$3.5 million, mainly to Europe and the United States.

25. Peanuts produced under the project would be almost exclusively for oil production. Oil processing facilities (mainly for cotton seed or castor) exist in the state and might absorb some of the peanut output. It is expected, however, that until the oil processing capacity in the state is expanded, most of the incremental peanut production would be processed in industries located in the states of Bahia (in the Northeast), Minas Gerais and Sao Paulo. With respect to manioc, most is expected to continue to be processed into flour at the some 1,000 small, traditional on-farm processing mills scattered throughout the project area.

26. Although there are a number of federal and state agencies 1/ to facilitate agricultural marketing, the marketing system in the project area depends almost exclusively on an intricate network of middlemen, including farmer-merchants, suppliers to truckers, truckers, central market buyers, etc., each usually specialized in certain crops and following different purchase practices. There are a total of over 400 such middlemen operating in the area, of which about half are truckers (see Table 7). Farmers who sell only small volumes or those who have their own transportation frequently sell directly in one of the several local markets to retailers, wholesalers or truckers, but usually the truckers buy at the farmgate. Prices are generally determined by the trucker who often has a near monopoly on transportation and has greater knowledge of prices and the supply/demand situation. The farmer-distributor buys from other smaller farmers to complement his own production and complete his carload. The trucker-supplier assembles produce for the trucker who takes it to the main consumption centers. There are usually three to five suppliers per trucker. The terminal market buyer does not generally have contact with

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1/ - Servicio de Informacao de Mercado (SIM), a dependency of SUDENE for providing marketing information.
- Comissao de Financiamento da Producao (CFP), a federal institution to implement a minimum price policy for certain products jointly with the Banco do Brasil and CIBRAZEM.
- Instituto de Azucar e do Alcool (IAA) for implementing sugar and alcohol production policies.
- Companhia Brasileira de Armazenamento (CIBRAZEM) for providing storage of agricultural products.
- Companhia Brasileira de Alimentos, COBAL, for providing wholesale marketing facilities (large produce markets in the major metropolitan areas and transshipment markets in main production areas).

the farmer as he buys from the preceding intermediaries and resells to other wholesalers or retailers. Another type of local intermediary, the maloqueiro, is a smaller scale middleman living in the area who deals with any type of product by transporting it on rented vehicles or animal-drawn carts. Another type, camboijeiros, own trucks and are located outside the Serra da Ibiapaba in the sertao towns, where they collect manure to bring to the Serra de Ibiapaba farmers. On their way back, they buy and carry farm products, primarily brown sugar (rapadura) and coffee.

27. This marketing system is in general quite effective but its cost efficiency is low. The resulting high marketing costs are reflected in considerable margins between farmgate and wholesale prices 1/ and are due mainly to high assembly cost, low volume transaction and a lack of direct access by most farmers to the local or regional markets. The basic factors responsible have been the precarious feeder road system in the project area and the absence of a central assembly market in the area capable of handling efficiently larger quantities of produce. The marketing system might not have been able to handle the additional production of the project effectively but the expansion of the rural feeder road system provided for under the project and the recent establishment of an assembly/transshipment market 2/ in the center of the project area are expected to increase the system's capacity and its efficiency by lowering transportation cost and improving competition so that reduced marketing cost would produce additional production incentives for the farmers in the form of higher farmgate prices. It is also expected that the provision of some grain storage facilities by CIBRAZEM would help to reduce the impact on the farmer of annual grain price fluctuations and to implement the Government's minimum price policies in the area. The assistance given to cooperatives might eventually also lead to an adoption of low cost cooperative marketing, especially of vegetables.

V. PRICES

28. Product prices at the farmgate level for 1974, 1975 and 1976 are given in Table 3. Price differentials between the farmgate and retail levels

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1/ Prices in the local markets are between 25% and 100% higher than those paid at farmgate.

2/ Centrais de Abastecimento (CEASA) recently constructing a mercado expedidor (assembly/transshipment market) in Tiangua at an investment cost of about Cr$ 2.7 million. It would provide facilities for truck parking; handling, sorting and weighing of produce; and marketing service agencies, including banks and a CEASA-SIM market information center.

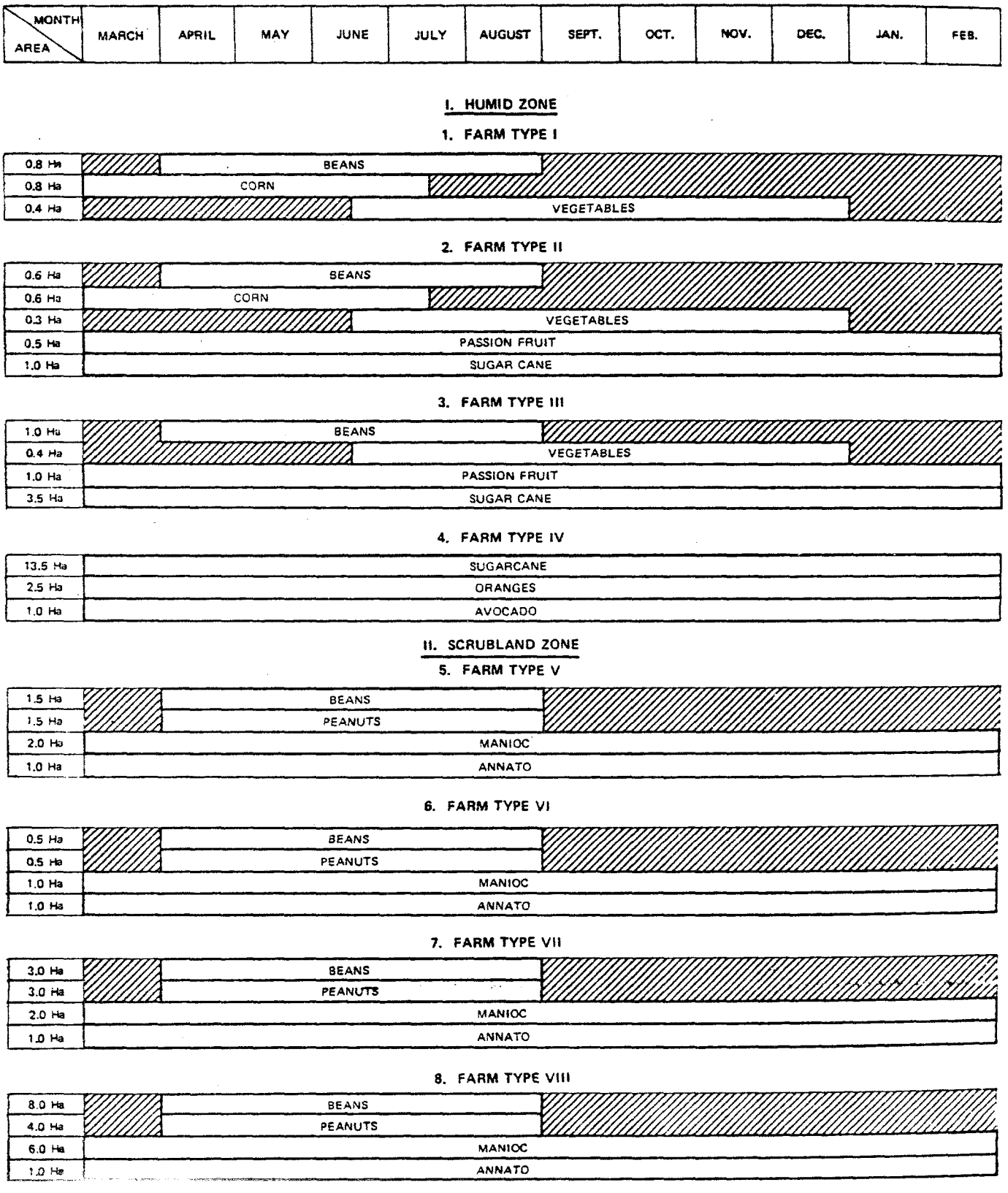
are high and reflect the low efficiency of the marketing system, high transportation cost, high losses in the marketing process and various fiscal charges. 1/ For vegetables, the farmers receive at the farmgate about 30-40% of the retail price in the local fresh market. The price at the processing industry for comparable vegetables is about one-third less than in the fresh market. For fruits, the farmer receives at the farmgate 20-30% of the retail price and, for staples (beans and manioc), 50-70%. Price fluctuations over the year are substantial, ranging from 100% for staple crops such as beans and manioc to an average of 350% for vegetables and up to 100% for fruits (for selected examples, see Table 8).

29. Prices are relatively free from Government regulations. Before February 1977, sugarcane producers received a direct Government subsidy of Cr$ 46 per ton of cane delivered to the factory, but this subsidy has been abolished. The only other scheme applicable to the output of the project is Government's minimum price program for beans, corn, peanuts and manioc. However, it has had no direct impact on the price level in the project area for lack of CIBRAZEM storage facilities and because prevailing farmgate prices have generally been higher than the support price level (for examples, see Table 9).

30. Since most of the additional production will be channelled to the regional, extra-regional and, to some extent, to the international market, it is expected that the incremental supply would not have negative effects on the level of farmgate prices. This assumption is supported by the excellent road connection between the project area and the potential markets, the new assembly/transshipment market in the project area and the expected improvement in the efficiency in marketing through the feeder road construction provided under the project.

1/ Imposto Sobre Transporte Rodoviario (ISTR): 5% over costs of freight.
FUNRURAL: 2.5 over value of all farm products sold.
ICM: Up to 15% of value of marketed production.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT – IBIAPABA
PROPOSED LAND USE AT FULL DEVELOPMENT STAGE



NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 1: Agriculture - Estimated Yearly Yields
(tons/ha)

Zones and Crops	Without Project	Production Years					
		1	2	3	4	5	6
1. Humid Zone							
Beans	.45	.45	.55	.60	.65	.70	.70
Corn	.70	.70	1.20	1.60	1.80	2.00	2.00
Vegetables	20.00	20.00	25.00	27.00	29.00	30.00	30.00
Sugarcane	32.00	32.00	34.00	38.00	42.00	45.00	45.00
Passion Fruit	10.00 1/	6.00 2/	12.00	14.00	14.00	14.00	-
Oranges	10.00 1/	8.00 2/	10.00	12.00	14.00	17.00	20.00
Avocado	5.00 1/	5.00 2/	7.50	10.00	12.00	14.00	16.00
Coffee	.30 1/	.30 2/	.40	.70	1.10	1.50	1.80
2. Scrubland (Carrasco)							
Beans	.30	.35	.40	.45	.50	.50	.50
Manioc	4.00	6.00	8.00	10.00	12.00	14.00	14.00
Peanuts	.50	.80	.90	1.00	1.10	1.20	1.20
Annato	-	.40	.60	.70	.80	.80	.80

1/ Average of all current plantations.

2/ Average yields during first year of production of new plantations.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 2: Yearly Input Coefficients Per Ha of Crop 1/

INPUT	UNIT	HUMID ZONE								SCRUBLAND (CARRASCO) ZONE			
		Beans	Corn	Vegetables	Sugarcane	Coffee	Oranges	Avocado	Passion Fruit	Beans	Peanuts	Manioc	Annato
Labour	Mandays	35	30	330	53	27	61	54	98	25	35	46 2/	26
Seeds	Kg	35	20	5	-	-	-	-	-	35	70	4	*
Insecticides & Fungicides	L or Kg	3	3	220	3	3.25	11	12	20	3	5	3	4
Mineral Oil	L	-	-	-	-	6	10	-	-	-	-	-	-
Urea	Kg	60	60	180	120	130	120	75	200	75	80	60	60
T.S.P.	Kg	40	45	120	80	220	220	160	900	50	50	115	40
K. Fert.	Kg	65	70	195	140	50	80	75	300	80	85	40	65
Manure	Tons	-	-	30	-	12.50	2	1.7	15	-	-	-	1
Dolomite	Kg	250	250	500	-	-	250	250	-	250	250	-	500
Wheel Tractors	Hours	3	3	5	4	5	-	-	-	3	3	3	4
Draft Animals	Days	1	1	3	4	-	5	5	5	1	1	5	1
Packing Mat.	Units	-	-	70	-	10	140	100	100	-	-	-	10

1/ Does not include inputs used for setting up the plantations and which were taken into consideration as investments.
2/ Cubic meters of cuttings.

ANNEX 7
Table 2

ANNEX 7
Table 3

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 3: Output and Input Farm Gate Prices
Cr$/Ton

Outputs	1974	1975	1976	Average Prices (1974-76) [2]	Projected Financial Prices [3]
	Market Prices in Current Cruzeiros			In Constant 1976 Terms	
Beans	2,330	3,205	7,667	5,420	5,420
Corn	700	833	1,267	1,235	1,235
Peanuts	1,740	2,240	2,440	2,880	1,985
Manioc	68	146	217	180	180
Sugarcane	47	76	121	105	105
Coffee	3,410	4,380	10,730	7,625	8,340
Passion Fruit	585	760	2,852	1,650	1,650
Urucu	n.a.	3,000	4,000	4,000	4,000
Citrus	n.a.	657	900	900	900
Avocado	680	1,080	1,280	825	825
Tomato	1,050	1,000	1,050	1,435	1,435
Green Pepper	1,300	1,300	1,280	1,800	1,800
Cabbage	1,267	1,067	1,267	1,665	1,665
Carrots	1,533	1,600	1,667	2,200	2,200
Chuchu	500	500	475	700	700
Garlic	n.a.	1,400	1,700	1,810	1,810
Beets	1,423	1,103	1,400	1,800	1,800
Inputs [1]					
Potassium Chloride	-	-	1,600	-	960
Superphosphate	-	-	1,500	-	900
Urea	-	-	3,000	-	1,800
Formicides (Mirex)	-	-	16,000	-	16,000
Mineral Oil	-	-	5,000	-	5,000
Insecticide Compound	-	-	60,000	-	60,000
Fungicide Compound	-	-	30,000	-	30,000
Dolomite	-	-	330	-	330
Tomato Seeds	-	-	600,000	-	600,000
Pepper Seeds	-	-	600,000	-	600,000
Carrot Seeds	-	-	250,000	-	250,000
Bean Seeds	-	-	5,000	-	5,000
Peanut Seeds	-	-	6,000	-	6,000
Corn Seeds	-	-	1,500	-	1,500

1/ Not included in the list are: Unskilled farm labor at Cr$18.00 per day, animal traction at Cr$25.00/day, wheel tractors to be Cr$98.00/hour and chain tractors to be Cr$305.00/hour.

2/ Average price calculations took into consideration an average inflation rate of 32% for the period mid 1974-mid 1975 and a 37% rate for the period mid 1975-mid 1976.

3/ Projected financial prices reflect, in some cases, adjustments where relatively high recent local prices are expected to decline and/or where the Bank's latest price projections for world-wide prices varied significantly from the average local 1974/76 prices.

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Table 4: Area Development by Farm Type
(ha)

Farm Type	Crop	Pre-project	Year I	Year II	Year III	Year IV	Year V	Number of Dev. Years
Humid Zone:								
Type I (currently sharecropper)	Beans	0.2	0.3	0.5	0.8	0.8	0.8	
	Corn	0.2	0.4	0.6	0.8	0.8	0.8	
	Vegetables	0.2	0.2	0.3	0.4	0.4	0.4	
	Total	0.6	0.9	1.4	2.0	2.0	2.0	3
	Incr. Area		0.3	0.5	0.6	-	-	
Type II (owner-operator of up to 10 ha)	Beans	0.2	0.2	0.4	0.6	0.6	0.6	
	Corn	-	-	0.3	0.6	0.6	0.6	
	Vegetables	0.2	-	0.2	0.3	0.3	0.3	
	Sugarcane	1.0	1.0	1.0	1.0	1.0	1.0	
	Passion Fruit	-	0.5	0.5	0.5	0.5	0.5	
	Total	1.4	1.7	2.4	3.0	3.0	3.0	3
	Incr. Area		0.3	0.7	0.6	-	-	
Type III(owner-operator of 10 - 25 ha)	Beans	0.8	0.3	0.9	1.0	1.0	1.0	
	Vegetables	0.2	0.1	0.3	0.4	0.4	0.4	
	Sugarcane	3.0	3.5	3.5	3.5	3.5	3.5	
	Passion Fruit	-	1.0	1.0	1.0	1.0	1.0	
	Coffee	1.5	1.5	2.0	3.1	3.1	3.1	
	Total	5.5	6.4	7.6	9.0	9.0	9.0	3
	Incr. Area		0.9	1.2	1.4	-	-	
Type IV (owner-operator of 25 - 200 ha)	Sugarcane	8.0	13.5	13.5	13.5	13.5	13.5	
	Coffee	8.0	8.0	11.0	14.0	17.0	20.0	
	Oranges	0.5	0.5	1.0	1.5	2.0	2.5	
	Avocado	1.0	1.0	1.0	1.0	1.0	1.0	
	Total	17.5	23.0	26.5	30.0	33.5	37.0	5
	Incr. Area		5.5	3.5	3.5	3.5	3.5	

Farm Type	Crop	Pre-project	Year I	II	III	IV	V	Number of Dev. Year
Carrasco Zone:								
Type V * (currently sharecropper)	Beans	0.4	0.5	0.7	1.0	1.2	1.5	
	Manioc	1.5	1.5	1.7	2.0	2.0	2.0	
	Peanuts	-	0.5	0.7	1.0	1.3	1.5	
	Annato	-	-	0.5	1.0	1.0	1.0	
	Total	1.9	2.5	3.6	5.0	5.5	6.0	5
	Incr. Area	0.6	1.1	1.4	0.5	0.5		
Type VI(owner-operator of up to 10 ha)	Beans	0.1	0.1	0.2	0.3	0.4	0.5	
	Manioc	0.5	0.5	0.6	0.7	0.8	1.0	
	Peanuts	-	-	-	0.2	0.4	0.5	
	Annato	-	0.2	0.5	1.0	1.0	1.0	
	Total	0.6	0.8	1.3	2.2	2.6	3.0	5
	Incr. Area	0.2	0.5	0.9	0.4	0.4		
Type VII (owner-operator of 10 - 25 ha)	Beans	0.9	1.0	1.5	2.0	2.5	3.0	
	Manioc	0.6	1.0	1.2	1.4	1.7	2.0	
	Peanuts	0.1	1.0	1.5	2.0	2.5	3.0	
	Annato	-	-	0.5	1.0	1.0	1.0	
	Total	1.6	3.0	4.7	6.4	7.7	9.0	5
	Incr. Area	1.4	1.7	1.7	1.3	1.3		
Type VIII (owner-operator of 25 - 200 ha)	Beans	1.0	2.0	3.0	4.0	6.0	8.0	
	Manioc	2.5	3.0	4.0	5.0	5.0	6.0	
	Peanuts	-	1.5	3.0	4.0	4.0	4.0	
	Annato	-	0.5	0.5	1.0	1.0	1.0	
	Total	3.5	7.0	10.5	14.0	16.0	19.0	5
	Incr. Area	3.5	3.5	3.4	2.0	3.0		

* In this case, assuming sharecropper would buy land.

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Table 5: Summary of Yields, Area Planted, and Output

Zones and Crops	Area under cultivation (ha)			Yields (ton/ha)		No. of Years 1/	Production (tons)		
	Without Project	With Project	Increm.	Present	Target		Present	Target	Increm.
1. Humid and Sub-humid									
Beans	582	1,198	616	0.45	0.70	5	262	838	576
Maize	68	758	692	0.70	2.00	5	48	1,516	1,468
Sugarcane	5,490	8,020	2,530	32.00	45.00 2/	5	175,680	360,900	185,220
Vegetables	318	555	237	20.00 2/	30.00 2/	5	6,360	16,650	10,290
Passion Fruit	-	845	845	-	14.00	3	-	11,830	11,830
Coffee	4,020	9,764	5,744	0.30	1.80	6	1,206	17,575	16,369
Oranges	210	1,050	840	10.00	20.00	6	2,100	21,000	18,900
Avocado	420	420	-	5.00	16.00	6	2,100	6,720	4,620
Sub-total	11,108	22,610	11,502	-	-	-	-	-	-
2. Scrubland									
Beans	2,150	12,690	10,540	0.30	0.50	4	645	6,345	5,700
Manioc 3/	9,312	22,020	12,708	4.00	14.00	5	18,624	154,140	135,516
Peanuts	76	8,520	8,444	0.50	1.20	5	38	10,224	10,186
Annato	-	3,310	3,310	-	0.80	4	-	2,648	2,648
Sub-total	11,538	46,540	35,002	-	-	-	-	-	-
Total	22,646	69,150	46,504	-	-	-	-	-	-

1/ Target yields will be attained in field crops after 4-6 years and in fruit tree crops 3-6 years after the first production is received.
2/ Weighted average yields taking into consideration present and future vegetable production.
3/ Due to the long vegetative cycle of manioc, areas under production are estimated at 50% of areas under cultivation.

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Table 6: Existing Plant Processing Capacity for Two Major Industries in Ceara

PRODUCTS	CAJUBRAS Factory (Kg/day)	CITIA Factory (Kg/day)
Tomato	150,000 1/	5,000
Maracujá (Passion Fruit)	60,000	12,000
Guava	100,000	5,000
"Jaca"	-	20,000
Mango	30,000	29,800
Cashew (fruit)	200,000	25,000
Cashew (nut)	20,000	-
Pineapple	30,000	3,000
Banana	30,000	5,000
Papaya	5,000	2,000
Soursop	5,000	-
"Tamarindo"	2,000	-
"Genipapo"	2,000	-
Citrus	-	1,000
Sweet potato	-	2,000
"Abóbora"	-	2,000
"Buriti"	-	3,000

Source: Data obtained from each company.

1/ Increased to 450,000 in 1976.

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Table 7: Estimated Number and Kind of Marketing Middlemen Operating in Project Area

Municipalities	Trucker	Farmer Merchant	Trucker Middleman	"Maloqueiro"	Central Market Wholesaler	Total
Vicosa do Ceara	3	5	8	7	2	25
Tiangua	20	12	40	20	5	97
Ubajara	10	10	40	10	5	75
Ibiapina	5	2	30	10	2	49
Sao Benedito	35	8	80	25	4	152
Guaraciaba do Norte	2	4	6	5	1	18
Carnaubal	1	3	3	4	-	11
TOTAL	76	44	207	81	19	427

Source: CEPA-IBRD Mission Survey, June 1976.

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Table 8: Farmgate Price Fluctuations for Major Agricultural Products in the Area

	Unit	1975		1976	
		Low	High	Low	High
Staple Crops					
Beans					
Corda	60kg	85.0	170.0	-	-
Mulatinho	60kg	140.0	290.0	-	-
Manioc flour	50kg	42.0	98.0	99.0	144.0
Fruits					
Orange	100	7.0	27.0	-	-
Avocado	100	3.6	46.6	15.3	190.0
Maracuja(Passion Fruit)	100	2.8	25.0	10.9	54.3
Vegetables					
Tomato	20kg	10.2	58.6	24.2	52.4
Carrots	15kg	15.5	28.1	19.8	40.7
Beets	15kg	15.0	22.5	18.7	65.7
Cabbage	15kg	5.1	23.0	12.0	34.8
Peppers	100	5.0	23.8	14.5	19.2
Garlic	10kg	13.0	16.0	16.3	17.8
Chuchu	100	3.1	12.5	3.0	30.0

ANNEX 7
Table 9

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 9: Minimum Prices for 1975/76 and 1976/77 Harvests

PRODUCTS	1975/76 Unit	1975/76 Price (Cr$)	1976/77 Unit	1976/77 Price (Cr$)
Beans				
1. "Branco"	(60 kg)	93.00	(60 kg)	142.20 to 148.20
2. "Preto"	-	94.80	-	135.00
3. "Macassar"	-	51.60	-	72.60 to 75.60
Manioc				
1. Roots	(ton)	105.00	(ton)	170.00
2. Flour	(50 kg)	24.00	(50 kg)	56.00
Shelled peanuts	(25 kg)	35.00 to 37.50	(25 kg)	48.00 to 51.00

Source: Preços Mínimos Norte e Nordeste - Safras 75/76 e 76/77. Ministry of Agriculture, Commission for Financing of Production (CFP).

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Producer Income and Employment

I. PRODUCER INCOME

Illustrative Farm Types

1. The target farming families of the Ibiapaba rural development project were identified as farmers operating less than 200 ha. It should be noted that, given the current production practices and (particularly in the carasco zone) restricting ecological factors, operations of up to this size can still be considered low income (see para 3). The target families were divided first according to tenure situation and farm size into four groups as follows: (a) Group I: the sharecroppers who do not currently own land (17% of the expected participants); (b) Group II: owner-operators with up to 10 ha (35% of the participants); (c) Group III: owner-operators with between 10 and 25 ha (21% of the participants); and (d) Group IV: owner-operators with between 25 and 200 ha (27% of the participants). For each of these general groups two basic representative farm models were prepared, one for the humid and sub-humid zone and the other for the scrubland (carrasco) zone. A summary of the phasing of development of the various farm types is given in detail in Table 1.

2. Although farm types will vary considerably within each group (especially because of the range of crops produced and the large number of possible cropping patterns) the pre-project characteristics assumed for the representative farm types are:

(i) Farm Type I: 340 farms cultivated by sharecroppers of the humid zone, with an average cultivated area currently of about 0.6 ha per family, growing beans, corn and vegetables and having an average yearly gross production value (after providing part of the crop to the landowner) of about Cr$ 5,000;

(ii) Farm Type II: 810 owner-operated farms of up to 10 ha in the humid zone, with an average currently of about 1.4 ha under cultivation, growing beans, vegetables and sugarcane and having an average yearly gross production value of about Cr$ 10,500;

(iii) Farm Type III: 440 owner-operated farms of 10-25 ha in the humid zone, with an average of about 5.5 ha under cultivation, growing beans, vegetables, sugarcane and coffee and having an average yearly gross production value of about Cr$ 22,000;

(iv) Farm Type IV: 420 owner-operated farms of 25-200 ha in the humid and sub-humid zone, with an average of 17.5 ha under cultivation, growing sugarcane, coffee, orange and avocadoes and having an average yearly gross production value of about Cr$ 54,000;

(v) Farm Type V: 670 farms cultivated by sharecroppers in the scrubland zone, with an average of about 1.9 ha of beans and manioc and having an average gross production value (after providing part of the crop to the landowner) of about Cr$ 1,200;

(vi) Farm Type VI: 1,190 owner-operated farms of up to 10 ha in the scrubland zone, with an average of about 0.6 ha under cultivation of beans and manioc and having an average yearly gross production value of about Cr$ 500;

(vii) Farm Type VII: 760 owner-operated farms of 10-25 ha in the scrubland zone, with an average of about 1.6 ha under cultivation of beans, manioc and peanuts and having an average yearly gross production value of about Cr$ 2,000; and

(viii) Farm Type VIII: 1,160 owner-operated farms of 25-200 ha in the scrubland zone, with an average of about 3.5 ha under cultivation of beans and manioc and having an average gross production value of about Cr$ 3,400.

3. As outlined in detail in Annex 7, the productivity of agriculture in the project area will be increased by the introduction of new technology and improved management practices. These will, among others, consist of the application of production inputs not presently applied such as selected seeds and adequate seeding rates, fertilizers, manure, farm machinery and plant protection materials and methods. Furthermore, the area under cultivation in each farm type will be expanded (as summarized in Table 1). It is expected that at full development (taking into consideration the phasing of yield improvements and of increases in area under cultivation, but not taking into account potential off-farm income of, particularly, smaller farmers who might work as laborers periodically for other farmers), the main yearly operating data (in rounded figures) on the various farm types would improve as follows:

Farm type	Area under production (ha)		Gross Production Value (Cr$)		Operating /1 Costs (Cr$)		Family Labor Value (Cr$)		Net Production Value (Cr$)	
	Pre-Proj.	Full Dev.	Pre-Proj.	Full Dev.	Pre-Proj.	Full Dev.	Pre-Proj.	Full Dev.	Pre-Proj.	Full Dev.
I	0.6	2.0	4,990	17,000	1,320	3,900	3,060	3,150	610	9,950
II	1.4	3.0	10,450	35,750	1,760	6,000	3,790	4,300	4,900	25,450
III /2	5.5	9.0	21,970	102,900	5,100	17,550	7,380	8,100	9,490	77,250
IV /2	17.5	37.0	53,890	414,550	33,980	77,500	9,570	10,750	10,340	326,300
V /3	1.9	6.0	1,150	15,850	580	6,100	700	3,700	-130	6,050
VI	0.6	3.0	520	8,250	180	3,000	220	1,850	120	3,400
VII	1.6	9.0	2,000	23,500	410	9,450	730	5,350	860	8,700
VIII	3.5	19.0	3,430	49,500	1,030	21,500	1,350	8,900	1,050	19,100

/1 Excluding family labor value.

/2 Including coffee.

/3 This model reflects improvements to sharecropper buying land.

Financial Analyses

4. Rate of return and cash flow analyses were carried for each Farm Type. The year-by-year details of the operations for each type of farm are given in Table 2-10. It should be remembered, of course, that the eight illustrative farm models will have a considerable number of variations. For example, there are especially numerous variations in the way particular sharecropping arrangements are set up in practice. Also, some of the sharecroppers in both the humid and carrasco zones will buy land; others will participate in the project without changes in the sharing arrangements; and still others will participate profitably only if the sharing arrangements are modified. To help show one case of the financial implications of a sharecropper buying or not buying land, an alternative to the model for Farm Type I (sharecropper, humid zone, Table 2) was developed and is presented in Table 3 (sharecropper in humid zone buying 5 ha). Also, because the financial results of project participation for a sharecroper in the carrasco were especially sensitive to the sharing arrangement assumed, only one representative model (sharecropper buying 30 ha, Table 7) is presented.

5. The various models are based on the production coefficient, yield, farming system, and price assumptions outlined in Annex 7. Owing especially to the nature of the target group, who are now mainly subsistence farmers for whom return on labor plays an important part in decision-making (and who, without the project, would be counting on income earned by working on other farms), the financial opportunity cost of family labor was deducted from the farm surplus before calculation of the rate of return. On-farm consumption was included as a benefit. It was also assumed that, during the first three years

of participation, the farmers would go on producing some crops under traditional methods along with the crops under improved methods. This traditional production would phase out completely during 3 years. Furthermore, it was assumed that the "without" project situation is, in fact, dynamic. Hence the "without" situation assumes, during the first 6 years, annual production increases from 1% in the carrasco (scrubland) zone to about 2-3% in the humid zone. As the focus of the project is largely on crop production, coffee production (especially important in the humid zone) was taken into account in showing the overall position of the farmer for two of the representative models, even though it is being developed by a separately financed Government program.

6. In general, it was assumed that each farmer would receive seasonal credit to cover 100% of purchased inputs (including hired labor) on a continuing basis as well as a proportion of subsistence (implied family labor) costs on a declining scale of 80% (year 1), 60% (year 2), 40% (year 3), 20% (year 4), and 0% thereafter. In several cases (in the carrasco zone) this general guideline was reduced further to ensure that the conservatively estimated expected production exceeded the seasonal loan by at least 25%. Investment credit was assumed, in general, to cover 80% of on-farm investment costs during the first five years, except in several of the carrasco zone models where 100% financing (which is allowed under POLONORDESTE regulations for smaller-scale investment credits) was assumed to help offset possible cash flow problems during the first two years. Also, to simplify calculations, it was assumed that all of the investment credit required during the first five years of a farmer's participation would be disbursed under one subloan with repayment being made during years 7-12 (the maximum term allowable under POLONORDESTE). Obviously, more than one investment subloan could be made to a farmer, and terms would vary with the situation. It was also assumed, again to simplify presentation, that all on-farm investment requirements after year 5 could be financed with internally generated funds. Overall, it should be noted that the debt service requirements in the cash flow analysis are in constant prices and therefore overstate the debt service in real terms because the credit is not indexed to offset inflation.

7. Except for the case of the carrasco sharecropper buying land, only crop sales were considered in the income stream, even though virtually all of the participating farmers would be likely to have other supplemental income (working on or sharecropping other farms, livestock product sales, etc.). Hence, cash inflow estimates are probably underestimated in most cases. For the carrasco sharecropper model (Table 7), an assumed rent income was added to reflect the fact that if the farmer needs to buy a minimum of 30 ha of land to get official land purchase credit he would be unable to use it all himself and would problably allow other sharecroppers or renters to use at least a small part of it.

8. The results of the rate of return and sensitivity analyses are given in Table 11.

II. EMPLOYMENT

9. It is expected that as a result of the proposed development, the amounts of required labor will also undergo a significant change. At full development, the overall yearly labor requirements of the project farms are estimated at about 2,295 thousand mandays compared with the 790 thousand mandays required before the project, or an increase equivalent to about 6,020 worker-years. From the total incremental labor requirements, it is estimated that some 75% will be covered by family labor and the remainder by hired labor. Problematic labor shortages are not expected because of the family labor ability to "stretch" itself during peak demand periods and to the new local practice of establishing the school calendar so as to free children in rural areas to help in the fields during peak seasons. This young labor force was not taken into consideration in the calculations of family labor availability. Also, should shortages occur due to other developments in the region and/or state, it is highly likely that the project area could count on attracting temporary labor from the nearby sertao areas, where underemployment exists. The details of the family labor requirements and availability in the various types at the full development stage are as follows:

Farm Type	Family Labor Requirements /1 (Mandays per Year)				Availability /2
	Without Project	With Project			With or Without Project
		Hired	Family	Total	
I	170	10	175	185	530
II	210	5	240	245	960
III	410	70	450	520	910
IV	520	865	600	1,465	865
V	40	-	210	210	530
VI	10	-	105	105	960
VII	40	-	295	295	910
VIII	75	145	495	640	865

/1 Although overall labor requirements are in most cases lower than family labor availability, hired labor is used in a part of the farm types due to peak requirements during a part of the year.

/2 Family labor availability was calculated according to number of weighted adult workers per family (women providing 0.5 worker-day equivalent, youths 13-18 providing 0.7 worker-day equivalent).

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Table 1: Phasing of Development

Zones and Farm Types	Without Project	Development Year I	II	III	IV	V	Total
Humid and Sub-humid		**A. Number of Units**					
Type I (sharecropper)	340	30	70	140	100	-	340
Type II (up to 10 ha)	810	70	160	320	260	-	810
Type III (10-25 ha)	440	40	90	180	130	-	440
Type IV (25-200 ha)	420	30	90	160	140	-	420
Sub-total	2,010	170	410	800	630	-	2,010
Scrubland (Carrasco)							
Type V (sharecropper)	670	60	130	270	210	-	670
Type VI (up to 10 ha)	1,190	100	240	470	380	-	1,190
Type VII (10-25 ha)	760	70	150	300	240	-	760
Type VIII (25-200 ha)	1,160	100	230	470	360	-	1,160
Sub-total	3,780	330	750	1,510	1,190	-	3,780
Total	5,790	500	1,160	2,310	1,820	-	5,790
Humid and Sub-humid		**B. Area Under Production 1/ (ha)**					
Type I (sharecropper)	0.6	0.9	1.4	2.0	2.0	2.0	-
Type II (up to 10 ha)	1.4	1.7	2.4	3.0	3.0	3.0	-
Type III (10-25 ha)	5.5	6.4	7.6	9.0	9.0 2/	9.0	-
Type IV (25-200 ha)	17.5	23.0	26.5	30.0	33.5	37.0 3/	-
Scrubland (Carrasco)							
Type V (sharecropper) 4/	1.9	2.5	3.6	5.0	5.5	6.0	-
Type VI (up to 10 ha)	0.6	0.8	1.3	2.2	2.6	3.0	-
Type VII (10-25 ha)	1.6	3.0	4.7	6.4	7.7	9.0	-
Type VIII (25-200 ha)	3.5	7.0	10.5	14.0	16.0	19.0	-

1/ Including coffee in Target Groups III and IV of the humid and sub-humid zones.
2/ Including 3.0 ha of coffee.
3/ Including 20.0 ha of coffee.
4/ In this case, model designed for sharecropper buying 30 ha module of land.

Table 2
Northeast Brazil
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Farm Type I: Sharecropper, Humid/Sub-humid Zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	-	2,075	1,085	1,183	-	-	-	-	-	-	-
Establishment of permanent crops	-	-	-	-	-	-	-	-	-	-	-
Land Purchase	-	-	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	2,500	-	-	-	-	-	-	-	-
Sub-total	-	3,075	3,585	1,183	-	-	-	-	-	-	-
Operating Costs											
Inputs 2/	1,323	1,782	2,717	3,912	3,912	3,912	3,912	3,912	3,911	3,912	3,912
Family Labor	3,058	1,593	2,421	3,139	3,139	3,139	3,139	3,139	3,139	3,139	3,139
Sub-total	4,381	3,375	5,138	7,051	7,051	7,051	7,051	7,051	7,051	7,051	7,051
Total	4,381	6,450	8,723	8,234	7,051	7,051	7,051	7,051	7,051	7,051	7,051
2. Gross Production Value											
Value of production under project	-	4,353	7,793	11,373	12,785	13,640	16,772	16,973	16,973	16,973	16,973
Value of traditional production 3/	4,985	604	402	201	-	-	-	-	-	-	-
Total	4,985	4,957	8,195	11,570	12,785	13,640	16,772	16,973	16,973	16,973	16,973
3. Net Production Value With Project 4/ (2-1)	-	- 1,493	-528	3,336	5,734	6,589	9,721	9,922	9,922	9,992	9,922
4. Net Production Value Without Project	604	604	650	703	749	804	852	852	852	852	852
5. Net flow from project investments (3-4) 5/	-	-2,097	- 1,178	2,633	4,985	5,785	8,869	9,070	9,070	9,070	9,070
Financial Rate of Return	----------	----------	----------	----------	>50%	----------	----------	----------	----------	----------	----------
B. FARM CASH FLOW											
In: Sales	4,319	4,291	7,529	10,908	12,119	12,974	16,106	16,307	16,307	16,307	16,307
Seasonal credit	-	3,056	4,170	5,168	4,540	3,912	3,912	3,912	3,912	3,912	3,912
Investment credit	-	2,460	2,868	946	-	-	-	-	-	-	-
Land Purchase credit	-	-	-	-	-	-	-	-	-	-	-
Total	4,319	9,807	14,567	17,022	16,659	16,886	20,018	20,219	20,219	20,219	20,219
Out: Investment Costs	-	3,075	3,585	1,183	-	-	-	-	-	-	-
Operating Costs	1,323	1,782	2,717	3,912	3,912	3,912	3,912	3,912	3,912	3,912	3,912
Debt Service: Seasonal	-	3,163	4,316	5,349	4,699	4,049	4,049	4,049	4,049	4,049	4,049
Investment	-	172	373	439	439	439	439	1,412	1,339	1,266	1,193
Total	1,323	8,192	10,991	10,883	9,050	8,400	8,400	9,373	9,300	9,227	9,154
CASH BALANCE BY YEAR END 6/	2,996	1,615	3,576	6,139	7,609	8,486	11,618	10,846	10,919	10,992	11,065
C. Composition of Net Farm Income											
Cash Income	2,996	1,615	3,576	6,139	7,609	8,486	11,618	10,846	10,919	10,992	11,065
Value of domestic consumption 7/	666	666	666	666	666	666	666	666	666	666	666
Total	3,662	2,281	4,242	6,805	8,275	9,152	12,284	11,512	11,585	11,658	11,731

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed; Cr$ 1,500 for water pump or storage facilities.
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 3
Northeast Brazil
Ceara Rural Development Project - Ibiapaba

Farm Type 1A: Sharecropper Buying Land, Humid/Sub-humid Zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	.	2,075	1,085	1,183	-	-	-	-	-	-	-
Establishment of permanent crops	-	-	-	-	-	-	-	-	-	-	-
Land Purchase	-	20,000	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	2,500	-	-	-	-	-	-	-	-
Sub-total	-	23,075	3,585	1,183	-	-	-	-	-	-	-
Operating Costs											
Inputs 2/	1,323	1,782	2,717	3,912	3,912	3,912	3,912	3,912	3,912	3,192	3,192
Family Labor	3,058	1,593	2,421	3,139	3,139	3,139	3,139	3,139	3,139	3,139	3,139
Sub-total	4,381	3,375	5,138	7,051	7,051	7,051	7,051	7,051	7,051	7,051	7,051
Total	4,381	26,450	8,723	8,234	7,051	7,051	7,051	7,051	7,051	7,051	7,051
2. Gross Production Value											
Value of production under project	-	6,530	11,690	17,059	19,178	20,460	25,158	25,459	25,459	25,459	25,459
Value of traditional production 3/	4,985	604	402	201	-	-	-	-	-	-	-
Total	4,985	7,134	12,092	17,260	19,178	20,460	25,158	25,459	25,459	25,459	25,459
3. Net Production Value											
With Project 4/ (2-1)	-	-19,316	3,369	9,026	12,127	13,409	18,107	18,408	18,408	18,408	18,408
4. Net Production Value Without Project	604	604	650	703	749	804	852	852	852	852	852
5. Net flow from project investments (3-4) 5/	-	-19,920	2,719	8,323	11,378	12,605	17,255	17,556	17,556	17,556	17,556
Financial Rate of Return	----------				47%						
B. FARM CASH FLOW											
In: Sales	4,319	6,468	11,426	16,594	18,512	19,794	24,492	24,793	24,793	24,793	24,793
Seasonal credit	-	3,056	4,170	5,168	4,540	3,912	3,912	3,912	3,912	3,912	3,912
Investment credit	-	2,460	2,868	946	-	-	-	-	-	-	-
Land Purchase credit	-	20,000	-	-	-	-	-	-	-	-	-
Total	4,319	31,934	18,464	22,708	23,052	23,706	24,492	28,705	28,705	28,705	28,705
Out: Investment Costs	-	23,075	3,585	1,183	-	-	-	-	-	-	-
Operating Costs	1,323	1,782	2,717	3,912	3,912	3,912	3,912	3,912	3,912	3,912	3,912
Debt Service: Seasonal	-	3,163	4,316	5,349	4,699	4,049	4,049	4,049	4,049	4,049	4,049
Investment 7/	-	2,572	2,773	2,839	2,839	2,839	2,839	5,070	4,826	4,582	4,338
Total:	1,323	30,592	13,391	13,283	11,450	10,800	10,800	13,031	12,787	12,543	12,299
CASH BALANCE BY YEAR END 6/	2,996	1,392	5,073	9,425	11,602	12,906	13,692	15,674	15,918	16,162	16,406
C. Composition of Net Farm Income											
Cash Income	2,996	1,392	5,073	9,425	11,602	12,906	13,692	15,674	15,918	16,162	16,406
Value of domestic consumption 8/	666	666	666	666	666	666	666	666	666	666	666
Total	3,662	2,058	5,739	10,091	12,268	13,572	14,358	16,340	16,584	16,828	17,072

1/ *Calculated as follows:* Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed; Cr$ 1,500 for water pump or storage facilities.
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ *Including family labor income.*
7/ Including service of land purchase loan.
8/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 4
Northeast Brazil
Ceara Rural Development Project - Ibiapaba

Farm Type II: Owner-operated with up to 10 ha, Humid/Sub-humid zone
Financial projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	
1. Costs											
Investment Costs											
Land Development	-	5,779	1,879	1,183	-	-	5,585	-	-	-	-
Establishment of permanent crops	-	4,977	-	-	-	-	4,977	-	-	-	-
Land Purchase	-	-	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	2,500	-	-	-	-	-	-	-	-
Sub-total	-	11,756	4,379	1,183	-	-	10,562	-	-	-	-
Operating Costs											
Inputs 2/	1,762	1,625	4,937	6,001	6,001	6,001	4,255	6,001	6,001	6,001	6,001
Family Labor	3,787	2,025	3,501	4,327	4,327	4,327	4,327	4,237	4,237	4,237	4,237
Sub-total	5,549	3,650	8,438	10,328	10,328	10,328	8,582	10,328	10,328	10,328	10,328
Total	5,549	15,406	12,817	11,512	10,328	10,328	19,144	10,328	10,328	10,328	10,328
2. Gross Production Value											
Value of production under project	-	8,832	20,563	27,846	30,071	31,615	28,850	34,099	35,749	35,749	35,749
Value of traditional production 3/	10,454	4,904	3,270	1,635	-	-	-	-	-	-	-
Total	10,454	13,736	23,833	29,481	30,071	31,615	28,850	34,099	35,749	35,749	34,749
3. Net Production Value											
With Project 4/ (2-1)	-	-1,670	11,016	17,969	19,743	21,287	9,706	23,771	25,421	25,421	25,421
4. Net Production Value Without Project	4,904	4,904	5,214	5,366	5,466	5,577	5,687	5,687	5,687	5,687	5,687
5. Net flow from project investments (3-4) 5/	-	-6,574	5,802	12,603	14,277	15,710	4,019	18,084	19,734	19,734	19,734
Financial Rate of Return	> 50%										
B. FARM CASH FLOW											
In: Sales	9,074	12,356	22,453	28,101	28,691	30,235	27,470	32,719	34,369	34,369	34,369
Seasonal credit	-	3,245	7,035	7,732	6,866	6,001	4,255	6,001	6,001	6,001	6,001
Investment credit	-	9,405	3,503	946	-	-	-	-	-	-	-
Land Purchase credit	-	-	-	-	-	-	-	-	-	-	-
Total	9,074	25,006	32,991	36,779	35,557	36,236	31,725	38,720	40,370	40,370	40,370
Out: Investment Costs	-	11,756	4,379	1,183	-	-	10,562	-	-	-	-
Operating Costs	1,762	1,625	4,937	6,001	6,001	6,001	4,255	6,001	6,001	6,001	6,001
Debt Service: Seasonal	-	3,359	7,281	8,003	7,106	6,211	4,404	6,211	6,211	6,211	6,211
Investment	-	658	904	970	970	970	970	3,117	2,955	2,793	2,631
Total	1,762	17,398	17,501	16,157	14,077	13,182	20,191	15,329	15,167	15,005	14,843
CASH BALANCE BY YEAR END 6/	7,312	7,608	15,490	20,622	21,480	23,054	11,534	23,331	25,203	25,365	25,527
C. Composition of Net Farm Income											
Cash Income	7,312	7,608	15,490	20,622	21,480	23,054	11,534	23,391	25,203	25,365	25,527
Value of domestic consumption 7/	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380
Total	8,692	8,988	16,870	22,002	22,860	24,434	12,916	24,771	26,583	26,745	26,907

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed; Cr$ 1,500 for water pump or storage facilities.
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 5
Northeast Brazil
Ceara Rural Development Project - Ibiapaba

Farm Type III: Owner-operated with 10-25 ha, Humid/Sub-humid Zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	-	23,586	3,716	4,414	-	-	15,289	-	-	-	-
Establishment of permanent crops	-	15,935	1,404	1,685	-	-	11,723	-	-	-	-
Land Purchase	-	-	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	2,500	-	-	-	-	-	-	-	-
Sub-total	-	40,521	7,620	6,099	-	-	27,012	-	-	-	-
Operating Costs											
Inputs 2/	5,100	5,333	13,439	16,259	17,572	17,572	14,192	17,572	17,572	17,572	17,572
Family Labor	7,384	5,747	6,901	7,929	8,113	8,113	8,113	8,113	8,113	8,113	8,113
Sub-total	12,484	11,080	20,340	24,188	25,685	25,685	22,305	25,685	25,685	25,685	25,685
Total	12,484	51,601	27,960	30,287	25,685	25,685	49,317	25,685	25,685	25,685	25,685
2. Gross Production Value											
Value of production under project	-	24,383	45,791	64,040	74,973	85,474	84,590	98,110	102,911	102,911	102,911
Value of traditional production 3/	21,970	9,486	6,320	3,160	-	-	-	-	-	-	-
Total	21,970	33,869	52,111	67,200	74,973	85,474	84,590	98,110	102,911	102,911	102,911
3. Net Production Value											
With Project 4/ (2-1)	-	-17,732	24,151	36,913	49,288	59,789	35,273	72,425	77,226	77,226	77,226
4. Net Production Value Without Project	9,486	9,486	10,279	10,736	10,899	11,230	11,424	11,424	11,424	11,424	11,424
5. Net flow from project investments (3-4) 5/	-	-27,218	13,872	26,177	38,389	48,559	23,849	61,001	65,802	65,802	65,802
Financial Rate of Return	---------- >50% ----------										
B. FARM CASH FLOW											
In: Sales	20,590	32,489	50,731	69,820	73,593	84,094	83,210	96,730	101,531	101,531	101,531
Seasonal credit	-	9,931	17,580	19,431	19,195	17,572	14,492	17,572	17,572	17,572	17,572
Investment credit	-	32,417	6,096	4,879	-	-	-	-	-	-	-
Land Purchase credit	-	-	-	-	-	-	-	-	-	-	-
Total	20,590	74,837	74,407	90,131	92,788	101,666	97,402	114,302	119,103	119,103	119,103
Out: Investment Costs	-	40,521	7,620	6,099	-	-	27,012	-	-	-	-
Operating Costs	5,100	5,333	13,439	16,259	17,572	17,572	14,192	17,572	17,572	17,572	17,572
Debt Service: Seasonal	-	10,279	18,195	20,111	19,867	18,187	14,689	18,187	18,187	18,187	18,187
Investment	-	2,269	2,696	3,037	3,037	3,037	3,037	9,763	9,257	8,751	8,245
Total	5,100	58,402	41,950	45,506	40,476	38,796	58,930	45,522	45,016	44,510	44,004
CASH BALANCE BY YEAR END 6/	15,490	16,435	32,459	44,624	52,312	62,870	38,472	68,780	74,087	74,593	75,099
C. Composition of Net Farm Income											
Cash Income	15,490	16,435	32,459	44,624	52,312	62,870	38,472	68,780	74,087	74,593	75,099
Value of domestic consumption 7/	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380	1,380
Total	16,870	17,815	33,839	46,006	53,692	66,250	39,852	70,160	75,467	75,973	76,479

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed; Cr$ 1,500 for water pump or storage facilities.
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 6
Northeast Brazil
Ceara Rural Development Project - Ibiapaba

Farm Type IV: Owner-operated with 25-200 ha, Humid/Sub-humid zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	-	82,539	16,798	16,798	16,798	16,798	37,071	-	-	-	-
Establishment of permanent crops	-	41,559	11,374	12,095	11,055	11,055	17,359	721	-	-	-
Land Purchase	-	-	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	2,500	-	-	-	-	-	-	-	-
Sub-total	-	125,098	30,672	28,893	27,853	27,853	54,430	721	-	-	-
Operating Costs											
Inputs 2/	33,983	20,706	38,498	45,833	56,978	65,767	74,631	76,084	77,537	77,537	77,537
Family Labor	9,567	6,480	8,928	9,360	9,972	10,476	10,620	10,692	10,764	10,764	10,764
Sub-total	43,550	27,186	47,426	55,193	66,950	76,243	85,251	86,776	88,301	88,301	88,301
Total	43,550	152,284	78,098	84,086	94,803	104,096	139,681	87,497	88,301	88,301	88,301
2. Gross Production Value											
Value of production under project	-	42,525	74,883	110,577	168,174	233,199	298,208	341,186	378,008	402,572	414,578
Value of traditional production 3/	53,886	10,336	6,990	3,445	-	-	-	-	-	-	-
Total	53,886	52,861	81,873	114,022	168,174	233,199	298,208	341,186	378,008	402,572	414,578
3. Net Production Value											
With Project 4/ (2-1)	-	-99,433	3,775	29,926	73,371	129,103	158,527	253,689	289,707	314,271	326,277
4. Net Production Value Without Project	10,336	10,336	12,313	13,698	13,993	15,040	15,503	15,503	15,503	15,503	15,503
5. Net flow from project investments (3-4) 5/	-	-109,769	-8,538	16,228	59,378	114,063	143,024	238,186	274,204	298,768	310,774
Financial Rate of Return	-	-	-	-	-	-	-	-	>50%	-	-
B. FARM CASH FLOW											
In: Sales	53,391	52,356	81,378	113,517	167,679	232,704	297,713	340,691	377,513	402,077	414,083
Seasonal credit	-	25,890	38,498	45,833	56,978	65,767	74,631	76,084	77,537	77,537	77,537
Investment credit	-	100,078	24,538	23,114	22,282	22,282	-	-		-	-
Land Purchase credit	-	-	-	-	-	-	-	-	-	-	-
Total	53,391	178,324	144,414	182,464	246,939	320,753	372,344	416,775	455,050	479,614	491,620
Out: Investment Costs	-	125,098	30,672	28,893	27,853	27,853	54,430	721	-	-	-
Operating Costs	33,983	20,706	38,498	45,833	56,978	65,767	74,631	76,084	77,537	77,537	77,537
Debt Service: Seasonal	-	26,796	45,390	51,312	61,036	68,069	77,243	78,747	80,251	80,251	80,251
Investment	-	7,005	8,723	10,341	11,901	13,461	13,461	43,267	41,024	38,781	36,538
Total	33,983	179,605	123,283	136,379	157,768	175,150	219,765	198,819	198,812	196,569	194,326
CASH BALANCE BY YEAR END 6/	19,408	-1,289	21,131	46,095	89,171	145,603	152,579	217,956	256,238	283,045	297,294
C. Composition of Net Farm Income											
Cash Income	19,408	-1,289	21,131	46,095	89,171	145,603	152,579	217,956	256,238	283,045	297,294
Value of domestic consumption 7/	495	495	495	495	495	495	495	495	495	495	495
Total	19,903	-794	21,626	46,590	89,666	146,098	153,074	218,451	256,733	283,540	297,789

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed; Cr$ 1,500 for water pump or storage facilities
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 7
Northeast Brazil
Ceara Rural Development Project - Ibiapaba

Farm Type V: Sharecropper buying land, Scrubland Zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	-	2,115	2,807	3,062	423	423	-	-	-	-	-
Establishment of permanent crops	-	-	463	463	-	-	-	-	-	-	-
Land Purchase	-	15,000	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	1,000	-	-	-	-	-	-	-	-
Sub-total	-	18,115	4,270	3,525	423	423	-	-	-	-	-
Operating Costs											
Inputs 2/	580	2,435	3,551	4,979	5,557	6,096	6,096	6,096	6,096	6,096	6,096
Family Labor	702	1,782	2,398	3,199	3,474	3,730	3,730	3,730	3,730	3,730	3,730
Sub-total	1,282	4,217	5,949	8,178	9,031	9,826	9,826	9,826	9,826	9,826	9,826
Total	1,282	22,332	10,219	11,703	9,456	10,249	9,826	9,826	9,826	9,826	9,826
2. Gross Production Value											
Value of production under project	-	3,363	5,850	9,360	12,006	14,460	15,255	15,658	15,838	15,838	15,838
Value of traditional production 3/	1,155	-	-	-	-	-	-	-	-	-	-
Rent Income 7/	-	1,730	1,730	1,730	1,730	1,730	1,730	1,730	1,730	1,730	1,730
Total	1,155	5,093	7,580	11,090	13,736	16,190	16,985	17,388	17,568	17,568	17,568
3. Net Production Value											
With Project 4/ (2-1)	-	-17,239	-2,639	-613	4,282	5,941	7,159	7,562	7,742	7,742	7,742
4. Net Production Value Without Project	-127	-127	-116	-105	-93	-81	-69	-69	-69	-69	-69
5. Net flow from project investments (3-4) 5/	-	-17,112	-2,523	-508	4,375	6,022	7,228	7,631	7,811	7,811	7,811
Financial Rate of Return	----------	----------	----------	----------	22%	----------	----------	----------	----------	----------	----------
B. FARM CASH FLOW											
In: Sales	505	4,443	6,930	10,440	13,086	15,540	16,335	16,738	16,918	16,918	16,918
Seasonal credit	-	2,690	4,680	6,259	6,252	6,096	6,096	6,096	6,096	6,096	6,096
Investment credit	-	3,115	3,416	2,820	338	338	-	-	-	-	-
Land Purchase credit	-	15,000	-	-	-	-	-	-	-	-	-
Total	505	25,248	15,026	19,519	19,676	21,974	22,431	22,834	23,014	23,014	23,014
Out: Investment Costs	-	18,115	4,270	3,529	423	423	-	-	-	-	-
Operating Costs	580	2,435	3,551	4,979	5,957	6,096	6,096	6,096	6,096	6,096	6,096
Debt Service: Seasonal	-	2,784	4,844	6,478	6,471	6,309	6,309	6,309	6,309	6,309	6,309
Investment 8/	-	2,018	2,297	2,495	2,478	2,502	2,502	4,998	4,752	4,500	4,250
Total	580	25,352	14,922	17,437	14,929	15,330	14,907	17,403	17,157	16,911	16,665
CASH BALANCE BY YEAR END 6/	-75	-104	104	2,082	4,747	6,644	7,924	5,431	5,857	6,103	6,349
C. Composition of Net Farm Income											
Cash Income	-75	-104	104	2,082	4,747	6,644	7,924	5,431	5,857	6,103	6,349
Value of domestic consumption 9/	650	650	650	650	650	650	650	650	650	650	650
Total	575	546	754	2,732	5,397	7,294	8,574	6,081	6,507	7,753	8,999

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed.
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Equivalent of land-owner's share of sharecropped production on 6 ha.
8/ Including service of land purchase loan.
9/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 8

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Farm Type VI: Owner-operated with up to 10 ha, Carrasco Zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	-	1,428	1,550	2,639	339	339	-	-	-	-	-
Establishment of permanent crops	-	185	278	463	-	-	-	-	-	-	-
Land Purchase	-	-	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	1,000	-	-	-	-	-	-	-	-
Sub-total	-	2,613	2,828	3,102	339	339	-	-	-	-	-
Operating Costs											
Inputs 2/	187	728	1,203	2,271	2,713	3,020	3,020	3,020	3,020	3,020	3,020
Family Labor	216	553	821	1,370	1,622	1,850	1,850	1,850	1,850	1,850	1,850
Sub-total	403	1,281	2,024	3,641	4,335	4,870	4,870	4,870	4,870	4,870	4,870
Total	403	3,894	4,852	6,743	4,674	5,209	4,870	4,870	4,870	4,870	4,870
2. Gross Production Value											
Value of production under project	-	1,050	2,195	4,359	5,967	7,130	7,684	7,974	8,141	8,233	8,233
Value of traditional production 3/	523	120	80	40	-	-	-	-	-	-	-
Total	523	1,170	2,275	4,399	5,967	7,130	7,684	7,974	8,141	8,233	8,233
3. Net Production Value											
With Project 4/ (2-1)	-	-2,724	-2,577	-2,344	1,293	1,921	2,814	3,104	3,271	3,363	3,363
4. Net Production Value Without Project	120	120	125	132	136	141	147	147	147	147	147
5. Net flow from project investments (3-4) 5/	-	-2,844	-2,702	-2,476	1,157	1,780	2,667	2,957	3,124	3,216	3,216
Financial Rate of Return	- - - - - - - - - - - -					23%	- - - - - - - - - - - -				
B. FARM CASH FLOW											
In: Sales	-	492	1,597	3,721	5,289	6,452	7,006	7,296	7,463	7,555	7,555
Seasonal credit	-	936	1,696	2,819	3,037	3,020	3,020	3,020	3,020	3,020	3,020
Investment credit	-	2,613	2,828	2,482	271	271	-	-	-	-	-
Land Purchase credit	-	-	-	-	-	-	-	-	-	-	-
Total	-	4,041	6,121	9,022	8,597	9,743	10,026	10,316	10,483	10,575	10,575
Out: Investment Costs	-	2,613	2,828	3,102	339	339	-	-	-	-	-
Operating Costs	187	728	1,203	2,271	2,713	3,020	3,020	3,020	3,020	3,020	3,020
Debt Service: Seasonal	-	969	1,755	2,918	3,143	3,126	3,126	3,126	3,126	3,126	3,126
Investment	-	183	381	555	574	593	593	1,904	1,805	1,706	1,607
Total	187	4,493	6,167	8,846	6,769	7,078	6,739	8,050	7,951	7,852	7,753
CASH BALANCE BY YEAR END 6/	-187	-452	- 46	176	1,828	2,665	3,287	2,266	2,532	2,723	2,822
C. Composition of Net Farm Income											
Cash Income	-187	-452	- 46	176	1,828	2,665	3,287	2,266	2,532	2,723	2,822
Value of domestic consumption 7/	678	678	678	678	678	678	678	678	678	678	678
Total	491	226	632	854	1,506	3,343	3,965	2,944	3,210	3,401	3,500

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed.
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 9
NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Farm Type VII: Owner-operated with 10-25 ha, Cerrasco Zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	-	2,538	3,315	3,315	1,100	1,100	-	-	-	-	-
Establishment of permanent crops	-	-	463	463	-	-	-	-	-	-	-
Land Purchase	-	-	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,000	1,000	-	-	-	-	-	-	-	-
Sub-total	-	3,538	4,778	3,778	1,100	1,100	-	-	-	-	-
Operating Costs											
Inputs 2/	405	3,117	4,904	6,692	8,073	9,453	9,453	9,453	9,453	9,453	9,453
Family Labor	734	1,908	2,848	3,778	4,558	5,337	5,337	5,337	5,337	5,337	5,337
Sub-total	1,139	5,025	7,752	10,470	12,631	14,790	14,790	14,790	14,790	14,790	14,790
Total	1,139	8,563	12,530	14,248	13,731	15,890	14,790	14,790	14,790	14,790	14,790
2. Gross Production Value											
Value of production under project	-	3,915	7,503	11,797	15,907	19,888	21,252	22,108	23,309	23,526	23,526
Value of traditional production 3/	1,995	856	570	285	-	-	-	-	-	-	-
Total	1,995	4,771	8,073	12,082	15,907	19,888	21,252	22,108	23,309	23,526	23,526
3. Net Production Value											
With Project 4/ (2-1)	-	-3,792	-4,457	-2,166	2,176	3,998	6,462	7,318	8,519	8,736	8,736
4. Net Production Value Without Project	856	856	876	894	916	934	957	957	957	957	957
5. Net flow from project investments (3-4) 5/	-	-4,648	-5,333	-3,060	1,260	3,064	5,505	6,361	7,562	7,779	7,779
Financial Rate of Return	- - - - - - - - - - - - - -					28%	- - - - - - - - - - - - - -				
B. FARM CASH FLOW											
In: Sales	1,345	4,121	7,423	11,432	15,257	19,238	20,602	21,458	22,659	22,876	22,876
Seasonal credit	-	3,817	6,458	8,203	8,985	9,453	9,453	9,453	9,453	9,453	9,453
Investment credit	-	3,538	3,822	3,022	880	880	-	-	-	-	-
Land Purchase credit	-	-	-	-	-	-	-	-	-	-	-
Total	1,345	11,476	17,703	22,657	25,122	29,571	30,055	30,911	32,112	32,329	32,329
Out: Investment Costs	-	3,538	4,778	3,778	1,100	1,100	-	-	-	-	-
Operating Costs	405	3,117	4,904	6,692	8,073	9,453	9,453	9,453	9,453	9,453	9,453
Debt Service: Seasonal	-	3,951	6,684	8,490	9,299	9,784	9,784	9,784	9,784	9,784	9,784
Investment	-	248	515	727	788	850	850	2,732	2,590	2,448	2,306
Total	405	10,854	16,881	19,687	19,260	21,187	20,087	21,969	21,827	21,685	21,543
CASH BALANCE BY YEAR END 6/	940	622	822	2,970	5,862	8,384	9,968	8,942	10,285	10,644	10,786
C. Composition of Net Farm Income											
Cash Income	940	622	822	2,970	5,862	8,384	9,968	8,942	10,285	10,644	10,786
Value of domestic consumption 7/	650	650	650	650	650	650	650	650	650	650	650
Total	1,590	1,272	1,472	3,620	6,512	9,034	10,618	9,592	10,935	11,294	11,436

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed.
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Based on average family size found in pre-project field survey and average consumption patterns.

Table 10
Northeast Brazil
Ceara Rural Development Project - Ibiapaba

Farm Type VIII: Owner-operated with 25-200 ha, Carrasco Zone
Financial Projection (Cr$)

A. FARM MODEL FINANCIAL RATE OF RETURN — Years	Pre-Project	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Costs											
Investment Costs											
Land Development	-	7,799	2,961	4,838	3,384	4,230	-	-	-	-	-
Establishment of permanent crops	-	463	-	463	-	-	-	-	-	-	-
Land Purchase	-	-	-	-	-	-	-	-	-	-	-
Implements 1/	-	1,500	1,500	500	-	-	-	-	-	-	-
Sub-total (C1)	-	9,262	4,461	5,801	3,384	4,230	-	-	-	-	-
Operating Costs											
Inputs 2/	1,031	6,944	10,863	15,319	17,593	21,483	21,483	21,483	21,483	21,483	21,483
Family Labor	1,350	4,563	6,642	7,920	8,352	8,874	8,874	8,874	8,874	8,874	8,874
Sub-total (C2)	2,381	11,507	17,505	23,239	25,945	30,357	30,357	30,357	30,357	30,357	30,357
Total	2,381	20,769	21,966	29,040	29,329	34,587	30,357	30,357	30,357	30,357	30,357
2. Gross Production Value											
Value of production under project	-	10,216	17,895	26,308	34,380	43,132	46,264	48,266	49,168	49,528	49,528
Value of traditional production 3/	3,426	1,045	696	368	-	-	-	-	-	-	-
Total (B1)	3,426	11,261	18,591	26,646	34,380	43,132	46,264	48,266	49,168	49,528	49,528
3. Net Production Value											
With Project 4/ (2-1)	-	-9,508	-3,375	-2,394	5,051	8,545	15,707	17,909	18,811	19,171	19,171
4. Net Production Value Without Project (B3)	1,045	1,045	1,089	1,113	1,149	1,184	1,220	1,220	1,220	1,220	1,220
5. Net flow from project investments (3-4) 5/	-	-10,553	-4,464	-3,507	3,902	7,361	14,687	16,689	17,591	17,951	17,951
Financial Rate of Return	----------					38%					----------
B. FARM CASH FLOW											
In: Sales	2,803	10,638	17,968	26,023	33,797	42,509	45,641	47,643	48,545	48,905	48,905
Seasonal credit	-	9,009	14,848	18,487	19,263	21,483	21,483	21,483	21,483	21,483	21,483
Investment credit	-	7,410	3,569	4,641	2,707	3,384	-	-	-	-	-
Total	2,803	27,057	36,385	49,151	55,727	67,376	67,124	69,126	70,028	70,388	70,388
Out: Investment Costs	-	9,262	4,461	5,801	3,384	4,230	-	-	-	-	-
Operating Costs	1,031	6,944	10,863	15,319	17,593	21,483	21,483	21,483	21,483	21,483	21,483
Debt Service: Seasonal	-	9,324	15,368	19,134	19,937	22,235	22,235	22,235	22,235	22,235	22,235
Investment	-	519	769	1,093	1,283	1,520	1,520	4,885	4,632	4,379	4,126
Total	1,031	26,049	31,461	41,347	42,197	49,468	45,238	48,603	48,350	48,097	47,844
CASH BALANCE BY YEAR END 6/	1,772	1,008	4,924	7,804	13,530	17,908	21,886	20,523	21,678	22,291	22,544
C. Composition of Net Farm Income											
Cash Income	1,772	1,008	4,924	7,804	13,530	17,908	21,886	20,523	21,678	22,291	22,544
Value of domestic consumption 7/	623	623	623	623	623	623	623	623	623	623	623
Total	2,395	1,631	5,547	8,427	14,523	18,531	22,509	21,146	22,301	22,914	23,167

1/ Calculated as follows: Cr$ 500 for small implements, Cr$ 1,500 for sorting and packing shed; Cr$ 1,500 for water pump or storage facilities
2/ Inputs include: Fertilizers, seeds, chemicals, hired labor, farm machinery, draft animals, packing materials, etc.
3/ Value of traditional crops that will be grown during the three first years of the project.
4/ Net production value = Gross Production Value less Total Costs.
5/ Not including family labor income.
6/ Including family labor income.
7/ Based on average family size found in pre-project field survey and on average consumption patterns.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 11 : Summary Results of Financial Rate of Return and Sensitivity Analyses of Farm Models

Farm Type	Financial Rate of Return					
	Best Estimate	50% Increase in Invest. Cost	25% Increase in Oper. Costs	25% Increase in All Costs	Decrease[1/] in Benefits	10% Increase in All Costs and 10% Decrease in Benefits
Humid Zone:						
sharecropper (buying land)	47	32	40	33	28	34
sharecropper (not buying land)	> 50	> 50	> 50	44	33	48
owner with up to 10 ha	> 50	> 50	> 50	> 50	42	> 50
owner with 10-25 ha	> 50	> 50	> 50	> 50	41	> 50
owner with 25-200 ha	> 50	> 50	> 50	> 50	35	41
Carrasco Zone:						
sharecropper (buying land)	22	14	12	9	16	11
owner with up to 10 ha	23	16	11	8	16	10
owner with 10-25 ha	28	21	8	7	17	9
owner with 25-200 ha	38	28	15	13	24	16

1/ 25% on humid zone; 10% on carrasco zone.

ANNEX 8
Table 11

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Economic Analysis

Introduction

1. The economic analysis for the proposed project was carried out in several parts. First, an internal economic rate of return was calculated for project components directly related to the incremental agricultural production of project participants. The methodology and details of that analysis are described in this annex. Second, an internal economic rate of return was calculated separately for the proposed rural electrification component, whose benefits (though related to the agricultural benefits) are separable in that they lie principally with the savings resulting from the substitution of electric motors for diesel powered engines used mainly for small scale sugar and manioc milling and small scale irrigation. Third, an economic rate of return was calculated for the combined agricultural and electrification components, the results described in this annex.

2. For the economic analysis of the agricultural components, the benefit stream was calculated to include the incremental crop production (other than coffee) by project participants. The benefit stream reflects both the phased entrance to project participation of the different types of representative producers and the phased increases of areas planted and yields received by participating farmers (see Annexes 7 and 8 for details of representative farm types and expected yields). The cost stream included three main components: (i) the on-farm investments by participating farmers in land-clearing, planting of permanent crops, equipment and tool procurement, development of on-farm storage, etc.; (ii) the incremental working capital (both purchased inputs and family labor) required to achieve the production increases; and (iii) a portion, as described in paragraph 4 in detail, of the extension and demonstration service, field experimentation, cooperative support, initial mechanization service equipment stock, feeder road, project administration and evaluation and soil conservation study costs.

Sources of Information

3. A major source of information on the existing situation (production systems, costs and revenues) of project area farmers of different types was a sample field survey carried out in late 1975 in the project area by CEPA-CE. The survey covered over 300 farmers. This data was complemented by information from the 1970 Agricultural and Population censuses carried out by IBGE (the Brazilian Geographical and Statistical Institute) and the 1972 cadastral survey carried out by INCRA (the National Institute for Colonization and Agrarian Reform). Estimates for potential yield improvements, on-farm investment and

production costs (which are detailed in the individual farm models in Annex 8) were based on consultations with the state research and extension companies and on field observation. Coffee production activities were included in several of the representative farm models because the coffee expansion program will play an important part in some project participant farms.

4. Cost estimates for off-farm investments and services (feeder roads, extension, experimentation, etc.) are detailed in the respective annexes on those subjects. In the case of extension services, 90% of estimated costs (baseline plus physical contingencies) were charged to the cost stream since at least 10% (a very conservative estimate) of the costs could be linked to other benefits which are not quantifiable (e.g., indirect support of non-project production such as coffee or livestock through improved overall farm management, demonstration effect on non-participating farmers, impact of social extension work). In the case of the experimentation, feeder road construction and road maintenance equipment, cooperative support, the initial equipment stock for mechanization services and overall project administration, 70% of the costs were charged to the cost stream. Again, only a conservatively estimated share of the costs were charged to non-quantified benefits. For example, expected project production would come from just over 60% of the area's farm operators. Clearly, the benefits of feeder road construction, as well as of other components, will extend far beyond the incremental "project" production facilitated among participants and would also include other important non-quantified production benefits (coffee, livestock, production generated among farmers not counted as participants, etc.) as well as social benefits. In the case of monitoring, 50%, and in the case of soil conservation studies, 20%, of the estimated costs were charged to the quantified production benefits of the Ibiapaba project.

5. For the most part, the prices used in the economic analysis reflected the average local market prices over the last 3 years (see Annex 7). Although there appears to be a relatively tight labor market in the project area during periods of peak agricultural labor requirement and higher wages may at times be required, it was assumed that applying a weighted average of the market wage to both family labor and hired labor would adequately reflect the overall yearly average. Only in the cases of farm-gate peanut and of fertilizer prices were reductions from recent local prices required to assure consistency with the Bank's world-wide price projections. As making a reasonable estimate of the tax component of the cost stream would be very difficult in light of the complexity of the cost stream and tax system, market prices of inputs or investment items have not yet been reduced to take into account taxes therein and, on the production side, farm-gate prices (not including taxes levied on marketed produce) were used.

6. A "shadow" or "efficiency price" for the foreign exchange rate was, however, used in the economic analysis. The "efficiency" rate was calculated to be that exchange rate which, if all trade-distorting tariffs, subsidies, advance import deposits, export taxes, and quantitative restrictions were

removed, would reestablish "equilibrium" in balance of payments taking account of planned capital inflows. The methodology used takes explicit account of Brazil's ability to affect the world price of a number of important export commodities and allows for varying estimates of the extent of unplanned deficits in the balance of payments. The data used for these calculations are for 1975, except that estimates of the most restrictive measures affecting imports in 1976 have been applied to the 1975 data. On this basis, the appropriate shadow exchange rate for Brazil is in the range of 23 to 28 percent above the official exchange rate as of mid-1976. For lack of more precise measures, a figure of 25 percent is being used. The stiff restrictive import measures which became effective in 1976 (including prior cruzeiro deposits, bearing no interest or monetary correction and equal to 100 percent of the f.o.b. value of many imports, as well as increased quantitative restrictions) coupled with a significant unplanned current account deficit, only in part attributable to temporary climatic factors affecting agricultural production, have had the effect of raising the shadow exchange rate to more than 20 percent above the official rate. Some degree of import control is likely to be retained over the medium term. For the longer term Government has embarked on a major import substitution drive involving important basic and intermediate inputs for industry as well as wheat, and exports may well require additional stimulation in the future.

7. Insofar as the Ibiapaba project is concerned, the foreign exchange costs (mainly indirect) for the various components (as estimated in Annex 5) were adjusted to reflect the "shadow" exchange rate. Table 1 sets forth the detailed cost and benefit streams assumed. In the case of benefits, the expected value of production of sugarcane, peanuts (vegetable oil) and annato was adjusted to reflect the fact that Brazil is a net exporter of those products.

Results of Economic Analysis

8. The internal economic rate of return (assuming a 17 year discount period, which is equivalent to the period within which a twelve-year agricultural investment sub-loan made during the fifth year of the project would be repaid) for the agricultural components was estimated to be 21% using efficiency prices. At market prices the rate dropped only marginally to 19%. The rate of the combined agricultural and electrification components would be about 19% using efficiency prices (15% using market prices).

9. The results of the sensitivity analysis on the agricultural component are given in Table 2. The rate of return is relatively sensitive to decreases in incremental production or increases in costs. One must take into account, however, the fact that very conservative assumptions were made in assigning the costs of "off-farm" investments and services to the cost stream.

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 1: Cost and Benefit Streams for Economic Analysis of Agricultural Components
(in efficiency prices converted to US$'000)

	Costs													
	On-Farm			Off-Farm										
Year	Investment	Incremental Working Capital	Sub-Total	Extension and Demonstration	Field Experimentation	Cooperative Support	Mechanization Service Equipment	Feeder Roads	Project Adminis. and Eval.	Soil Conservation Study	Sub-Total	Total	Incremental Production Benefits 1/
1	488.3	66.2	554.5	487.7	22.0	63.9	180.7	1,186.3	282.0	29.7	2,252.3	2,806.8	166.3
2	1,414.5	376.3	1,790.8	712.9	28.3	87.9	212.7	2,230.7	291.7	44.6	3,608.8	5,399.6	851.7
3	2,939.4	1,241.0	4,180.4	1,089.1	34.5	87.9	145.9	1,428.6		44.6	3,122.3	7,302.7	2,573.2
4	3,165.9	2,680.6	5,846.5	1,203.5	47.0	0.0	0.0	91.9		44.6	1,678.7	7,525.2	5,275.4
5	1,568.8	4,180.7	5,749.5	1,055.3				0.0		18.6	1,412.6	7,162.1	8,015.6
6	1,260.6	5,034.4	6,295.0	969.2						0.0	1,307.9	7,602.9	10,015.7
7	1,286.7	5,561.7	6,848.4									8,156.3	11,653.7
8	1,714.9	5,788.3	7,503.2									8,811.1	12,836.7
9	1,218.5	5,853.6	7,072.1									8,380.0	13,743.0
10	8.8	5,974.7	5,983.5									7,291.4	14,608.6
11	296.8	5,970.8	6,267.6						0.0		1,016.2	7,283.8	14,989.1
12	774.1	5,941.5	6,715.6									7,731.8	15,126.3
13	1,456.1	5,889.2	7,345.3									8,361.5	15,125.3
14	1,190.9	5,913.8	7,104.7									8,120.9	15,291.1
15	0.0	5,993.8	5,993.8									7,010.0	15,552.2
16	296.8	5,970.8	6,267.6									7,283.8	15,510.4
17	774.1	5,941.5	6,715.6									7,731.8	15,433.1

1/ Based on phased composite of representative farm models.

ANNEX 9
Table 1

NORTHEAST BRAZIL
CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

Table 2: Summary Results of
Economic Rate of Return and Sensitivity Analysis

	Internal Economic Rate of Return (%)
Best Estimates	
Agricultural Components	21
Rural Electrification Component	17
Combined	19
Agricultural Component Sensitivity Analysis	
Best Estimate	21
Change in Benefits of:	
+ 10%	26
- 10%	16
- 20%	10
Change in On-Farm Costs of:	
+ 10%	18
+ 20%	14
Change in Off-Farm Costs of:	
+ 10%	19
+ 20%	18
+ 50%	14
Change in All Costs of:	
+ 10%	16
+ 20%	12
Change in:	
all costs, + 10%; benefits, - 10%	11
all costs, + 10%; benefits, - 20%	5

NORTHEAST BRAZIL

CEARA RURAL DEVELOPMENT PROJECT - IBIAPABA

FISCAL IMPACT

I. RECOVERY OF PROJECT COSTS

1. During the 5-year project period, project costs are expected to be about US$55.8 million (including price and physical contingencies). Of this amount roughly US$18 million (again including contingencies) would be for on-farm development and incremental farm working capital or an average of just over US$3,000 per direct beneficiary farmer. Adding the sum of US$8 million of expected costs for other agricultural support services (extension, experimentation, cooperative support and mechanization services) mainly directed toward the same group, the cost per family of the total agricultural component would be on the order of US$4,500. The project administration, social and physical infrastructure costs (amounting to a total of almost US$30 million) are far more difficult to assign to particular families. Though some 5,000 families are expected to benefit from new electricity connections, the electrification benefits will also accrue to non-farm families and to all families using health posts, education or other public facilities, and the rural roads could easily be considered to benefit most of the rural population of some 25,000 families, as would improved health and education services. The sum of these non-agricultural expenditures would average roughly US$1,200 per rural family in the project area.

2. The effectiveness of cost recovery arrangements varies by component and, because of the importance of credit (for agriculture, land purchase and electricity connections) in recovering the costs, any estimate of real recovery depends very much on the assumptions made regarding the rate of inflation over the next several years in Brazil and the effect of this inflation in deflating the real value of repayments of unindexed credit. First, as far as the on-farm agricultural investment and incremental working capital costs are concerned (roughly US$18 million including contingencies), farmers are likely to finance at least 10-15% with their own resources at the outset. Of the remainder, which would be financed by credit, if one were to assume a gradually declining though continuing moderate inflation, credit repayments would recover as little as one-third and probably less than half of the real value of credit originally extended. Overall, therefore, real recovery of the on-farm project costs will probably be less than 60% and possibly as low as 40%.

3. Insofar as direct or indirect recovery of the some US$37 million in off-farm project costs is concerned, one could consider cost recovery to include: the estimated community contribution to investments in the health and sanitation component; road user charges (taxes on petroleum use, license fees, etc.); as a minimum, the tax income which would be derived from the marketed incremental production during the five-year project period (later tax income is considered in paragraph 15 below in offsetting incremental

recurrent costs); and a deflated real value of the electricity connection loan repayments. On such assumptions, about one-third (roughly US$12 million) of the off-farm five-year project costs would be recovered by the Government. Among the cost recovery mechanisms for off-farm project investments and services, direct and indirect road user charges will probably allow full recovery of the road component costs. The extent of real recovery of electrification investment costs will, however, depend on the impact of future inflation in deflating the real value of connection loan, but the mechanism of connection charges is already in place and electricity tariffs are sufficiently high to assure the continued viability of the power company and electrification cooperative. Other off-farm project costs (e.g., experimentation and extension services, project administration, studies, health and social infrastructure), which in this project will benefit mainly very low income groups, are typically not directly recovered by the Government.

4. The probable overall recovery of the total project cost is therefore estimated to be on the order of 35-40%, leaving a net fiscal burden to the Government of some US$33-36 equivalent. It should be noted, however, that this estimate is highly sensitive to the assumptions one makes regarding inflationary tendencies. In any case, the net burden does not appear excessive in view of Brazil's overall fiscal capacity.

II. INCREMENTAL RECURRENT COSTS

Not Directly Recovered from Beneficiaries

5. Agricultural Extension. At full development, the continuing agricultural extension and demonstration services would cost approximately US$978,000 annually in the project area. It is assumed that, for purposes of this analysis, the Government's policy of not charging the small farmer for such services will be continued. The recurrent cost estimate for extension is, however, probably on the high side, as it should be possible with the project experience to continue to improve the cost effectiveness of the service.

6. Agricultural Research. The maintenance and continued operation of the some 10 experimentation fields whose start-up would be financed by the proposed Bank loan would amount to approximately US$61,000 per year after the five year project period. It should be noted that this does not include the operating cost of the new EPACE research station at Tiangua which, though not part of the project, will also contribute to production increases.

7. Education and Training. It is assumed that the level of non-formal training continued after the five year project period would be slightly less annually than during the peak project year (when about US$133,000 equivalent in training costs would be incurred). Thus, it is assumed that annual recurrent non-formal training costs would approximate US$100,000. Recurrent costs for the formal primary education at project-financed schools would be about US$376,000 annually.

8. Health. At full development, the annual costs of operating the 62 new miniposts would be about US$197,000 equivalent, the referral services at the 7 health centers about US$35,000, the incremented hospital services about US$43,000, the endemic disease control programs about US$78,000 and the regional health administration set up about US$46,000. These costs total about US$399,000 equivalent. However, it is expected that up to 60% of the recurrent minipost costs will be recovered from beneficiaries so that the incremental fiscal burden generated by the health component would be more on the order of US$281,000 annually.

9. Project Administration and Evaluation. It is expected that the special project administration and evaluation set-up could be gradually phased out. Even if it were not, at least 30% of the costs of the administration unit and half of the costs of the monitoring and evaluation unit would be directly associated with other or subsequent POLONORDESTE projects. On this basis it can be assumed that the recurrent costs generated by the Ibiapaba project would be at most on the order of US$212,000 annually for project administration and US$55,000 for monitoring and evaluation, or a total of about US$267,000.

10. Total. The total quantifiable recurrent costs generated by the project, for which direct recovery from beneficiaries would not be made, amount to US$2,063,000, of which about 50% would be related to agricultural extension and experimentation services, 13% to project administration and 37% to social services (health, education and training).

Directly Recovered from Beneficiaries

11. Water Supply. It is expected that the operation and maintenance of the 62 new or improved village water supply systems included in the project will cost annually some US$124,000 equivalent, of which 89% would be at the local or community level and 11% at the regional (CAGECE) level. The costs of operation and maintenance should be fully recovered through beneficiary payments through the community health committees.

12. Feeder Road Maintenance. The cost of maintaining the 370 km of feeder roads improved or constructed under the project will be on the order of US$11,000 equivalent annually (US$300/km/yr). While it is virtually impossible to match specific tax receipts with subsequent expenditures these road maintenance expenditures should be fully covered by the local share of the various road user (principally the tax on fuel and lubricants) charges in effect.

13. Mechanization and Electrification Services. The costs of continued operation of these activities would be fully covered by direct user charges.

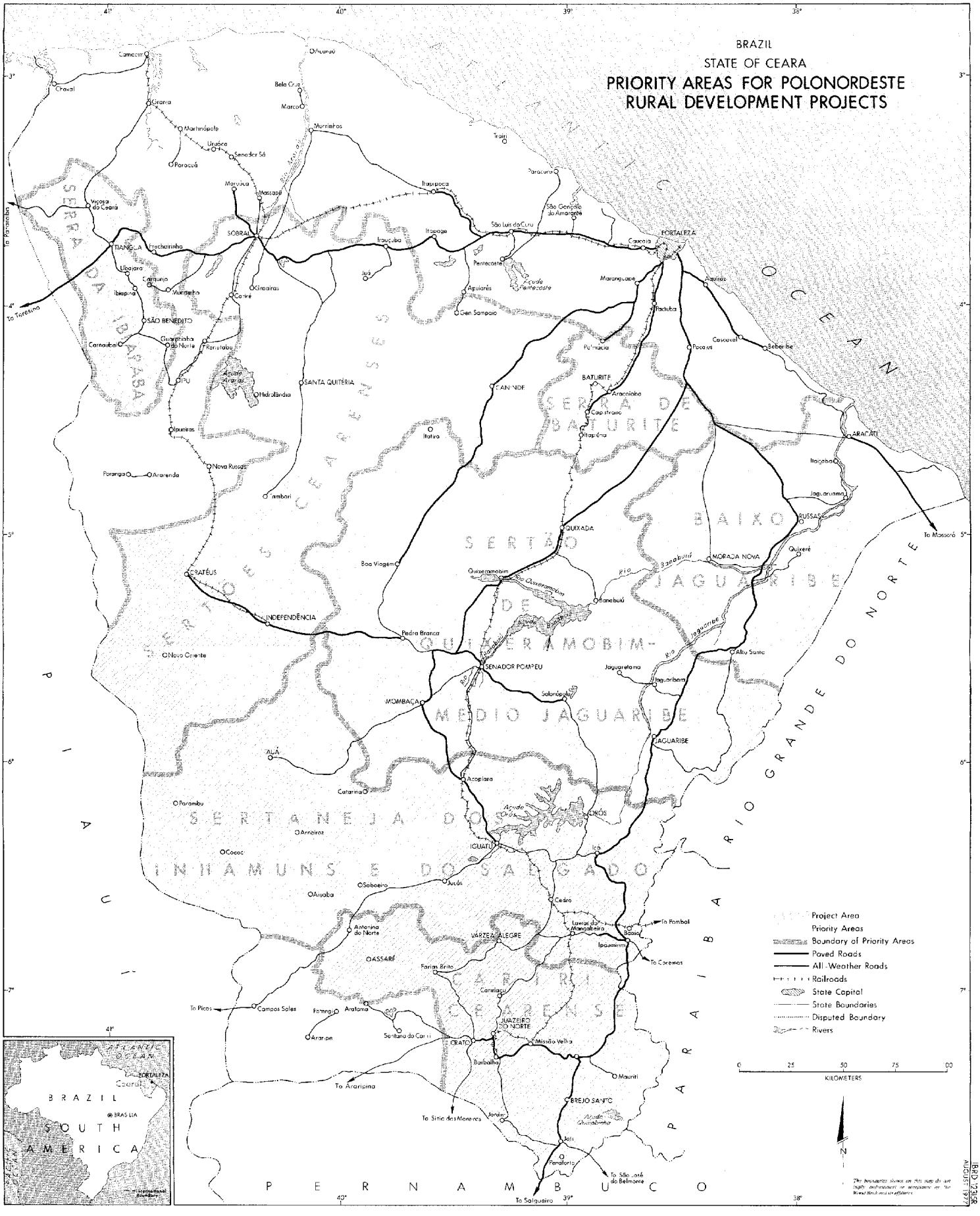
14. Credit. At present, given the rate of inflation in Brazil, the interest rate structure adopted for agricultural and land purchase credit to small farmers involves a substantial Government subsidy. It is virtually impossible to estimate, however, what the recurrent costs of this subsidy

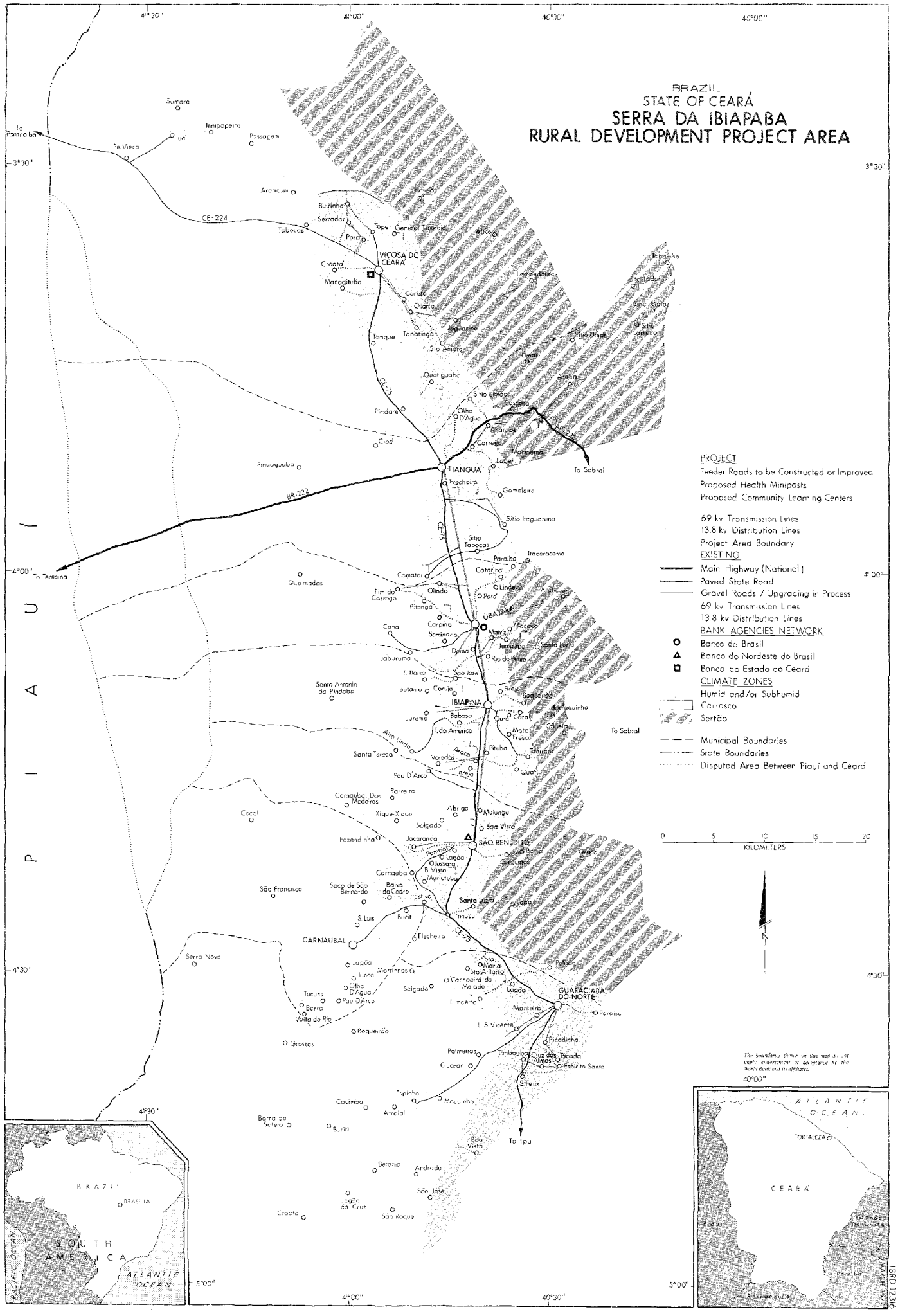
will be after the project is completed, partly because the inflation rate is likely to decline from the rather high level of 1975-1976. Also, the Government recently took some initial steps in adjusting interest rates marginally upward, and the possible extent of future adjustments is difficult to predict. If one were to assume rather pessimistically that Brazilian inflation would not drop below 15-20% by the end of the project period and that no further increases would be made in interest rates, a continued credit portfolio (as a result of this project and closely linked follow-up projects in the project area) on the order of US$4 million for seasonal purposes, US$7 million for investments and US$0.6 million for land purchase would involve a subsidy cost of as much as US$2.0 million annually. However, this is a highly speculative estimate which in any case is probably an upper limit. Equally, as changed conditions could result in no interest rate subsidy, it is impossible to attribute to the project a recurrent cost in this area.

Main Tax Revenues

15. Given the current tax system in Brazil, the main tax revenues likely to be generated by the production increases associated with the project are: (i) the ICM (the state's Imposto sobre Operacoes Relativas a Circulacao de Mercadorias), which is applied at a rate of 15% on the price of marketed production, some products being exempt and products shipped out of the state having a rate of 11%; and (ii) the FUNRURAL (the Government's Fundo de Assistencia ao Trabalhador Rural) charge of 2.5% on marketed production, a tax used to fund social assistance programs for rural workers.

16. Utilizing the incremental production and price estimates given in Annex 7, and assuming that 90% of the annato production, 50% of the peanut production and up to 33% of the vegetables and fruits will be shipped out of the state, the estimated ICM revenue at full development would amount to about US$1.52 million annually. The FUNRURAL revenue would amount to about US$0.36 million resulting in a combined revenue of US$1.86 million. This compares to the total quantifiable recurrent costs of about US$2.06 million (see para 10) resulting directly from the project.


BRAZIL
STATE OF CEARA
PRIORITY AREAS FOR POLONORDESTE
RURAL DEVELOPMENT PROJECTS
Camocim
Acaraú
Bela Cruz
Marco
Morrinhos
Granja
Martinópole
Uruoca
Senador Sá
Paracuru
Trairi
Itarema
Itapipoca
Massapê
Sobral
Viçosa do Ceará
Tianguá
Frecheirinha
Ubajara
Carnaubal
Ibiapina
Viriatinho
Graça
Carire
Irauçuba
Itapage
São Luis do Curu
São Gonçalo do Amarante
Fortaleza
Caucaia
Pentecoste
Apuiarés
Gen Sampaio
Maranguape
Pacatuba
Aquiraz
Pacajus
Cascavel
Beberibe
Palmácia
Baturité
Aracoiaba
Capistrano
Itapiúna
Canindé
Aracati
Itaiçaba
Jaguaruana
Russas
Quixadá
Quixeramobim
Morada Nova
Quixeré
Boa Viagem
Banabuiú
Pedra Branca
Independência
Crateús
Novo Oriente
Senador Pompeu
Jaguaretama
Jaguaribara
Alto Santo
Mombaça
Solonópole
Jaguaribe
Ala
Acopiara
Catarina
Parambu
Arneiroz
Cococi
Iguatu
Orós
Saboeiro
Jucás
Aiuaba
Cedro
Lavras da Mangabeira
Baixio
Ipaumirim
Antonina do Norte
Várzea Alegre
Farias Brito
Cariús
Campos Sales
Araripe
Santana do Cariri
Juazeiro do Norte
Crato
Missão Velha
Barbalha
Mauriti
Brejo Santo
Jardim
Jati
Penaforte
Sitio dos Moreiras
Araripina
Salgueiro
São José do Belmonte
Pernambuco
Piauí
Rio Grande do Norte
Paraíba
Ceará
Sertão de Crateús
Serra da Ibiapaba
Serra de Baturité
Sertão de Quixeramobim-Jaguaribe
Baixo Jaguaribe
Médio Jaguaribe
Sertaneja do Centro-Norte
Inhamuns e do Sertão de Quixadá
Cariri Oeste
Cariri
Oassaré
Project Area
Priority Areas
Boundary of Priority Areas
Paved Roads
All-Weather Roads
Railroads
State Capital
State Boundaries
Disputed Boundary
Rivers
KILOMETERS
BRAZIL
SOUTH AMERICA
BRASILIA
FORTALEZA
Ceará
IBRD 12736
AUGUST 1967


BRAZIL
STATE OF CEARÁ
SERRA DA IBIAPABA
RURAL DEVELOPMENT PROJECT AREA
PIAUI
CEARÁ
VICOSA DO CEARÁ
TIANGUA
UBAJARA
IBIAPINA
SÃO BENEDITO
CARNAUBAL
GUARACIABA DO NORTE
To Sobral
To Teresina
To Ipu
To Parnaiba
PROJECT
Feeder Roads to be Constructed or Improved
Proposed Health Minipasts
Proposed Community Learning Centers
69 kv Transmission Lines
13.8 kv Distribution Lines
Project Area Boundary
EXISTING
Main Highway (National)
Paved State Road
Gravel Roads / Upgrading in Process
69 kv Transmission Lines
13.8 kv Distribution Lines
BANK AGENCIES NETWORK
Banco do Brasil
Banco do Nordeste do Brasil
Banco do Estado do Ceará
CLIMATE ZONES
Humid and/or Subhumid
Carrasco
Sertão
Municipal Boundaries
State Boundaries
Disputed Area Between Piauí and Ceará
KILOMETERS
N
The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.
BRAZIL
BRASILIA
SOUTH AMERICA
PACIFIC OCEAN
ATLANTIC OCEAN
ATLANTIC OCEAN
FORTALEZA
CEARÁ
IBRD 12316
MARCH 1977