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AGRICULTURAL SERVICES DEVELOPMENT PROJECT

PROJECT FEASIBILITY STUDY

THE COMMONWEALTH OF THE BAHAMAS
MINISTRY OF AGRICULTURE, TRADE AND INDUSTRY

INTER-AMERICAN DEVELOPMENT BANK

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INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE

THE COMMONWEALTH OF THE BAHAMAS
MINISTRY OF AGRICULTURE, TRADE AND INDUSTRY

INTER-AMERICAN DEVELOPMENT BANK

THE BAHAMAS

AGRICULTURAL SERVICES DEVELOPMENT PROJECT
(BH-0011)

PROJECT FEASIBILITY STUDY

San Jose, Costa Rica
October, 1990

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CURRENCY EQUIVALENTS

Bh\$: Bahamian Dollar --

US\$1.00 = Bh\$1.00

WEIGHTS AND MEASURES

Imperial (British) System

GLOSSARY OF ABBREVIATIONS

BAIC	-	Bahamas Agricultural and Industrial Corporation
BhDB	-	Bahamas Development Bank
LSD	-	Land and Surveys Department
MATI	-	Ministry of Agriculture, Trade and Industry
MWV	-	Ministry of Works and Utilities
WSC	-	Water and Sewerage Corporation

**THE BAHAMAS
AGRICULTURAL SERVICES DEVELOPMENT PROJECT
(Bh-0011)**

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THE BAHAMAS
AGRICULTURAL SERVICES DEVELOPMENT PROJECT
(BH-0011)

INTRODUCTION

A. BACKGROUND

i. In August of 1988, the Inter-American Development Bank (IDB) contacted the Inter-American Institute for Cooperation on Agriculture (IICA), concerning the possibility of the Institute's cooperating in the preparation of the Agricultural Services Development Project for The Bahamas, under the procedures of the IDB-IICA Cooperative Program. IICA agreed to collaborate with the Bank in the preparation of the project, and during a special IICA mission to the Bank's Headquarters in September, it was decided that the project preparation effort would be carried out in two phases. Phase I, to take place between October and December of 1988, would seek to identify a suitable project, in close consultation with Bahamian authorities, and to advance its preparation as much as the time and the information available would permit. Phase II, to be carried out in 1989, would complete the preparation of the feasibility study.

ii. Accordingly, a Preparation Mission-Phase I visited The Bahamas for two weeks, from the 6th to the 19th of November 1988, in order to discuss with Bahamian authorities the concept of the project, its scope and strategy, and to start the project preparation effort. The mission consisted of the IICA Mission Coordinator and three consultants: an economist, an agronomist and a marketing specialist. While in the country, the Mission worked in close consultation with the Ministries of Agriculture and Finance. A mission report was prepared and presented to both the IDB and the Bahamian Government.

iii. Preparation Mission-Phase II arrived in The Bahamas on the 26th of June, 1989 in order to complete the preparation of the feasibility study of the project. It consisted of the IICA Mission Coordinator and seven consultants: an economist, an agronomist, a marketing specialist, an animal husbandry specialist, an irrigation and drainage specialist, an environmental specialist and an institutional and financial analyst ^{1/}.

^{1/} The Mission members were: Dr. Huntley G. Manhertz, economist; Dr. Herman A. Hamilton, agronomist; Dr. Trevor G. Hamilton, marketing specialist (these also participated in the first mission); Dr. Aston S. Wood, animal husbandry expert; Dr. Bishay G. Bishay, irrigation and drainage specialist; Dr. Nathan Richards, institutional and financial analyst; and Mr. Christopher M. R. Pastakia, environmental specialist. Mr. Joao Bosco E. Monnerat, from IICA, coordinated both missions.

iv. Throughout its stay in The Bahamas, the mission worked in close consultation and collaboration with the Ministries of Agriculture and Finance. The Financial Secretary discussed with the mission aspects of the project's concept and scope and was regularly informed about the progress of the work. The Department of Agriculture, of the Ministry of Agriculture, Trade and Industry (MATI) provided the mission with a technical counterpart team, as well as with secretarial support and office facilities. Additional support to the mission's work was provided by a number of Bahamian institutions, both public and private, as well as by individuals.

v. The field work in The Bahamas involved a visit to all eleven participating islands, during which a representative sample of local farmers was interviewed on their farms. The mission also interviewed resident officials of the Department of Agriculture, and paid visits to the Government Commissioners on the various islands.

vi. Toward the end of the project preparation effort, between the 11th and the 20th of September, the IDB sent a Mid-Term Review Mission to The Bahamas in order to discuss the various aspects of the preparation of the project with the IICA mission and the Bahamian authorities.

vii. The IICA project preparation mission concluded its field work in The Bahamas on the 10th of October, 1989. On the 20th of January, 1990, a draft of the complete project feasibility study was sent to the Ministry of Agriculture for review and comments. As a result of this exercise, it was decided that the Marketing Subproject should be redesigned and scaled down. To accomplish this task, a special complementary mission was put together and was sent to The Bahamas from the 20th August to the 8th September, 1990. It consisted of a marketing specialist, an institutional and financial analyst, and the IICA project coordinator.²

viii. The contributions made by the members of the special mission have been incorporated into this final version of the project feasibility study, which was completed at IICA Headquarters, in San José, Costa Rica, on the 9th of November, 1990.

B. ACKNOWLEDGEMENTS

ix. A project feasibility study, like the one presented in this document, can be successfully completed only through the concerted efforts of many individuals and institutions. Although

^{2/} The marketing specialist was Dr. Luis A. Ampuero Ramos, consultant, and the financial and institutional analyst was Mr. Freddy Revilla, of IICA.

it would be impossible to mention all those who, in one way or another, helped in the preparation of this document, the IICA project preparation mission would like to take this opportunity to acknowledge the support received from those who worked with it.

x. Most of the support came, as is to be expected, from the Ministry of Agriculture, Trade and Industry. A technical counterpart team was put together to work with the IICA team in the preparation of the feasibility study. The team was led by Messrs. Audley Greaves and Arnold Dorsett, at different stages of the preparation work. Its members were:

Mr. Simeon Pinder, Agronomy and Irrigation
Mr. Kenneth Cartwright, Agronomy and Irrigation
Mr. Stan Smith, Agronomy
Ms. Charmaine Price, Agronomy
Mr. Eric Carey, Extension
Dr. Basil Sands, Livestock
Mr. Komal Smith, Livestock
Mr. Elvis Rolle, Marketing
Mr. Charles Culmer, Marketing
Mr. Leslie Minns, Marketing
Mr. Bryan Taylor, Economist
Ms. Darleen Knowles, Economist
Dr. Maurice Isaacs, Environment
Mr. Egbert Wallace, Environment
Mr. Carl Smith, Financial and Institutional Analysis

xi. Within the Ministry of Agriculture the mission always found full support on the part of Mr. Basil O'Brien, Permanent Secretary; Dr. Prince Bonamy, Director of Agriculture; Dr. Keith Campbell, Senior Veterinary Officer; and Mr. Arnold Dorsett, Assistant Director of Agriculture. Throughout the project preparation effort, the mission benefited greatly from the continuous interest, collaboration and encouragement of Mr. Earl Deveaux, Advisor to the Ministry. The staff of the Bahamas Agricultural and Industrial Corporation were of help in many instances.

xii. We also wish to thank Miss Michelle Woodside and Miss Tiffany Neilly for their secretarial support; Mrs. Helen Johnson for keeping us in good spirits with her teas and coffees, always prepared with kind attention; and Mr. Larry Bowleg, Mrs. Janet Dorsett, and Mrs. Ernestine Bowleg, who operated the word processing equipment.

xiii. Outside the Ministry of Agriculture, a number of institutions and individuals gave invaluable support and advice to the various mission members. At the Land and Surveys Department, Mr. Francis Garroway and his staff were of constant help, and produced the maps for this report. Dr. Richard Cant, Mr. Philip Weech and staff members of the Water and Sewerage Corporation were

always available to share their knowledge and information with mission members. The preliminary designs for the civil construction and road building to take place under the project were prepared at the Ministry of Works. We wish to thank Mr. Peter Gordon, Director of Works, Messrs. John Shaw, David Marshall and Belville Edwards, engineers, Mr. Robert Douglas, architect, and Mr. Ken Bird, road engineer, for their invaluable support to the completion of this study.

xiv. The IDB representation in The Bahamas was a constant source of support to the Mission. We wish to thank Mr. Johann Schmälzle, Representative, Mr. Carlos Conde, Deputy Representative, Mr. Federico Gimenez, Sectoral Specialist, Miss Camille Davis, Administrative Officer, and their staff for all their help and attention.

xv. Finally, the preparation of this study would have been impossible without the commitment and support of the highest echelons of the Bahamian Government, in this case from the Ministries of Finance and Agriculture. The two Financial Secretaries under whom the mission worked, Mrs. Ethelyn C. Isaacs and Mr. Warren Rolle, followed the preparatory work with great interest, helping greatly with their support and advice.

xvi. Last - but definitely not least - we would like to extend our gratitude to the two Ministers of Agriculture under whom the present study was undertaken, the Hon. Ervin Knowles, M.P. and the Hon. Perry G. Christie, M.P., for their warm hospitality, unwavering support and constant encouragement throughout our work in The Bahamas. As we, the mission members, could see, the two Ministers share a vision of what agriculture must become in The Bahamas, and what kind of role the Ministry of Agriculture, Trade and Industry should play in it.

xvii. In such a vision, agriculture must contribute much more to the economy of the country as a whole, and to the well-being of the Family Islands in particular, especially the islands of the southeast. At the same time, the Ministry must have a strong presence in all the islands, and play a crucial role in the provision of agricultural services and in the implementation of projects. We, the mission members, share fully such a vision and will feel gratified if we have contributed to making it a reality.

C. STRUCTURE OF THE REPORT

xviii. The structure of this report follows basically the guidelines for project preparation set by the Inter-American Development Bank. The first chapter, Summary and Conclusions, presents a summary and the main conclusions drawn from the various subprojects. Chapter II, Frame of Reference, refers to the Bahamian economy as a whole and to the agricultural sector in particular, describing the environment in which the project is going to be implemented. Chapter III, The Borrower, the Executing Agency and

Other Participating Institutions, introduces the reader to the legal and administrative framework of the execution of the project, with an analysis of the institutions involved. Chapter IV describes the Project Area. The present project covers 11 of the 14 main islands of The Bahamas archipelago. Because the participating islands are responsible for almost the totality of the agricultural production of the country, the information about them refers, in practical terms, to the country as a whole. Therefore, Chapter IV presents only the information not presented in Chapter II, which has to do specifically with the project area, like physical characteristics, climate, land tenure and others.

xix. The technical proposals which make up the project, organized in various subprojects and components, are presented in Chapter V, The Project. The subprojects which make up the Agricultural Services Development Project are the following:

1. Crop Development
2. Livestock Development
3. Research, Extension and Training Services
4. Agricultural Marketing
5. Feeder Roads

A full presentation of these subprojects is made in the respective annexes attached to this report. Furthermore, Chapter V presents the project costs and a proposal for their financing.

xx. Chapter VI, Execution of the Project, deals with the institutional and administrative arrangements established for the execution of the project, which includes the follow-up and ex-post evaluation systems. Chapter VII, Justification, presents the technical, institutional, financial and economic analysis of the project. Finally, Chapter VIII, Outstanding Issues, addresses the main issues still outstanding in relation to both short-term problems (technical and institutional) and longer-term development objectives of the agriculture of The Bahamas.

xxi. The present report has a total of six annexes. Some are limited to the scope and objectives of the project, but others go beyond that to address issues which have to do with broader development possibilities of the agriculture of the country. One of the annexes is totally dedicated to the maps produced for this report. One set of maps shows the various areas chosen for agricultural development under the project on each participating island; the other is related to the environmental issues and natural resources of The Bahamas. The annexes are the following:

1. Agriculture, Research, Extension and Training
2. The Importance and Use of Livestock in The Bahamas
3. Development of Irrigation Projects in The Bahamas
4. Marketing of Agricultural Produce in The Bahamas
5. Environmental Issues in The Bahamas
6. Maps.

Chapter I. SUMMARY AND CONCLUSIONS

1.01 The Commonwealth of The Bahamas is an archipelago of over 700 islands and cays extending over an area of more than 100,000 square miles (259,000 sq. km). Most of the territory, therefore, is water, the land area being estimated at only 5,382 square miles (13,939 sq. km) or 5% of the territory. Although located in the North Atlantic, The Bahamas shares many characteristics with the islands of the Caribbean, especially with regard to soils and climate.

1.02 The country's total population in 1987 was estimated at 242,000, which gives a population density of 17.3 persons per square kilometre (45 per sq. mile), one of the lowest in the Caribbean. This figure, however, conceals a very uneven distribution of the population among the islands. It is estimated that around 83% of the total population is concentrated around just two cities: Nassau (66%) on the island of New Providence, and Freeport (17%) on the island of Grand Bahama. The other 17% of the population is scattered throughout 27 islands, with populations ranging from 50 to 8,000.

1.03 The islands of The Bahamas have traditionally been classified in terms of their vegetation: the Pine Islands of the north and the Coppice (hardwood) Islands of the southeast. The project will cover 11 of the 14 main islands of the archipelago. For purposes of this project, the islands have been divided in two groups:

Northern Group -	Grand Bahama
	Abaco
	Eleuthera
	New Providence
	Andros
Southeastern Group -	Cat Island
	Long Island
	Exuma
	Crooked Island
	Acklins
	Mayaguana

1.04 The Northern Islands present much more favorable conditions for commercial agriculture than the Southeastern Islands, especially in terms of soils, water availability and proximity to markets. It is there that most of the economic potential of Bahamian agriculture can be realized.

PROJECT CONCEPT AND RATIONALE

1.05 An analysis of Bahamian agriculture reveals that the sector finds itself at a cross-roads insofar as its role in national economic development is concerned. While its contribution

to the GDP and other aspects of economic activity can be considered marginal, the sector possesses the potential to provide critically important leverage required by the economy to achieve improved structural balance, while at the same time stimulating continued development and growth. An assessment of the opportunities which exist to expand the role and the functions of Bahamian agriculture point to areas where such improved contribution could take place:

- o The Bahamian economy is too dependent on the service sector, especially on tourism, and therefore needs to redress its structural balance; agriculture provides such an opportunity (Chapter II).
- o The country utilizes only a fraction, maybe 10 to 15%, of the estimated 170,000 acres of land considered suitable for agricultural use (Chapter IV).
- o The average annual value of the net foreign exchange food bill is \$120 million, which accounts for about 25% of non-petroleum imports and has shown a growth rate of about 14% per year over the past five years (Chapter II).
- o Agriculture seems to provide the most feasible vehicle through which economic development of the Southeastern Islands could be enhanced in the short term; an improved agricultural sector in these islands would undoubtedly serve to reduce migration towards Nassau (Chapters II and IV).
- o Although water is a scarce resource throughout the country, there are ample possibilities for irrigated agriculture in The Bahamas. In the Northern Islands, for example, only 7,300 acres, out of a potentially irrigated area of 40,000 acres, are presently under irrigation (Chapter IV).
- o As tourism increases so does the demand for food and the need to produce it locally (Chapter II).
- o The country's favorable climatic conditions and its proximity to major markets, especially in the United States, provide excellent possibilities for export agriculture (Chapter II).
- o There is ample scope for improvement of productivity through a better provision of agricultural services like research and extension (Chapter III).

1.06 It is from this overall perspective that the concept of the proposed project emerges. The ultimate goal of the project is to improve the structural balance in the Bahamian economy, through the implementation of a well-coordinated set of activities and programmes directed at stimulating the development of the agricultural sector. The project seeks to do so by providing the agricultural sector and the institutions involved with the management and promotion of agriculture in the country with the

necessary infrastructure, services and incentives for agricultural development.

1.07 The most immediate project objectives are the following:

- o to increase agricultural production directed to the domestic market, making the Bahamian economy less dependent on the importation of foodstuffs;
- o to make agriculture a more viable economic alternative, particularly for the populations of the Southeastern Islands, so that they may receive better incomes and contribute more to the economic development of the country;
- o to promote export agriculture in order to improve the country's agricultural trade balance; and
- o to strengthen the technical and managerial capabilities of the Ministry of Agriculture, Trade and Industry so that it can better serve and promote agricultural development in The Bahamas.

1.08 The project will address the main problems and obstacles which presently hinder agricultural production and development, through a set of activities or subprojects directed towards the following areas:

1. Crop Development
2. Livestock Development
3. Research, Extension and Training Services
4. Agricultural Marketing
5. Feeder Roads

1.09 The Crop Development Subproject has four development proposals or components: Orchard Crops, Selected Miscellaneous Crops, Specialty Crops and Export Crops. Three of these are geared mostly to the small-scale agriculture of the Southeastern Islands, and the fourth has to do with the large potential for export agriculture of the Northern Islands. The main emphasis of the models or proposals designed for the Southeast is on tree crops, a possibility which has been greatly neglected in the recent past. Such tree crops would be destined for both domestic and export markets. The four components were designed taking into consideration the availability of soil and water in the two project sub-areas, the possibilities for rainfed agriculture and the different irrigation approaches associated with the selected crops and availability of water. The less attractive conditions for on-farm investment in the Southeast are expected to be overcome through a number of incentives to be provided by the Government. Farm family incomes are expected to improve considerably. The areas selected for crop development in the various islands will be connected to the main road networks by feeder roads.

1.10 The Livestock Development Subproject was entirely designed for those Coppice lands of the Southeastern Islands which, although not suitable for crop production, are nevertheless capable of supporting small ruminants. For this reason, the sub-project

focuses only on sheep and goats to be raised under technically improved and economically more efficient conditions. This proposal is expected to benefit a large number of farmers in the Southeast. Other livestock development possibilities for The Bahamas, especially in the area of dairy and cattle (beef) production, are discussed in Annex 2 of this report. These possibilities can be explored either subsequent to, or concurrently with, this project but are not part of its present scope.

1.11 The third subproject -Research, Extension and Training- addresses a major area of concern for agricultural development, namely the institutional capability of the Ministry of Agriculture, Trade and Industry, through its Department of Agriculture and other bodies, to serve and promote agriculture in The Bahamas. This subproject proposes a thorough restructuring of the research and extension services of the Ministry by redesigning functions and objectives, redeploying personnel, expanding technical cadres and pursuing an intensive training programme. The institutional strengthening of MATI is viewed as one of the major objectives of the project.

1.12 The fourth subproject is Agricultural Marketing, seen as the central and crucial activity which will make the investment proposals advanced by the project viable. The Agricultural Marketing Subproject has three components:

- (i) The Produce Exchange System, which includes the Produce Exchange at Potter's Cay, Nassau, and eleven Packing Houses distributed throughout the project participating islands;
- (ii) The Mail Boat System
- (iii) The Market Information System

1.13 The fifth and last subproject is related to the Feeder Roads to be built or upgraded in order to link the areas selected for crop development to the main road network of the participating islands. An estimated 30 miles of new roads will be built in seven of the eleven participating islands.

THE EXECUTION MECHANISM

1.14 The project will be implemented by the Ministry of Agriculture, Trade and Industry, through both its Department of Agriculture and its affiliated Bahamas Agricultural and Industrial Corporation (BAIC). The latter is presently being reorganized in order to be able to execute some of the project components. For the same purpose, the Department of Agriculture will also be strengthened through technical co-operation and other mechanisms. It is proposed that a Project Co-ordination Unit (CU) be created within the Department of Agriculture to execute the project. The Co-ordinating Unit will serve as a link with the financing institution and will be directly responsible for the supervision and administrative control of the execution of the project. Each Division of the Department of Agriculture, depending on its area

of specialization, will be responsible for the technical and operational aspects each of the project's components.

1.15 Given the unique characteristics of the land tenure system described in previous chapters, it has been proposed that the Bahamas Agricultural and Industrial Corporation (BAIC) be responsible for the administration of rural credit, provided that there is clear evidence that the BAIC has been strengthened and reorganized to manage the rural credit system.

1.16 Execution of any possible technical co-operation will be the sole responsibility of the Co-ordinating Unit, with advisory assistance from the Divisions of the Department of Agriculture, for the different areas of specialization.

OUTSTANDING ISSUES

1.17 The Agricultural Services Development Project may be considered as the first major intervention made by the public sector to improve the state of agriculture in The Bahamas. This means that the project will take place in an environment - be it physical, institutional, economic or social - in which this kind of intervention is not usual and which therefore will have to be adapted and prepared so that the various technical, operational and administrative proposals made by the project may be successfully introduced.

1.18 It is clear, then, that the Ministry of Agriculture will have to address a number of issues regarding either the more immediate impediments to the execution of the project or, on a longer term basis, some structural factors adversely affecting the development of agriculture in the country. Some of these issues can be tackled immediately; others will require more time to be resolved.

1.19 The more immediate issues to be addressed have to do with administrative and operational matters regarding the execution of the project, which are summarized below.

1.20 Following the recommendations presented in the institutional analysis, the internal structure of MATI will need to be adapted for project execution. A Project Co-ordination Unit needs to be established and staffed with the personnel needed to implement the various project components.

1.21 In the crop and livestock development areas, there is a need for training and reassigning existing technical personnel, as well as for hiring new staff to carry out the work of the project. Such actions, if taken at an early stage, will facilitate and expedite the execution of the project.

1.22 It is necessary to find sites for the new buildings proposed by the project, making sure that legal matters are taken care of and that infrastructure and services will be in place.

1.23 Legal issues related to the establishment of slaughter slabs in four participating islands must be resolved.

1.24 The new operations proposed by the project for the marketing system will require detailed planning and a substantial amount of internal reorganization.

1.25 The redeployment of existing personnel and the deployment of new staff in the participating islands will raise a number of operational issues that must be foreseen and resolved in areas such as housing, transportation, working facilities, salary levels, incentives, etc.

1.26 Operational issues related to the renovation of marketing facilities and the establishment of new ones (bidding procedures, construction contracts, importation of equipment, etc.) must be foreseen and planned well in advance because of the multifarious tasks to be accomplished and the amount of resources involved.

1.27 The installation of cooling facilities on the mail boats will be a complex operation, and details of same will need to be anticipated.

1.28 Farmers must be surveyed and organized in all islands, so that they may be informed about the project and feel encouraged to participate in it.

1.29 In addition to these more immediate matters, a number of longer term issues related to the prospects of agricultural development in The Bahamas must be addressed. They represent constraints which must be either removed or mitigated so that the development proposals may be successfully implemented. Such issues are summarized below.

1.30 Land Tenure - The land tenure systems of The Bahamas are described and discussed in different sections of this report. The importance of the matter and the need for the systems to be updated were amply recognized by the Ministry of Agriculture and discussed during the preparatory work of this project. Assistance to the Ministry in this area could be provided by, and should come from, institutions with extensive experience in this subject matter. The various aspects of the matter - legal, historical, social, anthropological, economic and agricultural - will have to be taken into account so that a rational, equitable, modern and coherent new system may be established.

1.31 Agricultural Credit - This issue is closely related to land tenure, since land is used as collateral for loans. However, other aspects of agricultural credit, such as loan distribution and collection, concessionary facilities and others, are equally relevant and must be duly addressed so that agricultural credit in The Bahamas may become a much more important factor in the country's strategy for agricultural development.

1.32 Natural Resources Management - Given the relative scarcity of natural resources - except for the many beautiful beaches and an almost ideal climate - and the peculiar geographical configuration of the country, The Bahamas needs a comprehensive plan for natural resources management. Utilization of land and water for agricultural purposes will depend on how other competing

uses of those two natural resources are established on a priority basis. Above all, the environment must be protected in a country that depends so much on tourism. There is an urgent need for inter-institutional co-ordination and co-operation. Recommendations in this regard are provided in Annex 5 of this report.

1.33 Irrigation and Water Use - As part of the natural resources management plan, The Bahamas needs a Master Plan for Land and Water Use. The advancement of agriculture will depend heavily on irrigation. Therefore, irrigation methods and systems will have to be adapted to the characteristics and water availability of each island. Furthermore, they will have to be in accordance with the overall plan for natural resources development. Detailed reference to irrigation methods is presented in Annex 3 of this report.

1.34 Inter-Island Transportation - Most of the transportation of agricultural produce in The Bahamas is made by the so-called mail boats. Under the project, the mail boats will be upgraded in terms of storage space and cold-storage facilities with a view to dramatically reducing the spoilage of agricultural produce during transportation. The whole issue of inter-island transportation is therefore crucial and will have to be addressed by the Government so that it does not become a bottleneck for agricultural development. Annex 4 of this report discusses the issue and makes recommendations regarding possible solutions to the present problems.

1.35 Promotion of Investment in Large-Scale Agriculture - This report shows very clearly that there are ample possibilities for large-scale export-oriented agriculture in the Northern Islands. For such investment to take place, it is necessary to (a) create an environment which is conducive to corporate farming, and (b) promote this kind of agriculture by showing the comparative advantages which The Bahamas enjoys in relation to neighbouring countries. The two large-scale citrus plantations which are presently operating with success on Abaco Island serve as concrete evidence of the possibilities for commercial agriculture in the North.

1.36 The issues discussed above are related to various external variables which can affect the execution of the project. The execution of an integrated project like the present one, with all its complexities, will always be affected by external factors which are outside the control of the executing agency and which will depend on policy decisions which are generally made at a higher policy-making level. This calls for continuous dialogue and co-operation among government and other participating institutions.

COSTS OF THE PROJECT

1.37 All project costs will be presented in US\$ equivalent values. There are three groups of costs:

- a) The investment and operating costs envisaged for the five year period of execution of the project. Estimated costs: US\$11,774,334.

- b) The credit loan facility requirements for farmers (on-farm investment in crops and livestock). Estimated costs: US\$1,257,000.
- c) The technical cooperation which will be needed for the execution of the project, including training and technical advisory services. Estimated costs: US\$2,435,116.

The Investment and Operating Costs

1.38 The investment and operating costs are estimated at the equivalent of US\$11,774,334. They refer to the direct costs of the project and exclude escalation, contingencies and financial charges'. The total costs by category and subcategory is as follows:

THE INVESTMENT AND OPERATING COSTS

CATEGORY AND SUBCATEGORY	TOTAL US\$	%
ENGINEERING AND ADMINISTRATION	1,002,545	8.6
BUILDINGS AND ROADS	4,411,450	37.5
LAND CLEARING AND PREPARATION	1,050,000	8.9
OTHER INVESTMENT	747,000	6.3
INCREMENTAL WORKING CAPITAL	780,000	6.6
MACHINERY, EQUIPMENT AND VEHICLES	2,428,339	20.6
a. MACHINERY	1,300,835	
b. EQUIPMENT	752,500	
c. VEHICLES	295,000	
LAND	20,000	0.2
ASSOCIATED COSTS	1,335,000	11.3
a. PERSONNEL	240,000	
b. UTILITIES	120,000	
c. SUPPLIES	125,000	
d. MAINTENANCE	850,000	
GRAN TOTAL	11,774,334	100.0

/ The financial charges will be determined when the loan is negotiated between the country and the financing agency.

The Credit Component

1.39 This cost is estimated at the equivalent of US\$1.257,000, as follows:

LOAN FACILITY REQUIREMENTS	TOTAL COST	
	US\$	%
1. ORCHARD CROPS <u>1/</u>	560,000	44.5
2. SPECIALTY CROPS <u>2/</u>	79,000	6.3
3. SHEEP AND GOATS <u>3/</u>	618,000	49.2
TOTAL	1,257,000	100.0

- 1/ Crop Development Subproject. This originates from an expected participation of 20 farmers from each of the 6 Southeastern Islands plus South Andros, each receiving US \$ 4,000 over the 5-year period of the project. Total Farmers: 140. Estimated area: 700 acres.
- 2/ Crop Development Subproject. This originates from development of tree crops covering 280 acres of the 6 Southeastern Islands plus South Andros, over a 2-year period.
- 3/ This is the financial support required to initiate the national sheep and goat herd improvement programme. The expected participation is about 149 farmers with herd sizes of 50, 100, 150 and 200-doe unit.

Technical Co-operation

1.40 This cost is estimated at the equivalent of US\$2,435,116. A detailed exposition justifying the especial treatment for the technical co-operation for execution of the project is presented in Chapter V. It is suggested that the technical co-operation for the project be financed with non-reimbursable funds of the financing institution.

Financing

1.41 The proposed financing of the project will be as follows:

a) Investment and Operating Costs

The total costs of the project would be financed by a loan of US\$ 7,910,262 in foreign exchange from the IDB, (67% of total costs) and by local counterpart funds amounting to US\$3,864,072 (33% of total costs). The source of financing by investment categories, would be as in the table below:

COST BY INVESTMENT CATEGORY AND SOURCES OF FINANCING (US\$)

CATEGORY AND SUBCATEGORY	SOURCES		TOTAL
	IDB (FOREIGN EXCHANGE)	LOCAL CONTRIBUTION	
ENGINEERING AND ADMINIST.	300,763	701,782	1,002,545
BUILDINGS AND ROADS	3,529,160	882,290	4,411,450
LAND CLEARING AND PREP.	-----	1,050,000	1,050,000
INVESTMENTS IN OTHER GOODS	747,000	-----	747,000
INCREMENTAL WORKING CAPITAL	780,000	-----	780,000
MACHINERY, EQUIPMENT AND VEHICLES	2,428,339	-----	2,428,339
- MACHINERY	1,380,839	-----	1,380,839
- EQUIPMENT	752,500	-----	752,500
- VEHICLES	295,000	-----	295,000
LAND FOR CIAREC	-----	20,000	20,000
ASSOCIATED COSTS	125,000	1,210,000	1,335,000
- PERSONNEL	-----	240,000	240,000
- UTILITIES	-----	120,000	120,000
- SUPPLIES	125,000	-----	125,000
- MAINTENANCE	-----	850,000	850,000
TOTAL	7,910,262	3,864,072	11,774,334
PERCENTAGES (%)	67	33	100

b) Credit

The credit loan facility, which amounts to \$1,257,000, will be utilized to finance both the Orchard Farm and the Specialty Crops development models proposed by the project, for a total amount of \$639,000. For the implementation of the five sheep and goat farm models a total of \$618,000 will be needed. All these funds will be distributed and collected through the Bahamas Agricultural and Industrial Corporation (BAIC) of the Ministry of Agriculture.

c) Technical Co-operation

The technical co-operation needed for the execution of the project is estimated at \$2,435,116. It is suggested that \$432,000 of this total be financed by local funds, and \$2,003,116 be financed by non-reimbursable funds from the Inter-American Development Bank. The local counterpart funds correspond to the hiring of the General Manager and the Plant Manager, respectively, for the Produce Exchange at Potter's Cay, Nassau, and would translate a commitment on the part of the Ministry of Agriculture to the adoption of a completely new operational system for agricultural marketing in The Bahamas.

FINANCIAL AND ECONOMIC ANALYSIS

1.42 The financial and economic analysis of the various subprojects and of the project as a whole revealed that the feasibility indicators (Internal Rate of Return and Net Present Value) are totally satisfactory. Returns are expected from the Selected Miscellaneous Crops Model, from the Orchard Crops Model, from the Sheep and Goats Models and from the Marketing Subproject. The Research, Extension and Training Services Subproject and the Feeder Roads Subproject will be considered as project costs only.

1.43 Under these assumptions, the Financial Internal Rate of Return (FIRR) for the project as a whole is 33.5%. The Net Present Value(12%) is \$32,097,880. The Marketing Subproject was evaluated only for the situation "with project". This is due to the fact that the situation "without project" represents a financial loss to the Government of about \$2.5 million annually. To add such an amount to the stream of incremental net benefits would result in financial indicators being too high.

1.44 The economic analysis of the project stemmed directly from its objectives and goals, and from the detailed features of its components. Within this context, the expected benefits which will accrue to the country as a result of the execution of the project may be classified as tangible or intangible, direct or indirect, although distinctions between these categories are sometimes difficult to make. The following tangible benefits were identified for the project:

Increased Production

1.45 An increase in the physical volume of agricultural production is the most common benefit arising from an agricultural project. In the case of the present project, increased production will result from (a) the clearing and preparation of the most suitable lands for crop production and the introduction of new crops and methods of cultivation on the various participating island; (b) the introduction of more efficient methods of livestock raising - especially of small ruminants like sheep and goats - which will make much better use of those Coppice lands on which such activities take place; and (c) the provision of the essential support services to farmers, so that they have the incentive and the confidence to adopt the new proposals.

1.46 A likely added benefit will be that the farm family itself will be consuming more and better agricultural products as a result of the project, since there will be a wider variety of better quality products from which to choose.

Quality Improvement

1.47 It is expected that the increased production resulting from the project will also be of better quality. In the case of The Bahamas, quality improvement is of utmost importance since the project will aim at supplying the tourist hotels and ultimately the export market. Better quality produce receives higher prices, which, in turn, increases the farmer's income.

Timely Sale of Produce by the Farmers

1.48 The marketing infrastructure and services to be provided by the project will make it possible to schedule the sale of produce by the farmers, since storage facilities will be available when harvest time comes. In turn, scheduling of production will be made possible through a combination of extension and marketing information services.

Soil Improvement and Cost Reduction through Mechanization

1.49 Land clearing and preparation in the project area will be carried out by tractors and other equipment. Lighter tractors and other machinery will be kept on the islands to be leased to farmers, so that they may keep the land cleared and cultivated. The use of such machinery will have the effects of improving the texture and quality of the soils (by crushing the limestone and introducing organic materials) and also reducing labour costs.

Losses Avoided

1.50 The availability in all participating islands of Packing Houses equipped with adequate storage facilities will not only encourage farmers to produce more, but will also avoid post-harvest losses, since the various kinds of produce will be properly stored. Losses will also be avoided during transportation because mailboats will be equipped with cooling and other storage facilities. Finally, losses will be avoided at the Produce Exchange, since the renovated building will be provided with adequate and cooling facilities.

Improvement of Income Levels

1.51 Increased production, better quality produce and timely sale of produce will certainly push income levels up throughout the project area. This goes beyond being a purely economic benefit to become a social benefit to which the Government attaches great importance. Higher incomes will encourage people to remain on their islands, thus reducing or stopping outmigration towards Nassau.

Savings on Foreign Exchange

1.52 Import substitution of fruits and vegetables will help to alleviate the presently expensive food and will save foreign exchange.

1.53 Some of the benefits resulting from an agricultural project may be difficult to measure or to assess, either because of their nature or because they manifest themselves in areas which go beyond the scope of the project. In the case of The Agricultural Services Development Project, a number of intangible, but real and important benefits, can be identified.

Improvement of Structural Balance in the Bahamian Economy

1.54 As mentioned previously, the Bahamian economy leans too heavily on the service sectors, especially on tourism. Common sense and the uncertainties of the international environment indicate that this would be a good time to begin to redress that imbalance, by tapping the possibilities offered by agriculture and other sectors.

National Integration

1.55 Being an archipelago strategically located in the North Atlantic, The Bahamas assigns a high priority to the settlement of its territory. The many islands which make up the archipelago must be permanently settled and economically active. Agriculture seems to be the most immediate and viable way of keeping the population on the land, and of providing a way of living that is naturally complementary to tourism, as the latter spreads itself throughout the Family Islands.

Rational Use of Natural Resources

1.56 The project proposes an expansion of agricultural lands, more advanced methods of cultivation, and the use of irrigation as some of its main features. Such proposals lead immediately to a number of questions on how the natural resources of the Bahamas are presently being used, how they should be used in the future and, finally, how all this will affect the physical environment of the

country. These concerns are of the utmost importance to a country that relies so much on tourism. In this respect, a number of suggestions and proposals are made in the project. The country needs a comprehensive plan for use of natural resources, and for the utilization of fresh water for irrigation purposes. There is a great need for inter-institutional coordination in this area, and the project advances some ideas on how to achieve this. Such actions are expected to lead to benefits which go far beyond the scope of the project, to apply to the country as a whole.

Institutional Strengthening

1.57 The project involves substantial strengthening of the technical and managerial capabilities of the Ministry of Agriculture, which will be reflected in the research, extension, marketing and other services to be provided by the institution and its affiliated bodies. Institutional strengthening, however, will go beyond the Ministry itself to reach all the institutions involved with agricultural development and natural resources management in The Bahamas, since such institutions - both public and private - will have to coordinate and cooperate among themselves in areas of common concern.

THE EVALUATION METHODOLOGY

1.58 The stream of quantifiable costs and benefits generated by the project will accrue from six sources:

- i) The Selected Miscellaneous Crops Model
- ii) The Orchard Crops Model
- iii) The 50-Doe Sheep/Goats Model
- iv) The 100-Doe Sheep/Goats Model
- v) The 200-Doe Sheep/Goats Model
- vi) The Marketing Subproject

NOTE: As in the financial analysis, no benefits, only costs, are taken into account in the analysis of the Research, Extension and Training Services Subproject and of the Feeder Roads Subproject.

1.59 Three conversion factors were calculated for the economic analysis: The Standard Conversion Factor (SCF); The Conversion Factor for Unskilled Rural Labour (CF₁); and the Conversion Factor for Transportation by Boat (CF₂). Agricultural inputs and equipment, including vehicles for farm use, are completely exempt from taxes in The Bahamas. The rationale and the procedures to calculate the conversion factors are presented in the addendum at the end of this chapter. The values found are the following:

Standard Conversion Factor:	0.85
Unskilled Rural Labour:	0.65
Transportation by Boat:	0.89
Unskilled Boat Labour (estimated):	0.80

1.60 The results of the economic analysis are presented by the tables below.

**PROJECT ECONOMIC BENEFITS
(\$'000)**

YEAR	MISCELL. CROPS	ORCHARD FARMS	SHEEP & GOAT FARM	MARKETING SYSTEM	TOTAL BENEFITS (1)
1				(63.8)	(63.8)
2	1,323.0	(113.4)	(387.0)	792.4	1,615.0
3	2,507.0	118.0	(491.0)	797.1	2,931.1
4	3,730.0	345.3	(283.0)	1,399.4	5,191.7
5	4,953.0	496.9	69.0	1,399.4	6,918.3
6	5,759.0	506.2	372.0	1,229.4	7,866.7
7	5,850.0	788.9	786.0	1,399.4	8,824.4
8	5,850.0	1,031.8	747.0	1,399.4	9,028.3
9	5,850.0	1,457.8	785.0	1,399.4	9,492.2
10	5,850.0	2,139.6	749.0	(753.9)	7,984.8
11	5,850.0	3,012.7	785.0	1,229.4	10,877.1
12	5,850.0	3,725.8	752.0	1,399.4	11,727.2
13	5,850.0	4,197.0	786.0	1,399.4	12,232.4
14	5,850.0	4,426.1	750.0	1,399.4	12,425.5
15	5,850.0	4,426.1	783.0	1,399.4	12,458.5
16	5,850.0	4,426.1	750.0	1,399.4	12,425.5
17	5,850.0	4,426.1	783.0	1,399.4	12,458.5
18	5,850.0	4,426.1	750.0	1,399.4	12,425.5
19	5,850.0	4,426.1	783.0	1,399.4	12,458.5
20	5,850.0	4,426.1	750.0	1,399.4	12,425.5

**PROJECT COSTS
(\$'000)**

YEAR	ENG. & ADM.	BUILD.	ROADS	LAND CLEAR. & PREP.	INVEST. IN OTHER GOODS	INCREM. WORK. CAPITAL	MACHIN.	EQUIP.	VENI-CLES	LAND FOR CIAREC	ASSOC. COSTS	TOTAL INV & OPER. COSTS	CREDIT	TECH. CO-OP.	TOTAL COSTS (2)
1	1,002.5	3,361.5	1,050.0	1,050.0	747.0	780.0	1,380.8	752.5	295.0	20.0	267.0	10,706.3	----	1,267.6	11,973.9
2											267.0	267.0	214.0	804.0	1,285.0
3											267.0	267.0	390.0	324.0	981.0
4											267.0	267.0	316.0		583.0
5											267.0	267.0	337.0		604.0
6											267.0	267.0			267.0
7											267.0	267.0			267.0
8											267.0	267.0			267.0
9											267.0	267.0			267.0
10											267.0	267.0			267.0
11											267.0	267.0			267.0
12											267.0	267.0			267.0
13											267.0	267.0			267.0
14											267.0	267.0			267.0
15											267.0	267.0			267.0
16											267.0	267.0			267.0
17											267.0	267.0			267.0
18											267.0	267.0			267.0
19											267.0	267.0			267.0
20											267.0	267.0			267.0

**STREAM OF NET ECONOMIC BENEFITS OF THE PROJECT
(\$'000)**

YEAR	TOTAL BENEFITS (1)	TOTAL COSTS (2)	NET BENEFITS (1) - (2)
1	(63.8)	11,973.9	(12,037.7)
2	1,615.0	1,285.0	330.0
3	2,931.1	981.0	1,950.1
4	5,191.7	583.0	4,608.7
5	6,918.3	604.0	6,314.3
6	7,866.7	267.0	7,599.7
7	8,824.4	267.0	8,557.4
8	9,028.3	267.0	8,761.3
9	9,492.2	267.0	9,225.2
10	7,984.8	267.0	7,717.8
11	10,877.1	267.0	10,610.1
12	11,727.2	267.0	11,460.2
13	12,232.4	267.0	11,965.4
14	12,425.5	267.0	12,158.5
15	12,458.5	267.0	12,191.5
16	12,425.5	267.0	12,158.5
17	12,458.5	267.0	12,191.5
18	12,425.5	267.0	12,158.5
19	12,458.5	267.0	12,191.5
20	12,425.5	267.0	12,158.5

EIRR =	36.26%
NPV (12%)	35,951.43

1.61 The Economic Internal Rate of Return (EIRR) for the project as a whole is 36.3%, and the NPV(12%) is \$35,951,430. As in the financial analysis, the Marketing Subproject was evaluated in the "with project" situation only, and the economic benefits of not losing about \$2.5 million a year in marketing operations was not taken into account.

Chapter II. FRAME OF REFERENCE ^{1/}

A. OVERVIEW

2.01 The Commonwealth of The Bahamas is an archipelago of over 700 islands and cays extending over an area of more than 100,000 square miles (259,000 sq. km). Most of the territory, therefore, is water, the land area being estimated at only 5,382 square miles (13,939 sq. km) or 5% of the territory. Although located in the North Atlantic, The Bahamas shares many characteristics with the islands of the Caribbean, especially with regard to soils and climate.

2.02 Based on characteristics of land types, soil capabilities, water resources and vegetation, the archipelago is divided into two groups of islands: The Pine Islands of the North (Grand Bahama, Abaco, New Providence and Andros) and the remaining Coppice (hardwood) Islands of the Southeast (see map on page). A survey of land resources carried out during the early seventies, with United Kingdom technical assistance, provides basic qualitative data for the characterization of the islands. ^{2/} Rainfall, which averages about 52 inches annually for The Bahamas as a whole varies from 62 inches for the Pine Islands to 35 inches for islands in the Southeast. Because of the porous nature of the soils, there are no fresh water rivers or streams in The Bahamas. On most of the larger islands, the water table is very near the surface. This provides relatively easy access to potable water, but, given the proximity of sea water, there is always the danger of salt-water intrusion from overly rapid extraction. The largest fresh-water deposits appear to be on Andros, from which water is barged to New Providence to supplement that island's supply for Nassau.

2.03 The country's total population in 1987 was estimated at 242,000, which gives a population density of 17.3 persons per square kilometre (45 per sq. mile), one of the lowest in the Caribbean. This figure, however, conceals a very uneven distribution of the population among the islands. It is estimated that around 83% of the total population is concentrated around just two cities: Nassau (66%) on the island of New Providence, and Freeport (17%) on the island of Grand Bahama. The other 17% of the population is scattered throughout 27 islands, with populations ranging from 50 to 8,000.

^{1/} Sections of this chapter were adapted from recently prepared IDB documents.

^{2/} Land Resources Division, Ministry of Overseas Development, U.K., Land Resources of the Bahamas: A Summary, 1977.

2.04 While the overall population is relatively young, literate and economically active, the age, sex, and employment structure varies markedly among the islands. For the most part, the less developed islands (particularly the ones in the south) display a population structure characterized by the presence of older people and a low percentage of working-age males, which reflects the patterns of migration towards Nassau and, to a lesser extent, towards Freeport. These internal migration patterns, in turn, reflect the lack of economic opportunities on the Family Islands, in general, and on the Southeastern Islands, in particular.

2.05 The main assets of the Bahamian economy - which the country shares with the rest of the Caribbean - centre around its potential for tourism: beautiful beaches, ideal weather, and proximity to a major market. Moreover, the Bahamian economy has been historically an open economy, with its related tax-haven policies, which have resulted in the mushrooming of a major international financial centre and the development of export-oriented services such as refinery and transshipment activities. Nevertheless, the country needs to address a number of issues related to its development prospects: (i) tourism and financial services account for 85% of the country's GDP, which makes the economy too dependent on these two sectors; (ii) also, tourism and financial services are concentrated around two cities, Nassau and Freeport, making them very attractive to the population of the other islands, especially the young population; (iii) the size and geographic dispersion of the country pose considerable logistic obstacles to an integrated development; (iv) apart from some salt and calcium-based minerals, the country lacks mineral resources; (v) water is relatively scarce; (vi) in order to keep all the islands inhabited, especially the ones in the southeast, the Government has to create economic opportunities outside Nassau (New Providence) and Freeport (Grand Bahama) which are sufficiently attractive to keep the young population in the Family Islands.

B. ECONOMIC FRAMEWORK

2.06 The Bahamian economy has in recent years consistently registered positive real rates of growth in domestic output. During the period 1983-1988 for example, the annual growth rate of GDP in nominal terms averaged about 11.5% while domestic prices increased at an average annual rate of about 5.0%. With such moderate rates of inflation, the Bahamian economy continues to be among the most stable among the Caribbean territories. When adjusted for inflation, the average annual rate of growth in real output is estimated at about 6%.

2.07 While output performance of the economy can be considered satisfactory, there remains much concern regarding structural balance and the overall capacity to maintain its historical

stability and growth. Constraints arise more from the fact that the Bahamian economy is quite open and is therefore subject to the vagaries of a changing world environment. The Bahamian economy nonetheless has performed credibly in recent years, notwithstanding external shocks emanating from the wider world economic environment.

2.08 There is a lack of statistical information to support analysis of changes in the trend and pattern of household income, particularly with respect to distribution among the respective income-earning strata and also between the urban and rural sectors. A cursory examination would, however, suggest that in the case of the former (i.e. distribution with respect to earning strata), the degree of positive skewness is much less marked than for most other Caribbean territories and there also exists a consistency in the inter-strata growth trends.

2.09 The degree of inequality between urban and rural income earners is quite marked. Similarly, there is also a marked contrast between levels of earnings (farm and nonfarm) in the North (Pine Islands) and those in the South (Coppice Islands). These discrepancies arise primarily from the geographic bias of economic opportunities in favour of the North. The Agricultural Services Development Project should serve to initiate a correction of the present experience.

2.10 As illustrated in the following table, the tourism and service sectors provide the principal underpinnings to the economy.

TABLE 2.1 MAJOR SECTORS AND ESTIMATED LEVELS OF OUTPUT FOR THE BAHAMIAN ECONOMY (MILLIONS OF BAHAMIAN DOLLARS)

I T E M	1983		1984		1985		1986		1987		1988*	
	OUTPUT	%	OUTPUT	%	OUTPUT	%	OUTPUT	%	OUTPUT	%	OUTPUT	%
AGRICULTURE	80	5	85	4	96	4	111	4	123	4	140	5
INDUSTRY	409	23	447	22	471	21	514	21	552	20	704	22
CONSTRUCTION	52	3	58	3	64	3	71	3	80	3	90	3
OTHER**	357	20	389	19	407	18	443	18	472	17	614	19
SERVICES	1255	72	1466	74	1689	75	1892	75	2128	76	2301	73
TOURISM	556	32	747	37	925	41	1024	40	1194	43	1265	40
COMMERCE	140	8	144	7	140	7	218	9	216	8	244	8
FINANCE	259	15	278	14	301	13	325	13	369	13	420	13
GOVERNMENT	300	17	317	16	323	14	325	13	349	12	372	12
NOMINAL GDP	1744	100	2018	100	2256	100	2517	100	2803	100	3145	100
PERCENTAGE CHANGE IN GDP		5.5		15.7		11.9		11.4		11.5		12.2
INFLATION RATE		4.1		3.9		4.6		5.4		5.8		5.1

* PRELIMINARY

** PRIMARILY CONSISTS OF ENCLAVE MANUFACTURING AND TRANSPORTATION

SOURCES: WORLD BANK ECONOMIC REPORT ESTIMATES
CENTRAL BANK OF THE BAHAMAS

2.11 The data demonstrate that the Bahamian economy is primarily sustained by service industries, which account for about 75% of gross domestic output. The directly productive segments of the economy consist primarily of manufacturing, transportation and construction. Transportation and construction are, however, integrally linked with the service sector. Manufacturing accounts for about 10% of annual output but is primarily enclave in character, having very little linkage with the rest of the economy. This sector is dominated by the production of chemical and pharmaceutical products. The petroleum/petrochemical industry, which represented an important component of the manufacturing sector, has been declining progressively since the mid-1980s.

2.12 Tourism, financial services and public sector operations essentially comprise the service sector. Tourism accounts for about 56.0% of the sector and for about 40% of gross domestic output. Financial services and Government each account for about 13% of GDP. Commerce, which accounts for about 10% of GDP, is essentially supported by the prevailing level of activity in tourism and Government. In recent years, there has been a relative decline in the output, an experience which might be attributable to the openness of the economy and the relatively high level of direct purchases made by Bahamian residents in the United States.

2.13 Contrasting with the domestic output limitations which characterize the production sector of the Bahamian economy is the very high level of domestic consumption, 60% of which is supported by imports. In recent years, for example during the 1980-1986 period, non-petroleum merchandise imports increased sharply, at an average annual rate of about 14.0 percent, according to the Central Bank of The Bahamas. Similarly, the component of imports comprising foods, beverages and other edible commodities has consistently accounted for about 25% of the value of gross, non-petroleum imports and has also increased at approximately 14% yearly.

2.14 Notwithstanding the key role played by imports in fulfilling aggregate demand, the Bahamian economy does not suffer from a chronic foreign exchange shortage. Since about 1980 there has been a consistent building up of the country's external reserves, increasing at an average annual rate of about 8% and amounting to about US\$177.0 million at March 1989. In recent years, inflows from tourism and financial services have been adequately covering the foreign exchange requirements. Following a decline of about 1.0% in 1982-83, tourism inflows have averaged about an 11.0% annual increase during the past five years, while net earnings from financial services have been fluctuating around US\$80.0 million per year.

2.15 The structural configuration of the Bahamian economy, as it is, appreciably influences the character of public sector revenues. The relatively high level of imports which sustain consumption in the economy also represents a critical pressure on the revenues. Insofar as any development strategy seeks to create a pattern of

diversification which emphasizes import substitution -for example in the case of food and agricultural raw materials-, there will need to be countervailing strategies to avoid revenue displacement.

2.16 The Bahamas enjoys an environment of relatively high wage rates in the formal sector of the economy. As a consequence of this and because of the moderate to low inflation rates, there appears to be no overwhelming need for public policy for purposes of moderating the trend of wages and prices. In addition, trade union advocacy seeking to increase wage earnings by way of collective bargaining is virtually absent in the private sector. Rather, collective bargaining concerns seem to be more frequently applied to correcting wage disparities among public sector and para-statal agencies and between them and the private sector.

2.17 As earlier indicated, The Bahamas has a disproportionate dependence on tertiary economic activities (i.e., tourism, financial services, commerce and government sectors). This seems to create a fundamental structural imbalance in the economy. The economy can therefore be considered to be highly susceptible to external shocks, and greater attention should be given to the requirements for structural diversification through a more systematic exploitation of domestic resources.

2.18 In this regard, the need to further improve the quality and variety of tourist resort facilities, as well as tourism-related products, while simultaneously forging deeper linkages with other sectors of the economy, has been emphasized in recently enunciated Government policy statements. In fulfillment of these policy goals, high priority has been accorded to projects involving tourism expansion, the upgrading of relevant infrastructure in the Family Islands, increasing private foreign and domestic investments in agriculture and manufacturing, and developing the fishing industry.

2.19 The Government, being also cognizant of the trend towards concentration of economic activities in the Northern Islands, has announced plans to introduce legislation which will seek to expand and consolidate incentives to expedite economic and social development among the Family Islands, particularly in the southeast.

Recent Economic Trends

2.20 The Bahamian economy suffered a slowdown during 1988 as a result of the decline in tourist activity in late 1987 and early 1988, which followed the turmoil in the international financial markets. The slowdown was intensified by measures taken in January 1988 to stem the rapid expansion of consumer credit in order to contain the rise in consumption and protect the country's international reserve position. A stepped-up public investment program, combined with continued strength in commercial

construction activity and a modest recovery in tourism during the second half of the year, appears to have kept overall real output levels growing moderately for the year as a whole.

2.21 Although total tourist arrivals were up 2.5% as a whole, tourist expenditures were off for several reasons: fewer arrivals during the first quarter of the year when hotel prices are highest; concentration of growth in the cruise visitor category, which contributes comparatively little to tourism earnings; and an overall decline in arrivals in New Providence, where per visitor expenditures are highest, which was not offset by the 8 percent increase in arrivals in the Family Islands, where average expenditures are significantly lower.

2.22 Most of the dynamism in the economy during 1988 was in the construction sector, which benefited from several large private sector investment projects in hotel construction and shopping centers, and from strong expansion of the public investment program. Major public projects included renovation and/or expansion of several port and airport facilities, including those on New Providence and several of the Family Islands, and power, water and road projects on several islands. Most of these projects were expected to carry over into 1989 and in some cases beyond, which should provide continued stimulation to the economy and continued strong import demand.

2.23 Although little information is available on sectoral output, the manufacturing sector appears to have suffered from both the slowdown in domestic consumption induced by the credit squeeze, and from the delayed reopening of a major export-oriented pharmaceutical plant on Grand Bahama Island, which also affected merchandise export earnings. Agricultural output fell sharply in 1988, particularly livestock production and, to a lesser degree, crop production; this was attributable to higher feed prices resulting from the North American drought, severe flooding on several of the islands early in the year, and outbreaks of disease affecting both crops and poultry. Substantial declines were reported in production for the domestic market as well as for export.

2.24 The country's balance of payments position recovered somewhat in 1988 following a sharp deterioration in 1987, as the current account deficit was reduced by almost US\$40 million. Lower imports more than compensated for stagnant exports to produce a substantial reduction in the trade deficit. At the same time, however, tourism earnings, the largest source by far of foreign exchange, fell by about 3 percent, which reduced the services surplus. Large private capital inflows, associated in part with the new hotel construction projects, were sufficient to finance the current account deficit and produce a small external reserve gain, in contrast to the large loss recorded in 1987.

2.25 The fiscal situation deteriorated in 1988 as total expenditures grew twice as rapidly as revenues. Current revenues grew by 8.5 percent as indirect taxes --about 85 percent of total revenues-- increased by more than 9 percent despite sharply lower imports. At the same time, current outlays rose by more than 14 percent, primarily because of increases in Government wages in the second half of the year and increased purchases of goods and services. Capital expenditures shot up by more than 45 percent, as capital transfers to public entities more than doubled to over 6 percent of total expenditures, compared with less than 4 percent the previous year.

2.26 The upshot of these trends was the disappearance of the modest savings recorded by the Government in previous years and the emergence of a current deficit equivalent to some 1 percent of current expenditures. With the sharp rise in capital outlays, the overall deficit more than doubled, with the financing coming entirely from domestic sources --primarily from the sale of a Bh\$75 million Government bond issue late in the year.

2.27 While the bulk of the Government securities were purchased by non-bank financial institutions, banking system credit to the Government also expanded dramatically, by more than 40 percent. Credit restrictions imposed by the Central Bank early in the year to discourage consumer lending caused credit to the private sector to increase moderately in real terms during 1988, while the share of personal loans fell in relation to total private sector credit.

2.28 As a result of the tighter credit restrictions, total domestic credit growth slowed to 14 percent for the year, down from 23 percent in 1987, when credit to the Government was declining and the private sector was the source of expansion. At the same time, the banking system's net foreign assets contracted as Central Bank foreign reserves increased by US\$4.2 million while the commercial banks increased their net foreign liabilities by more than US\$30 million. Monetary liabilities of the banking system grew moderately, with strong growth in fixed deposits compensating for very little expansion in the money supply. Inflation slowed from 5.8 percent in 1987 to an estimated 5.1 percent on New Providence Island (where two-thirds of the population live); prices on Grand Bahama Island (with one-sixth of the population) rose at a much slower pace.

2.29 Based on a biennial labor force survey taken in May, 1989, unemployment appears to have fallen to 11 percent in 1988 from 12.2 percent in 1986, despite rapid growth in the labor force stemming from increased participation rates of both male and female workers. The fall in unemployment was most dramatic on Grand Bahama Island; despite a 25 percent increase in the labor force in two years, the unemployment rate was almost cut in half, to 7.4 percent in 1988, probably due to an increase in commercial construction activities.

Economic Policies

2.30 The focus of economic policies during 1988 continued to be on strengthening the country's attractiveness for tourism and improving the geographic distribution of economic activity and social services among the various islands. In order to encourage increased private sector involvement in the tourism industry, the government-owned Hotel Corporation signed a long-term lease on one of its major hotel properties on New Providence island. Revenues from the lease will help develop several tourism projects which are already in the planning stage on other islands. New training facilities are also under completion at the College of The Bahamas to improve the quality and quantity of tourism services at all levels. New cruise-ship port facilities, improved road systems, expanded electric power generation and distribution, and additional water, sewage and solid waste disposal facilities are all designed to improve the country's appeal for tourism as well as the living conditions of local residents.

2.31 Monetary policies during 1988 had to deal with the rising fiscal deficit --the result of the sharp rise in public investment and the mid-year salary increase-- and the rapid expansion of consumer credit during the second half of 1987, which was causing a drain on the country's international reserves. In January, the Central Bank raised the discount rate by 1.5 points, capped deposit interest rates at 8 percent (to discourage the deposit rate "war"), and exhorted banks to tighten lending requirements (particularly for consumer credit), restore their statutory reserve positions, and maintain existing lending rate structures. Subsequently, banks were authorized to borrow from offshore parent organizations in order to meet reserve requirements, but not for direct on-lending. Relatively tight credit conditions throughout 1988, especially for consumers, had a dampening effect on retail sales of consumer durables.

2.32 A major economic policy issue being studied in late 1988 and early 1989 was the introduction of a national health insurance program, which would reduce the heavy fiscal burden of the country's health services delivery system and generate a stable source of financing to further improve the quality and distribution of services over the long term.

Outlook

2.33 Economic growth in The Bahamas over the foreseeable future will depend primarily on continued growth in tourism sector activity. While existing lodging capacity plus planned additions are adequate to accommodate needed growth, it will be increasingly difficult to attract the needed tourist flows if, as appears likely, competing lower-cost Caribbean destinations continue increasing their market share. However, efforts to improve the

quality of infrastructure and services, to develop additional tourism centers in several of the Family Islands, and to tailor marketing and services better to the individual needs of specific market segments should help to sustain the momentum of tourism growth.

2.34 Moderate economic growth may continue during 1989 on the strength of a high level of construction activity sustained by large planned public sector investment outlays and several large private hotel projects. Both agriculture and manufacturing output will probably recover somewhat from their depressed levels of 1988, but the country's external position may suffer deterioration if, as is likely, domestic demand grows more rapidly than output. Investment in agriculture seems to be particularly important because, if it does not come about, the country will remain increasingly dependent on the importation of food and also will be unable to stop out-migration from the Family Islands. The Agricultural Services Development Project addresses both these issues.

C. THE AGRICULTURAL SECTOR

Recent Economic Situation and Prospects

2.35 In The Bahamas, agriculture represents a sector in which there is still considerable scope for improvement and development. The sector accounts for about 4.0% of GDP, provides about 5% of employment and generates about 20% of non-petroleum exports. The Government of The Bahamas has accorded high priority to agricultural development and has instituted in the past a number of support programmes, including programmes for research and extension, credit and marketing. Nonetheless, a large portion of the cultivable area in the country still remains unutilized. The annual catches of fish and sea foods are well below maximum sustainable yields, given that The Bahamas has about 45,000 square miles of shallow water and about 25,000 miles of coral bank edges. The forest reserves have also not been adequately tapped. While the country is more or less self sufficient in poultry, it still relies substantially on imports for other meats.

2.36 Agriculture and fishing activities are dominated by small-scale producers. The agricultural sector has in recent years experienced higher-than-average rate of growth in output, due in part to the growth of output in fruits and vegetables for the local market as well as increased output of citrus and papaya for export; but its relative importance in the Bahamian economy is still marginal. Local agriculture supplies 20% of the country's food requirements. As a result, The Bahamas is forced to import most of its food. In 1986, the country's

food import bill was US\$155 million while agricultural exports amounted to US\$22 million.

2.37 In order to improve the agricultural situation, the Government recently adopted a National Food Policy. This policy will, among other things, seek to: ensure an adequate supply of nutritional foods for all Bahamians; reduce, as much as possible, the dependence on imported foods; expand food production for the export market; use development in agriculture and fisheries as a vehicle for creating employment opportunities. However, the ability of the Government to increase agricultural self-reliance will depend mainly upon the increased substitution of imported fruits and vegetables by local production as well as by the expansion of export production to generate adequate foreign exchange earnings to import foodgrains and other necessary food items.

Agricultural Production

2.38 Agricultural production in The Bahamas consists mainly of fruits, vegetables and poultry directed to the local market, although citrus fruits and some seasonal vegetables are exported. Table 2.2 shows the estimated value of agricultural production in The Bahamas from 1981 to 1985 in current Bahamian dollars.

Table 2.2 Agricultural Production, 1981-85 (Millions of Bb\$)

	1981	1982	1983	1984	1985
Fruits and Vegetables	6.0	7.0	8.8	12.0	13.4
Poultry	19.6	15.1	17.1	20.9	20.0
Meats	0.7	0.7	0.8	0.7	0.6
Dairy	0.6	-	-	-	-
Total	26.9	22.8	26.7	33.6	34.0

Source: Ministry of Agriculture, Commonwealth of The Bahamas

2.39 Total exported agricultural production from The Bahamas includes marine products, fruits and vegetables, and some forestry products (cascarilla). Marine products (crawfish and salt) account for most of the export value. Fruits and vegetables have been experiencing a sharp increase in recent years because plantations in Abaco and Grand Bahama are now

coming into full production, although 1988 represented a decline in that trend.

Crops

2.40 Although detailed information on crop production, by item and by island, was not available, Table 2.3 provides a good estimate of crop production in the country, presenting information on the amount of produce purchased by the Produce Exchange and the Packing Houses during the period 1985-1987.

Table 2.3 Purchases of Selected Produce Items, 1985-1987 (Short tons)

Produce	1985	1986	1987
Orange	232	307	253
Grapefruit	13	30	34
Persian Lime	374	118	110
Tangerine	89	25	52
Avocado	13	20	34
Banana	1,078	640	449
Pineapple	327	426	351
Watermelon	576	378	282
Irish Potato	132	228	479
Sweet Potato	21	28	4
Pigeon Peas	29	21	9
Tomato	1,054	904	927
Cabbage	208	413	738
Sweet Pepper	310	106	90
Cucumber	73	77	34
Onion	262	183	379
Corn	110	280	154

Source: Produce Exchange. Planning and Statistics Unit - Dept. of Agriculture.

2.41 Most of the items on Table 2.3 have good market potential, since they supply only a fraction of total demand. Table 2.4 presents total demand for selected fruits and vegetables by source, in 1986. It can be appreciated that the only products that succeed in satisfying most of the domestic demand are pineapples (93%), watermelons (79%) and bananas (76%).

Table 2.4 Domestic Purchases and Imports of Selected Fruits and Vegetables - 1986

Produce	Unit	Domestic Purchase (1)	Imports (2)	Total Demand (3)	(1)/(3) (%)
Avocado	case	1,105	10,460	11,505	9,6
Banana	case	45,026	14,166	59,192	76,1
Lemon/Lime	case	7,707	35,901	43,608	17,7
Orange	case	26,934	83,172	11,020	24,4
Pineapple	case	24,564	1,856	26,420	93,0
Watermelon	case	12,394	3,296	15,690	79,0
Grapefruit	case	6,543	60,793	67,336	9,7
Plantain	case	173	69,702	69,875	0,3
Cabbage	bags	15,518	63,226	78,744	19,7
Cucumber	case	5,567	7,404	12,971	42,9
Onion	bags	8,603	179,018	187,621	4,6
Sweet Pepper	case	10,283	35,674	45,957	22,4
Tomato	case	81,066	99,041	166,596	40,6
Cassava	bags	707	7,364	8,071	8,8
Irish Potato	bags	7,031	238,083	245,114	2,9
Sweet Potato	bags	1,373	33,441	34,814	3,9
Yam	bags	36	11,662	11,698	0,3

Source: Ministry of Agriculture, Commonwealth of The Bahamas

2.42 The information presented in Table 2.4 shows very clearly that the potential for agriculture in The Bahamas lies in the production of fruits and vegetables. Their comparative advantage can be assessed from the fact that (a) they compete favourably in the local market with the imported produce in terms of quality and price, since they are graded according to international standards and do not receive any price subsidy, and (b) large investments are presently being made by foreign and joint-venture companies in the area of citrus production for export.

Crop Yields

2.43 Reference has been made to the reliability and usefulness of data available from the Agricultural Census of 1978. Nevertheless, Table 2.5 below provides the average yield according to the Census, and a potential targeted yield which can be expected with the application of currently available technology involving proper choice of varieties, source and level of fertilizing nutrients, and cultivation methods. It is important that meaningful and fairly precise data on the level of technology and projected yields for each main farming system be developed in

the project area. An important offshoot of such an exercise is that it will serve to design research programmes for priority fruits and vegetables.

Table 2.5 Average Yield of Selected Crops and their Potential with Improved Technology (Pounds per Acre)

Crop	Average Yield (1)	Potential Yield (2)
Banana	19,736	24,000
Orange	6,547	40,000
Grapefruit	21,396	30,000
Lime	10,798	35,000
Corn	1,034	4,000
Potato	8,319	15,000
Cassava	11,834	24,000
Tomato	12,400	40,000
Onion	7,943	16,000

Source (1): Summarized from FAO Report 1987 and Agriculture Census 1978.

(2): Mission Estimates

Livestock

2.44 The value of livestock products imported by The Bahamas during 1986 was approximately \$60 million. Domestic production is difficult to quantify since there is no formal marketing system for livestock. Some data is provided by the Agricultural Census of 1978 (Table 2.6). It shows cattle and swine dominating in the North while sheep and goats are more common in the Southeastern Islands.

2.45 Grazing livestock in The Bahamas consists of sheep, goats and cattle. Cattle are not widespread and the constraint on feed supply resulting from a lack of native grasslands creates circumstances which are naturally conducive to goat and sheep production. Intensive feedlot management is not currently in place but is worthy of examination.

2.46 Small stock will occupy a central position in farming systems designed to accommodate smaller mixed-agriculture farming enterprises. Poultry and swine production, which lend themselves to large-scale concentrated processing, are likely to be dominated by one or two processors. A

single organization produces more than 50% of projected poultry requirements for local consumption. Swine production is likely to follow along the same lines. What might be desirable in this approach is a system that will incorporate the production from smaller establishments. Some research results relating to pasture trials, goat and sheep productivity in relation to breed, and linkages between crops and animals are on record.

2.47 Sheep and goats are at the centre of the livestock development proposal advanced by this project. Other areas of livestock development to be explored in the longer term are presented in Annex 2 of this report.

Table 2.6 Number of Livestock in the Project Area

Island	Cattle	Sheep	Goats	Swine
Eleuthera	123	1,692	1,798	522
Andros	268	1,233	421	437
New Providence	410	635	851	4,807
Abaco	78	208	55	56
Grand Bahama	38	15	38	359
Sub-total	917	3,783	3,163	6,181
Long Island	-	5,982	3,500	243
Cat Island	67	368	2,291	111
Exuma	27	812	1,679	258
Acklins				
Crooked Island				
Mayaguana and others	230	-	2,611	735
Sub-total	333	7,162	10,081	1,347
Total (All islands)	1,250	10,945	13,244	7,528

Source: Agricultural Census 1978, Commonwealth of The Bahamas

Agricultural Services

Markets and Marketing

2.48 Three different markets can be identified for Bahamian agriculture. The first is represented by the local population of about 242,000 and can be called the "local market"; the second includes about 3 million tourists who visit the islands every year; and the third is the external market, traditionally linked

to the United States, but also with possibilities in Canada, the United Kingdom and Western Europe. All markets have ample possibilities for Bahamian agriculture and this project will seek to create the necessary conditions for the country to take advantage of them.

2.49 As mentioned before, most of the local market is concentrated in the cities of Nassau and Freeport, around which most of the tourism also centres. Therefore, whoever caters to the tourism industry also caters to the local population. A significant part of the food and agricultural produce consumed in those two cities is imported. This situation changes in the remaining islands, where local production has a much larger share of the markets; but then these markets are also small.

2.50 When looking at the marketing of Bahamian agriculture, a distinction must be made between livestock farmers and producers of fresh fruits and vegetables. Livestock farmers, primarily those in poultry meat, eggs and swine production, are all located in the centres of their target markets and therefore have very simple distribution processes.

2.51 The marketing of fresh fruits and vegetables has a significant level of government participation, primarily because it is now too complex and unprofitable to attract private sector interest. Its main aspects are the following:

- . Government-owned and operated distribution facilities account for about 80% of domestic marketing of fresh fruits and vegetables.
- . The Government plays a major role in setting the prices that farmers receive for fresh fruits and vegetables, mainly because it is the major buyer and wholesaler of those products.

2.52 The key players in the distribution of fresh fruits and vegetables are the following:

- 1) Ministry of Agriculture and its subsidiaries
 - The Produce Exchange
 - The Packing Houses
 - The Market Development Committee
- 2) Private Sector
 - Mail boats
 - Wholesalers and retailers

2.53 In the livestock production subsector, marketing has the following characteristics:

- . the farmer plays the role of producer and wholesaler;
- . the private sector is the only player in production and marketing;
- . Government's marketing support services, with the exception of abattoir and public health inspection, are not used; and
- . the distribution process is relatively efficient.

2.54 The Ministry of Agriculture coordinates the marketing of fresh fruits and vegetables. Day-to-day activities are coordinated by the Produce Exchange in Nassau, while field activities are executed through seven Packing Houses strategically located among the chain of leading producing islands: Eleuthera, Andros, Cat Island, Exuma and Long Island.

2.55 In the private sector, there are two key players in marketing. They are a) the owners of mail boats, whose traditional responsibility has been to transport the mail, and b) retailers, such as supermarkets and grocery shops. The mail boat owners operate private boats and receive a subsidy from the Government to sail to specific islands. The supermarkets and other retailers distribute both imported and locally produced foods. Their main functions are the following:

- . to carry adequate stock to meet their customers' needs, and
- . to identify efficient sources of supply of goods.

Research and Extension Services

2.56 The development of agriculture in countries such as The Bahamas, with limited availability of land and water supply, must be based on the adoption of technologies that will maximize production. Scientific research is the source of such technologies, whether it is original or whether it adapts technology to the country's specific conditions.

2.57 Agricultural research in The Bahamas started in 1973, with an agreement between the Ministry of Agriculture and the United States Agency for International Development (USAID) that led to the establishment of the Bahamas Agricultural Research Centre (BARC), on Andros Island. The project was executed over a five year period. Research results which have been accumulated since that time should be used as a starting point for a new phase of research efforts in the country.

2.58 Extension services should be directed at crop production and marketing information. Technical aspects of crop production, such as reduction of post-harvest losses

and quality assurance, should be transmitted to farmers together with marketing intelligence and information, since both these aspects of extension are equally important.

2.59 As mentioned before, the main agricultural research institutions in The Bahamas are The Bahamas Agricultural Research Centre (BARC) on Andros Island and the Gladstone Road Agricultural Complex (GRAC) on New Providence Island. These institutions will be reorganized as part of the proposals advanced by this project. Such reorganization will centre around the following issues:

- (i) establishing research and extension priorities and programmes in the areas of crops, soils, livestock and farmings systems;
- (ii) exploring sources of international cooperation and technical assistance to help expedite the reorganization of research and extension services; and
- (iii) designing the renovation of BARC and GRAC as far as physical plant and equipment are concerned.

CHAPTER III

THE BORROWER, THE EXECUTING AGENCY AND OTHER PARTICIPATING ENTITIES

A. THE BORROWER AND THE GUARANTOR

3.01 The Commonwealth of The Bahamas, through the Ministry of Finance, will be the borrower and guarantor of the loan to finance the Project. Chapter IX of the Constitution of The Bahamas, which went into effect on July 10, 1973, when The Bahamas formally declared its independence from Great Britain, establishes the consolidation of funds which obliges the government to administer the revenues and expenditures of the State. The Ministry of Finance must submit an annual budget to the Parliament, containing the maximum limits for public spending, known as the Consolidated Fund. Subsequently, and without the need for approval by the Parliament, the Ministry of Finance, on behalf of the government, issues the Appropriations Act, which sets forth a clear and detailed list of State revenues and expenditures. In this way, the Ministry of Finance assumes the responsibility, on behalf of The Bahamas, of borrower and guarantor for any State funding.

B. INSTITUTIONAL ANALYSIS OF THE EXECUTING AGENCY

1. Identification and Functions

3.02 The Executing Agency will be the Ministry of Agriculture, Industry and Trade, through the Department of Agriculture. A Coordinating Unit, created to coordinate the execution of the project, will be assigned to the Agency.

3.03 The Ministry of Agriculture, Trade and Industry (MATI) was originally established in 1963 as the Ministry of Agriculture and Fisheries. Because of the limited activity in the islands, it was expanded to include the work of three ministries. Nevertheless, the Departments of Agriculture and Fisheries are the most important sections of MATI, the main objective of which is:

To encourage the development of agriculture, trade and industry in The Bahamas, by promoting, monitoring and supervising activities related to these topics.

3.04 Pursuant to the Act which created MATI, its basic functions vis a vis the agricultural sector are:

- i) To direct, organize and implement agricultural services of the Commonwealth, and to coordinate all national, municipal and private activities related to the agricultural sector.
- ii) To study, conduct research and organize, using progressive and well-defined plans, all matters that can contribute to the progress and improvement of public agricultural institutions, and to promote the development of same.
- iii) To conduct research and provide agricultural extension services, which are essential to establishing favorable conditions for the development of public and private institutions of the sector.

- iv) To advise public and private organizations on agricultural matters.
- v) To create and organize technical committees as necessary to study and improve agricultural conditions in the archipelago.
- vi) To ensure compliance with legal provisions and regulations related to the agricultural sector.

2. Organization and Administration

3.05 MATI is organized to operate at the central and local levels and has an advisory office, at the highest level. The attached organizational chart illustrates the different units currently in operation, with emphasis on the Department of Agriculture.

3.06 At the central level, the organizational structure of MATI includes the Office of the Minister and the Permanent Secretary, the highest authorities of the Ministry. This Office has the decision-making, management and supervisory authority for policies on agriculture, trade and industry.

3.07 The Office of the Minister receives executive advisory services from the Bahamas Agricultural and Industrial Corporation (BAIC). The BAIC, which is currently being reorganized, is responsible for providing the Ministry with advisory services on agricultural and industrial policies, pursuant to the Act creating the Ministry.

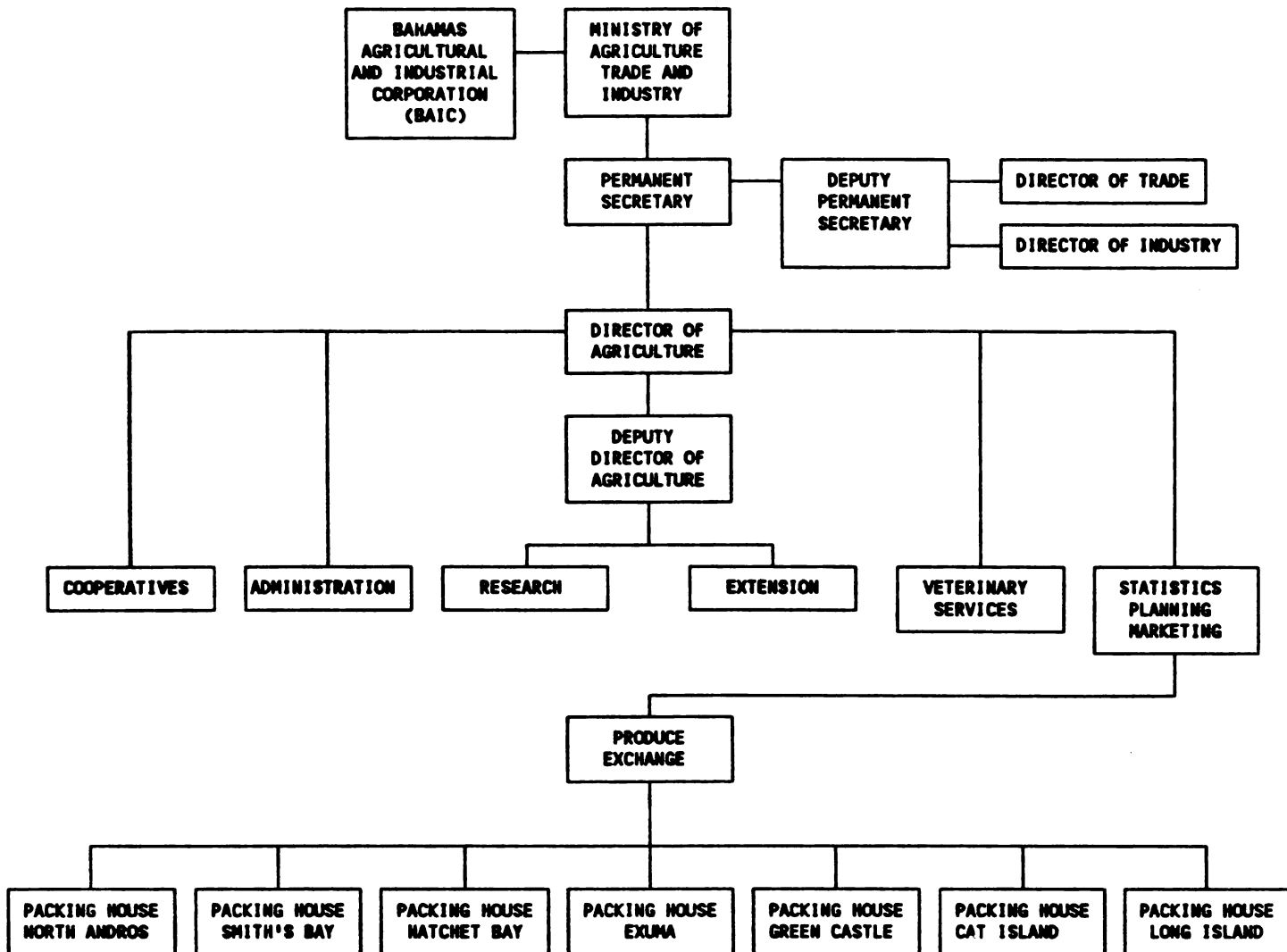
3.08 At the central and executive level, MATI is divided into four departments, to wit: Department of Agriculture, Department of Fisheries, Department of Trade and Department of Industry, each headed by a Director. These Departments come under the Permanent Secretary, although they are administratively independent. For the purposes of this project, the institutional and financial analysis focuses on the Department of Agriculture, since it is the executing agency of the Project.

3.09 The Department of Agriculture is headed by the Director of Agriculture, assisted by the Deputy Director of Agriculture. The Research and Extension Divisions come under the Deputy Director. The Office of the Director of Agriculture is directly responsible for the Divisions of Veterinary Services; Planning, Statistics and Marketing; Cooperatives and Administration.

3.10 At the central level, the above Divisions carry out technical advisory activities in their areas of concentration, including research, extension services and animal health. The Divisions of Administration and Planning, Statistics and Marketing are designed to provide support.

3.11 At the operating level, the Department of Agriculture, through its Divisions, has initiated activities related to extension, research and animal health in its research centers located on the northern islands. It is expected that, with the implementation of this Project, these activities will also be carried out on the southern islands.

**TABLE 3.1
MINISTRY OF AGRICULTURE TRADE AND INDUSTRY
ORGANIZATIONAL STRUCTURE**



3.12 With regard to marketing, in view of the urgent need for a marketing system for agricultural commodities, the Department of Agriculture developed Packing Houses, which are currently in operation, albeit in rather rudimentary facilities.

3.13 The seven Packing Houses currently operating in the main southern islands' come under the marketing and packing center, known as the Produce Exchange. Administratively the Produce Exchange system is very weak and it can be said that there is practically no system of organization. It operates with one supervisor and a number of state employees who take care of the different tasks involved in receiving and selling the commodities.

3.14 The Produce Exchange represents the most important operating activity of the Department of Agriculture. It comes under the administrative and technical responsibility of the Division of Marketing, which sets the rules and procedures under which the Exchange carries out its activities. As can be seen, the current system is overly centralized, complicating excessively the execution of this important agricultural activity and limiting all entrepreneurial actions.

3.15 The Division of Administration covers two large areas: Accounting and General Services. The latter, in addition to providing general support, includes the personnel section.

3.16 Human Resources. As of December 1989, the Department of Agriculture of MATI had a total of 329 positions, broken down as follows:

TABLE 3.2
DEPARTMENT OF AGRICULTURE
PERSONNEL

CATEGORY	NUMBER	%
Technicians	56	17
Mid-level technicians	101	31
Administrative Services	59	18
	113	34
TOTAL	329	100

3.17 Forty-eight percent of the personnel of the Department of Agriculture are assigned to technical duties, i.e., agricultural extension services and research and marketing. Not all positions are filled, however, and some are filled by lay personnel. Eighty-seven (87) percent of the qualified personnel work out of Department headquarters in Nassau, the capital, and agricultural areas are therefore neglected. Fifty-two percent of the positions are filled by support personnel, in both administrative and general services, which is not consistent for an agency such as the Department of Agriculture, which is essentially technical in nature.

¹ Chapter V presents a detailed description of the marketing system.

3.18 This situation calls for more efficient organization of personnel, more in tune with the specific needs of the Department of Agriculture. In light of this, recommendations as to personnel needs are dealt with in Chapters V and VI, when detailed descriptions of the different sub-projects and the execution mechanism of the Project are given.

3.19 Financial Management. The Department of Agriculture keeps its budgetary accounts through auxiliary records that provide for control of operating assets. Mechanized accounting equipment is used to prepare the accounting records, and a computerized system is being installed to facilitate the execution of the budget.

3.20 The Department of Agriculture and MATI do not have an office of internal audit. The only financial control is exercised by the Ministry of Finance, either through the allocation of funds, by requesting more information before making disbursements requested, or through periodic audits made in accordance with the Ministry of Finance's programming.

C. FINANCIAL ANALYSIS OF THE EXECUTING AGENCY

1. Introduction

3.21 The financial management of the Commonwealth of The Bahamas is carried out through a revenue and disbursement budget, which is approved annually by the Parliament, prepared and submitted by the Ministry of Finance. Its Office of the Budget is in charge of coordinating the preparation of the budget for the fiscal year with the other government entities. It is also responsible for analyzing, coordinating and evaluating budgetary execution. Each ministry or government institution has an Accounting Division, in charge of executing the budget and governed by budgetary rules and regulations established by the Ministry of Finance.

2. Budgetary System

3.22 The revenue and disbursement budget of the Commonwealth is based on the budget-by-program process. Each unit of an administrative organization, whether a Ministry or another type of state organization, programs its activities for the fiscal year. These activities make up programs or sub-programs, which are allocated funds by item, and which, together, make up the budget.

3.23 The budget of the Commonwealth is divided into two large items: i) revenue budget which, as its name indicates, refers to resources to be received by the State for executing its activities; and ii) disbursements budget, which summarizes how these financial resources will be used. This budget includes current expenditures and capital expenditures.

3.24 The budget is executed through quarterly allocations of quotas and according to revenues the government receives. A centralized payment system is used. Budget items are funded through a system of budgetary codes.

3. Budgetary Analysis.

3.25 Table 3.3 shows the Department of Agriculture's share in government expenditures between 1986 and 1990.

TABLE 3.3
BUDGETARY EXECUTION FY 1986-1990
(IN MILLIONS OF BHS)

BUDGET	1986	1987	1988	1989
GOVERNMENT	474.2	543.5	579.5	702.3
CURRENT EXPENDITURES	420.6	478.2	511.9	564.2
CAPITAL EXPENDITURES	53.6	65.3	67.6	138.1
DEPT. AGRICULTURE	4.2	4.2	5.3	6.8
CURRENT EXPENDITURES	3.6	3.8	4.2	4.4
CAPITAL EXPENDITURES	0.6	0.4	1.1	2.4
SHARE (IN %)				
OVERALL	1.0	1.0	1.0	1.0
CURRENT EXPENDITURES	1.0	1.0	1.0	1.0
CAPITAL EXPENDITURES	1.0	1.0	2.0	2.0

Source: Revenue and Expenditures Budget of the government of The Bahamas for fiscal years 1986-1990.

3.26 As seen in Table 3.3, the government has allocated a minimal percent of financial resources to the Department of Agriculture, barely 1% of the national budget. From a financial point of view, over the past four years, the current expenditure of the Department of Agriculture have increased at a slower rate than those of the Government. While government expenditures increased an average of 10% between 1986-89, operating expenditures for the Department of Agriculture increased only 7%. Nevertheless, the situation with regard to capital expenditures is totally different: on the average, capital expenditures for the Department of Agriculture increased 100%, while capital expenditures for the general national budget increased only 43%. This demonstrates the government's interest in solving the deterioration of fixed capital available to the sector. This matter is more thoroughly addressed in several chapters of the Project.

3.27 Table 3.4 shows the distribution, by principal item or expenditure, of resources allocated by the national budget to the Department of Agriculture, for the 1986-1989 period.

3.28 The overall figures of the budget of the Department of Agriculture show practically no changes over the 1986-1989 period. The current disbursement budget reflects natural growth, and capital disbursements reflect extraordinary growth. Notably, in the last two years, capital expenditures of the Department of Agriculture doubled. Up to 90% of resources were allocated for

TABLE 3.4
DEPARTMENT OF AGRICULTURE
EXPENDITURE FY 1986 - 90
(IN THOUSAND OF BHS)

EXPENDITURE	1986	%	1987	%	1988	%	1989	%
CURRENT								
PERSONNEL	2850	78	2822	73	3157	75	3400	77
TRAVEL AND PER DIEM	89	2	90	2	90	2	90	2
TRANSFER OF ITEMS	39	1	53	1	47	1	47	1
UTILITIES	196	5	232	6	246	6	246	5
PRINTING	24	1	18	1	23	1	23	1
OTHER SERV.	92	3	60	2	68	2	68	2
MATERIALS	248	7	476	12	455	11	455	10
REPAIRS-MAINT.	97	3	99	3	101	2	101	2
OTHER	14	-	12	-	12	-	12	-
TOTAL CURRENT	3649	100	3862	100	4199	100	4442	100
CAPITAL								
CENTRAL AGRIC. STAT. IMPROVEMENTS	50	8	25	6	50	4	200	8
FEEDER FARM ROADS AND LAND CLEARING	100	17	50	13	250	23	650	27
DEVELOPMENT AND IMPROVEMENT OF BOTANICAL GARDEN	25	4	5	1	50	4	25	1
DEVELOPMENT AND EQUIPPING PACKING HOUSES AND PRODUCE EXCHANGE	75	13	20	5	150	14	425	18
PILOT FOOD TECHNOL- OGY PROCESSING PLANT	50	8	25	6	-	-	-	-
AGRICULTURE DEVELOP- MENT	50	8	50	13	250	23	400	17
MINI MARKET DEVELOP.	-	-	-	-	-	-	100	4
OTHERS (EQUIPMENT, REPAIR)	250	42	225	56	350	32	600	25
TOTAL CAPITAL	600	100	400	100	1100	100	2400	100
TOTAL EXPENDITURE	4249		4262		5297		6842	

Source: Revenue and Expenditures Budget of the government of The Bahamas for fiscal years 1986-1990.

current disbursements. This trend has been declining, however, over the past two years, in favor of capital disbursements. In 1989, capital expenditures accounted for 35% of the Department's budget, which is a good indication of the government's interest in boosting capital formation in the agricultural sector.

3.29 If we look at current disbursements, we can see that approximately 75% of these are earmarked for salaries, wages and fringe benefits, which is excessively high. Far less, a mere 10%, corresponds to other operating expenditures. With regard to capital disbursements, resources are allocated in proportion to the size of the program or project to be implemented. It is important to stress the fact that MATI and the Department of Agriculture, in particular, have developed an investment program that has been growing continually, not only in size, but also in the number of activities carried out. This indicates that they have accumulated programming experience that favors project execution. In order to give an idea of the Department's executing capabilities, the preceding table indicates the largest investments being handled by the Department of Agriculture.

3.30 With regard to the Department of Agriculture's capabilities to execute the budget, if we compare the approved budget to the executed budget, we see that execution capacity is 100%, as far as current expenditures are concerned. The same applies for capital expenditures, which is unusual for government organizations. The following is a breakdown of overall investments as of December 31, 1989 for the main projects executed by the Department of Agriculture.

TABLE 3.5
DEPARTMENT OF AGRICULTURE
INVESTMENTS TO 31.12.89
(IN THOUSAND BH \$)

PROJECT	TOTAL COST	EXPENDITURE	
DEVELOPMENT AND IMPROVEMENT OF BOTANICAL GARDEN	304	294	97%
DEVELOPMENT AND EQUIPPING PACKING HOUSES AND PRODUCE EXCHANGES	1,265	1,035	82%
PILOT FOOD TECHNOLOGY PROCESSING PLANT	1,119	1,100	98%
CENTRAL AGRIC. STATION IMPROVEMENTS	588	528	90%
AGRICULTURE DEVELOPMENT F.I.	3,015	2,015	67%
FEEDER FARMROADS AND LAND CLEARING	2,509	1,660	66%
IMPROVEMENTS TO BAIC FACILITIES	693	663	96%
FARMERS-MINI MARKET DEVELOPMENT	260	100	38%
OTHERS	8,083	6,883	86%
TOTAL	17,836	14,278	80%

Source: Revenue and Expenditure Budget of the government of The Bahamas for fiscal years 1986-1990.

3.31 As seen in Table 3.5, the Department of Agriculture's executing capabilities have reached an acceptable level. The Department currently executes 25 programs and projects financed by the budget or grants, for a total investment value of approximately Bh\$17.8 million, of which 80% was executed. Although the experience of the Department of Agriculture does not include larger, multilaterally funded projects, it has undoubtedly gained experience in this respect.

3.32 Financing the Budget. Current and capital disbursements are financed by State revenues (regular resources), which come mainly from taxes. The Department of Agriculture also contributes to State revenues through the sale of commodities marketed by the Produce Exchange. Chapter V, dealing with the agricultural marketing sub-project, provides a detailed account of the performance of these revenues. The State also receives limited amounts of revenue (no more than Bh\$150,000 annually) for services it provides to the Department of Agriculture.

Chapter IV. THE PROJECT AREA

A. THE TWO PROJECT SUB-AREAS

4.01 The project will cover 11 of the 14 main islands of The Bahamas archipelago ^{1/}. Therefore, reference to the project area relates, in practical terms, to the country as a whole. The reason for having two project sub-areas arises from the marked differences that can be found between the Northern and the Southeastern Islands and, consequently, between the different development approaches that will be adopted to deal with these two groups of islands. Because the 11 participating islands are responsible for practically the totality of the agricultural production of The Bahamas, part of the material usually covered by this chapter has already been addressed in Chapter II Frame of Reference, of this report.

4.02 The islands of The Bahamas have traditionally been classified in terms of their vegetation: the Pine Islands of the north and the Coppice (hardwood) Islands of the southeast. For purposes of this project, however, the islands have been divided in two groups - Northern and Southeastern - because one of the Coppice Islands, Eleuthera, shares many characteristics with the group of four Pine Islands (Grand Bahama, Abaco, New Providence and Andros). The two groups of participating islands are, then, as follows:

Northern Group - Grand Bahama
 Abaco
 Eleuthera
 New Providence
 Andros

Southeastern Group - Cat Island
 Long Island
 Exuma
 Crooked Island
 Acklins
 Mayaguana

4.03 The Northern Islands present much more favorable conditions for commercial agriculture than the Southeastern Islands, especially in terms of soils, water availability and proximity to markets. It is there that most of the economic potential of Bahamian agriculture can be realized.

^{1/} The major islands not covered are San Salvador, Rum Cay and the Inaguas.

4.04 The Southeastern Islands, in turn, despite their lesser agricultural potential, are very important and represent a high priority in the country's overall development strategy. Settlement of these islands and their economic viability are vital for the country to preserve its territorial integrity and socio-economic balance.

4.05 Nassau, the capital city, located on the island of New Providence, and Freeport, the other main city, located on Grand Bahama, are the two poles of attraction for internal migration from the Family Islands, especially for the younger persons. It is around Nassau and Freeport that most of the tourism industry is centred, which causes an economic and spatial imbalance in relation to the rest of the country.

4.06 In its overall design, the project will seek to address the differences between the Northern and Southeastern groups of islands, and, at the same time, will aim to reflect the Government's strategy for the development of the country as a whole.

B. PHYSICAL CHARACTERISTICS

4.07 A detailed account of the physical characteristics of The Bahamas is presented in Annex 1 of this report. It is based on The Bahamas Land Resource Survey, conducted by Little et. al. during the 1970's under a British government technical cooperation programme and was adapted from the National Food and Nutrition Action Plan prepared by the FAO in cooperation with the Ministry of Agriculture of The Bahamas. What follows is a summary of what is presented in Annex 1.

Vegetation

4.08 The most obvious distinction between the islands concerns vegetation and has led to the division between the Pine Islands and the Coppice (hardwood) Islands. The Pine Islands have natural forests of Caribbean pine and generally a wetter, cooler climate. The pine forests occupy the soily rock plains, and the size of the timber is a useful indicator of the agricultural potential of the underlying land.

4.09 The remaining islands in the southeast were originally covered with hardwood forests and shrubland. Continuous occupation and exploitation over several hundred years have reduced this to closely spaced stands of narrow-stemmed, semi-deciduous and evergreen broad-leaved trees, often only 10 to 15 feet (3-4.5 metres) high and which rarely exceed 35 feet (10

metres). The density and size of this woodland varies according to the quantity and seasonality of the rainfall, so that in the southeast it is reduced to sparse cover, more closely resembling thorn woodland or desert scrub than the more abundant cover of the wetter Northern Islands.

Rainfall

4.10 In the Northern Islands the rainfall pattern is characterized by high annual falls which are unevenly distributed between a warm, wet summer season from May to October and a dry, cooler winter from November to April. The four northernmost islands all have between 50" and 60" rain per year. In contrast, the four southernmost islands are the driest, with 45-55% of that amount, or 27.5" to 35.7" per year.

4.11 Most of the summer rain in The Bahamas falls in intense local storms which can produce wide variations in incident rain at close locations and which create local problems for producers. There is the difficulty of maintaining steady growth in crops when rainfall occurs in brief, high-intensity storms followed by periods of dry weather. The soil and base rock are receptive to intense falls of rain and there is little runoff, so moisture is rapidly lost to the plant.

Temperature

4.12 A most important feature for Bahamian agriculture is the remarkably stable temperatures year round and the complete absence of frost. Mean daily temperatures in New Providence vary between a maximum of 77°F to 89°F and a minimum of 62°F to 75°F. In Great Inagua, maxima can vary between 82°F to 91°F., but minima are virtually the same as New Providence, in the range 67°F to 76°F. These two islands reflect the temperature ranges observed in the Northern and Southeastern Islands, respectively.

4.13 Mean relative humidity varies between 75% and 82% in New Providence and marginally higher, at 79% to 88%, in Great Inagua. This figure conceals the fact that absolute humidity is much lower in the winter (Dec-Mar) period, which makes this an ideal period for production of many temperate food crops, particularly vegetables. Moving from winter to summer (May-Sep), with much higher humidity and rainfall, it becomes much more difficult to produce the same group of crops. This is because of higher susceptibility to disease in the more humid atmosphere, and the prospect of crop damage from excessive rain.

4.14 The absence of frost, because of the small land mass of each island, is a unique feature of The Bahamas. When coupled with an average of 7 hours of sunshine/day year round and the mild

moist atmosphere, The Bahamas have a production advantage over many other locations which can produce similar crops, but only on a seasonal basis. The close location of The Bahamas to mainland USA, and the regular transport connections to Canada and Europe provide specific market opportunities to capitalize on the beneficial climate for agricultural production.

Wind

4.15 Prevailing winds throughout the islands are from the easterly quarter. In the northerly sector, the prevailing winds are from the northeast from October to April. Although mean wind speed is in the range of 7-10 knots, it is not uncommon to have periods during the winter with wind speeds of 15 knots or more. Moving southward, the period of northeasterly winds becomes shorter and less pronounced, so that in the southernmost islands the predominant wind direction is east-southeast all year.

Hurricanes

4.16 While they are not frequent, the potential for hurricane damage should be taken into account for long-term agricultural planning. As shown in Table 4.1 it is significant that Grand Bahama with its otherwise high potential for tree crops has double the chance of hurricane damage compared to Abaco or Andros. In Abaco there is a permanent citrus/avocado orchard more than 18 years old, with a strong history of regular high production.

4.17 A major consideration when one embarks on tree crop production is the need to select with care orchard sites laid out in a manner that minimizes possible hurricane damage. Part of any overall plan to mitigate hurricane damage should be the maintenance of national mother stocks of the principal commercial tree plants, which should include improved varieties of citrus, mango, avocado and papaya.

TABLE 4.1 INCIDENCE OF HURRICANES IN THE BAHAMAS - 1871/1963

ISLAND	NUMBER PASSING ACROSS AN ISLAND	NUMBER PASSING WITHIN 200 NAUTICAL MILES
ABACO	8	91
GRAND BAHAMA	16	70
ANDROS	9	90
ELEUTHERA	6	85
CAT ISLAND	7	39
EXUMA	5	45
LONG ISLAND	7	45
CROOKED ISLAND, ACKLINS	9	45
PLAYAQUANA	5	45
GREAT INHOUA	3	45

SOURCE: LITTLE ET. AL. 1977:7

Soils and Landform

4.18 The landforms in each island are a composite of dunes, beach ridges, marshes and plains, some of which are actively forming and others are in various stages of decomposition from prior ages. With the highest point on land being 207 feet (63.7 m) above mean sea level, micro relief and local conditions are important in determining suitable locations for agriculture in The Bahamas.

4.19 Virtually all the land is limestone-based, though the limestone is by no means uniform in structure, density or strength. The limestone varies according to origin and age, the most important variations being in the type of limestone and degree of hardness. The soluble nature of limestone means that most of the soil is eventually lost in the normal degradation process, and that natural soils are thin and of little structural strength. They are strongly alkaline, of low natural fertility and have a high capacity to lock up applied fertilizer.

4.20 Observed soil differences may be related to minor differences in the base limestone. There are four general classes of soils:

- (i) Limestone Residues (Red and brown lateritic soils) with two sub-classes: Aluminous Lateritic Soils ("red soils", "pineapple soils", "Bahamas red loam"; and Immature Lateritic Soils ("Brown mineral soils", "Bahamas stony loam");
- (ii) Organic Soils (Leafmould soils on rock, muck soils);
- (iii) Sedimentary Soils (Sandy soils with humus, sandy soils with caliche; limesilt soils);
- (iv) Man-made soils (Quarry pit soils, artificially augmented soils of Exuma, heaped up marsh soils of North Eleuthera, prepared rockland, crushed rock.

Land Capability Classification

4.21 Annex 1 of this report presents a Land Capability Classification which, in summary, is the following:

Tillage Land:

- | | |
|------------------|--|
| Class 1: | Small individual area of deeper red and brown soils together with "whitelands" (humic sands) |
| Classes 2 and 3: | Intimate associations of soil and rock (occupying the top 3-18 inches of |

the ground surface) suitable for preparation as ploughland; Class 2, gravelly; Class 3, stony.

Non-Tillage Land:

Class 4A: Rockland, not steep, not suitable for ploughing but usable for agriculture.

Classes 4B, 5, 6 and 7 (See Annex 1 for detailed description)

4.22 Practically, all the land which can be used for agriculture falls into Classes 1-4A. In the Land Capability Map published with their report, Little et. al. (1977) provide some estimates of the areas of the various land capability classes for the principal islands. The most obvious feature of the data is the predominance of agricultural class land in the three islands of Abaco, Grand Bahama and Andros.

4.23 The agricultural suitable land for the Northern and Southeastern project sub-areas has been estimated at 139,441 and 29,653 acres respectively, as shown in Table 4.2 below. This is based on a land capability assessment that disregards the underground water resources capable of accommodating unlimited supplementary irrigation for fruit and vegetable production.

TABLE 4.2 SOME BASIC AGRICULTURAL FACTS RELATING TO THE PROJECT AREA.

№	ISLAND	SIZE (ACRES)	POPULATION	FARMERS	AGRICULTURAL SUITABLE LAND (ACRES)	FARM LANDS (ACRES)
1	ELEUTHERA	128,000	8,300	400	7,289	6,404
2	ANDROS	1,472,000	4,400	500	51,189	6,795
3	NEW PROVIDENCE	51,200	135,400	130		5,572
4	ABACO	415,400	7,400	130	45,355	20,791
5	GRAND BAHAMA	339,200	33,000	70	35,608	743
SUBTOTAL		2,405,800	188,500	1,230	139,441	40,306
6	LONG ISLAND	110,700	3,350	320	6,000	8,217
7	CAT ISLAND	96,000	2,140	250	1,838	29,921
8	KEEGA	72,300	3,670	270	308	2,760
9	ACKLINS	93,600	400	100	2,000 **	1,000 **
10	CROOKED ISLAND	58,900	800	85	3,500 **	2,500 **
11	MAYAGUANA	70,400	400	80	16,010	1,908 **
SUBTOTAL		501,900	10,840	1,105	29,653	46,306
TOTAL		2,907,700	199,340	2,335	169,094	86,611

SOURCE: AGRICULTURAL CENSUS, 1978/79 REPORT
 * MISSION ESTIMATES. FARMERS RELATE TO PERSONS WHOSE OCCUPATION, PRINCIPALLY, BUT NOT EXCLUSIVELY, IS FARMING
 ** MISSION ESTIMATES

4.24 There are currently 7,250 acres of land under irrigation in the two project sub-areas. The installation of irrigation facilities in those areas was not carried out in concert with land suitability and maximum water reserves.

Water Resources

4.25 The only source of irrigation water in The Bahamas is groundwater. The results of many studies indicate that the hydrophysical characteristics of the limestone at the ground surface of The Bahamas islands in general, provide excellent conditions for rainfall to percolate down to the underlying water table. It appears that little, if any, of the rainfall runs off on the surface. Fresh groundwater occurs as a lens floating on the underlying brackish and then saline groundwater, and all of the recharge to the fresh-water lens comes from rainfall occurring on the islands. Part of the rain that falls on an island is evaporated directly from the land surface and the vegetation, a second part is consumed by plants from the soil before it reaches the water table, and the remainder percolates down to the water table. Of that part which reaches the water table, a portion moves through the ground in a downward and horizontal directions to the ocean.

Quality of Groundwater

4.26 Groundwater quality, which is determined by a large number of variables, may be considered in terms of chemical, bacteriological and physical characteristics. Under The Bahamas conditions, the chemical characteristic of groundwater is of most concern to irrigation. The Bahamas islands have in general a limestone geological formation and that results in fresh ground water having, in general, a rather high content of calcium and bicarbonates. The water lenses in The Bahamas islands are subject to many physical influences but normally they present a depth profile that is generally composed of: (1) a freshwater (potable) section where the chloride content ranges from 90 to 400 ppm; (2) a transition zone, commonly about 1-2 m thick, in which chlorides increase rapidly from 400 to 1200 ppm; and (3) a saline portion in which chlorides increase rapidly from 1200 ppm to levels approaching that of seawater. On the larger islands the freshwater (potable) section is separated from levels containing sea water by approximately 10 m. Table 4.3 below, shows information on fresh water lenses in the project area. Detailed information on fresh water resources per island can be found in Annex 3 of this report.

TABLE 4.3 FEATURES OF THE ISLANDS SELECTED FOR THE STUDY: LAND SIZE AND CHARACTERISTICS OF STUDIED FRESH WATER LENSES

ISLAND OR THEREFORE	LAND SIZE IN ACRES	MEAN RAINFALL IN MM	TOTAL AREA OF FRESH-WATER LENSES IN ACRES	RATIO OF TOTAL FRESH-WATER LENSES TO LAND SIZE	VOLUME OF WATER IN LENS 1000 M CUBED
NORTHWESTERN ISLANDS					
ELEUTHERA	127,996	1,141	16,598	0.1297	146,816
ANDROS		1,175			
NORTH	836,370		338,577	0.4199	4,307,000
SOUTH	550,381		202,204	0.3670	1,496,000
MANGROVE CAY	115,194		42,624	0.3700	315,000
ABACO		1,547			
GREAT	399,985		113,146	0.2838	1,218,000
LITTLE	15,360		2,750	0.1797	17,000
GRAND BAHAMA	332,790	1,496	146,207	0.4393	1,532,000
AUGUST CAY	2,560		415	0.1625	2,000
DUSH CRY	2,560		1,255	0.4900	9,000
SOUTHEASTERN ISLANDS					
LONG ISLAND	110,714	904	9,301	0.8400	26,231
CAT ISLAND	95,997	960	14,776	0.1539	130,916
KIUMA		1,008			
GREAT	63,998		6,365	0.9950	40,996
LITTLE	6,400		220	0.3440	1,085
BARRATERRA	1,920		99	0.5200	1,532,000
ACKLINS	95,997	813	15,782	0.1644	63,566
CROOKED ISLAND	58,876	881	5,923	0.1006	19,490
WYBAQUANA	70,398	864	2,340	0.3320	5,772

SOURCE: HART AND WESCH (1986)

C. ECONOMIC BASE

Crops and Livestock Resources

4.27 As mentioned before, the 11 participating islands of the project are responsible for practically the totality of agricultural production of The Bahamas. Therefore, the information related to crops and livestock production in the two project sub-areas has already been presented in Chapter II, Frame of Reference, of this report. As that and other information presented in this report clearly show, agriculture is a main economic activity in the Southeastern Islands and must necessarily be at the centre of any development proposal for that region. At the same time, the islands of the north have great potential for agricultural development, especially for larger-scale, export-oriented corporate farming. The development proposals advanced by this project are based on such considerations.

Other Economic Activities

4.28 Agriculture is almost always complemented by some other economic activity in The Bahamas, especially in the Southeastern Islands. Farmers may have other sources of income in areas such as fishing, small business ventures (like taxis and restaurants), or working in the tourism industry. The alternatives vary from island to island, but the part-time nature of agriculture in the Southeast and the lack of other economic activities in the area seem to indicate that agriculture has plenty of economic space to occupy. In the Northern Islands, it will have to compete with other highly attractive alternatives.

D. SOCIAL ASPECTS

Land Tenure

4.29 The Agriculture Census of 1978 recorded 4,246 individual farms occupying 86,611 acres of land in The Bahamas. In designing an appropriate programme to promote further development of agriculture, it is necessary to examine more closely the distribution of farm size, the location of farming in the islands and the intensity of land use.

4.30 Farming land is unevenly distributed among farmers in The Bahamas. To interpret the situation, Census data have been condensed into five farm-size categories. These categories are intended to represent the farming systems probably employed, and the potential for future development.

The categories selected are:

Less than 2 acres:	Most likely to be a part-time farmer operating in the low investment system.
2 - 5 acres:	A one-man farming operation, non mechanized.
5 - 20:	More than a one-man farming operation, will need labour assistance at least for harvesting. Some opportunity for capital accumulation and investment.

20 - 200:

Potentially a farming business with paid wage labour, and sufficient cash flow to enable investment in mechanized farming methods.

Greater than 200:

Mostly large-scale, professional farms; all paid labour, mechanized and technically sophisticated.

4.31 Table 4.4 below, presents the number and area of farm holdings by size categories.

TABLE 4.4 NUMBER AND AREA OF HOLDINGS BY ISLAND AND FARM SIZE CATEGORY

FARM SIZE CLASS		FARMS <2ac	FARMS 2-5ac	FARMS 5-20ac	FARMS 20-200ac	FARMS >200 ac	TOTAL FARMS	PERCENT BY ISLAND
ELEUTHERA	NO	230	187	195	39	6	657	15.5
	AREA	182	568	1,807	1,876	1,971	6,404	7.4
ANDROS	NO	427	164	90	26	4	711	16.7
	AREA	368	458	686	1,091	4,192	6,795	7.9
NEW PROVIDENCE	NO	141	118	183	23	2	437	10.3
	AREA	116	355	1,322	1,015	2,764	5,572	6.3
BARBADO	NO	224	47	24	7	2	304	7.2
	AREA	172	136	167	186	20,130	20,791	24.1
GRAND BAHAMA	NO	166	11	6	1	1	185	4.4
	AREA	76	32	53	34	548	743	0.9
LONG ISLAND	NO	81	168	281	71	6	607	14.3
	AREA	76	479	2,783	3,501	1,378	8,217	9.2
CAT ISLAND	NO	86	181	137	36	10	450	10.6
	AREA	97	592	1,048	1,301	26,883	29,921	34.7
THE EXUMAS	NO	201	179	56	12	3	451	10.6
	AREA	216	546	427	466	1,105	2,760	3.2
WEST OF BAHAMAS	NO	250	133	41	12	8	444	10.5
	AREA	245	397	358	621	3,787	5,408	6.3
TOTAL FARMS	NO	1,806	1,168	983	227	42	4,246	100.0
	AREA	1,548	3,563	8,651	10,091	62,758	86,611	100.0
PERCENTAGE BY FARM SIZE CLASS	NO	42.5	28.0	23.2	5.3	1.0	100.0	
	AREA	1.8	4.1	10.0	11.7	72.4	100.0	

SOURCE: AGRICULTURE CENSUS 1978.

4.32 The data demonstrate a marked skewness in farm-size distribution. About 43.0% of individual farms were less than 2 acres, and about 70% had less than 5 acres. Collectively they occupied not much more than 5,000 acres, or 5.9% of the recorded farm area in The Bahamas. At the other end of the scale there were 42 farms (1% of the total) larger than 200 acres, occupying 62,758 acres, or 72.4% of total farm area.

4.33 Farm land is not only unevenly distributed among farmers, but it is also unevenly distributed among islands. Table 4.2 shows that 77% of the better agricultural class land is on three islands of the Northern group: Andros, Abaco and Grand Bahama. Yet, 62% of the land used for agriculture is in the Southeast. However, this has been the traditional pattern of Bahamian agriculture.

4.34 Another feature of Bahamian agriculture which creates difficulties for development is the matter of land tenure. This is both in terms of the way in which the land is held by farmers for their current operations, and the matter of access to additional land for those who wish to become farmers or to increase their farming activities.

4.35 In The Bahamas there are four categories of land tenure, classified on the basis of occupancy and ownership status. These are:

Generation Property:

Lands are essentially "family lands" which remain occupied by successive generations over time. These lands cannot be sold or transferred outside a family, although there could be some element of fragmentation with respect to occupancy.

Commonage Lands:

These lands are available for use by all individuals within a community, but are owned by no one. Community collective decision-making may be applied in ratifying or vetoing the use of these lands by other persons within a particular community.

Crown Lands:

These are lands owned by the government. It is estimated that there are about 2.0 million acres of these lands. Further, these lands provide the most promising land resource potential for agricultural development. About 400,000 acres of these lands are in natural forests, a situation which will require that the issue of land-use rationalization be addressed.

Private Property:

This is usually occupied on a freehold basis, with the owner having a registered title to the land.

Labour Force, Employment and Availability of Agricultural Labour

4.36 The labour force survey reports that in May of 1986 the Bahamian labour force stood at about 110,000 persons. In relation to the previous survey, done in 1980, the average annual growth rate of the labour force was around 4.5%. During the same 1980-86 period, the Bahamian population increased at an estimated average annual rate of 1.7%, which suggests an increasingly high rate of labour participation. The labour participation ratio was estimated to be 71.4% in 1986, an increase of 4.0% over 1980.

4.37 The unemployed component also increased during this period, but at a much slower rate, resulting in a slight decline of unemployment from an estimated 12.2% in 1986 to 11% in 1988.

4.38 The work force is relatively young, with about 48% being less than 30 years of age. The age group 15-29 years accounts for about 44.0% of the employed work force, and by contrast, about 76% of the unemployed. The average unemployment rate, countrywide, is estimated at about 11%, but there is a wide variation among the islands. The estimated rate ranges from 8.3% in Abaco to 15.0% in Andros. The nationwide average unemployment rate for males is 9.7%, ranging from 6.6% in Abaco to 14% in Andros.

4.39 The category classified as "community, social and personal services", which includes the Government sector, represents the largest employer of labour in The Bahamas, accounting for approximately 31% of employed persons. This is followed by the group hotels and restaurants, with 20%, and commerce (retail and wholesale trades) with 13%. Agricultural and related activities (e.g. forestry and fishing) accounted for only about 5.0% of total employment in 1986.

4.40 The distribution of employment varies widely among the islands, based on the main economic activity which takes place on a particular island. Among the Family Islands, agriculture has for a greater share of employment.

4.41 Migration from the Southeastern Islands to the Northern Islands, particularly to New Providence and Grand Bahama, continues to pose a serious problem as regards labour availability in some islands and the social pressures created in the metropolitan centres (Nassau and Freeport).

4.42 The following table provides a breakdown of the farm population, or occupants of farmsteads, as provided by the Agricultural Census.

TABLE 4.5 FARM HOLDERS BY AGE, SEX AND SIZE OF HOLDING

Farm Size Class	Unit	Farms 2ac	Farms 2-5ac	Farms 5-20	Farms 20-	Farms 200	Total Farms	Percent All Holders
15-24 years		31	28	12	5	4	80	1.9
25-34		152	45	36	10	1	244	5.7
35 - 44		333	156	120	23	4	636	15.0
45 - 54		387	282	249	45	5	968	22.8
55 - 64		408	332	305	76	13	1,134	26.8
65 - 74		334	251	209	48	9	851	20.0
75 YEARS PLUS		161	94	52	20	6	333	7.8
Total	Male	1,101	833	826	200	32	2,992	70.5
	Female	705	355	157	27	10	1,254	29.5
Total		1,806	1,188	983	227	42	4,246	100.0

Source: Agricultural Census 1978 and FAO Reports

4.43 The data demonstrate that 54.4% of all farmers were 55 years or older in 1978, which underlines the extent of out-migration from agriculture. Although no more recent information is available on this issue, there is also no indication that it has changed appreciably.

4.44 The adequate supply of domestic labour on a timely basis to support an expansion in agricultural production is expected to pose a problem in The Bahamas. The hotel and service sectors, being dominant as they are, will continue to attract younger workers. This situation of labour supply will no doubt have implications for the country's policies on employment and migration in the near future. It will also appreciably influence the approach taken to stimulate development of agriculture, particularly with respect to the selection of enterprises, their location and the level of capital intensity adopted. The issue of migration, however, transcends the labour supply problem, and encompasses such wider political and socio-economic considerations as decentralized regional development and income redistribution through appropriate wage and price policies which discriminate on the basis of location and type of industry.

Social Services

4.45 Although social services -specially health and education- seem to be adequately provided in the Northern Islands, they are definitely lacking in the Southeast. Except maybe for Exuma Island, this has contributed enormously to the migration of the young population towards Nassau and also to the little attractiveness of those islands to professional personnel such as doctors, teachers, extension agents or dentists. This is coupled by a lack of amenities and cultural activities. The Government is presently committed to reverse such a situation.

E. INFRASTRUCTURE

Marketing

4.46 The infrastructure for agricultural marketing in the project area is comprised by the following buildings:

- . Produce Exchange, at Potters Cay, Nassau, New Providence
- . Kemproad Outlet, Nassau, New Providence
- . Produce Exchange, Freeport, Grand Bahama
- . 7 Packing Houses distributed through 5 islands.

4.47 Table 4.6 below provide detailed information on the buildings.

TABLE 4.6 THE BAHAMAS: DETAILS ON PHYSICAL FACILITIES AT THE PRODUCE EXCHANGE, PACKING HOUSES AND OUTLETS

LOCAL/NAME OF FACILITY	SIZE OF BUILDING SQ. FT	NUMBER OF COOLING UNITS INSTALLED	CU. FT	DAILY COOLING CAPACITY (TONS)
PRODUCE EXCHANGE, NASSAU	13,000	8	47,000	60
KEMPROAD OUTLET	1,920	1		
FREEPORT EXCHANGE	4,000	3	11,800	13
NORTH ANDROS PACKING HOUSE	4,000	1	2,800	1.5
NORTH ELEUTHERA	2,400	1	2,800	1.5
HATCH BAY, ELEUTHERA	2,400	1	2,800	1.5
GREEN CASTLE, ELEUTHERA	2,400	1	1,980	1.0
SMITH BAY, CAT ISLAND	2,400	1	2,800	1.5
MT THOMPSON, EXUMA	2,400	1	2,800	1.5
NORTH LONG ISLAND	2,400	1	2,800	1.5

SOURCE: DEPARTMENT OF AGRICULTURE

4.48 The islands without Packing Houses are the following: Abaco, Crooked, Aklins and Mayaguana. All the facilities described in Table 4.6, with the exception of the exchange in Freeport, are in a state of disrepair, needing urgent renovation, upgrading or rebuilding. Almost all the cooling units are out of use and a good part of the other equipment is old. Every island needs at least one Packing House; some, because of their peculiar geographical form and distribution of farming communities, need more than one. This project is proposing a substantial improvement in marketing infrastructure, as it is presented in Chapter V and Annex 4 of this report.

4.49 Transportation of produce from the Family Islands to Nassau is made by the so-called mail boats. There is a total of 23 mail boats serving all the Family Islands. Although the mail boats provide an invaluable service to The Bahamas (transporting not only mail but also passengers and cargo) none of them is adequately equipped to transport fresh produce. A substantial part of the spoilage of fresh produce is attributable to the poor installations on the mail boats. This issue is addressed by the marketing proposals of this project.

Roads

4.50 The quality of the road infrastructure in the Family Islands varies from island to island. Again, there seems to be an adequate network of roads in the Northern Islands but a much poorer one in the Southeastern Islands. Furthermore, the areas selected for agricultural development under this project are not all connected to the main road network. The project is therefore proposing road construction and/or upgrading according to the needs of each island.

Irrigation

4.51 Because of the porous nature of the calcareous soils of The Bahamas the only water for irrigation is groundwater and irrigation can only be carried out through the gun sprinkler system or through the drip system. Two large-scale citrus plantations on Abaco use a sophisticated drip irrigation system. Medium-sized vegetable farms, like the ones which can be observed in North Andros, adopt the gun sprinkler system. Irrigation is an essential element in the production strategies advanced by this project and a thorough treatment of the subject, as it relates to Bahamian conditions, is undertaken by Annex 3 of this report.

Ports and Wharfs

4.52 The Family Islands as a whole are adequately provided with ports and wharfs for the purposes of this project. Mail boats of different sizes call on the different islands without difficulty and the proposed barges for the roll-on-roll-off container system will be able to call on the ports of the participating islands.

Chapter V. THE PROJECT

A. PROJECT CONCEPT AND RATIONALE

5.01 An analysis of Bahamian agriculture reveals that the sector finds itself at a cross-roads insofar as its role in national economic development is concerned. While its contribution to the GDP and other aspects of economic activity can be considered marginal, the sector possesses the potential to provide critically important leverage required by the economy to achieve improved structural balance, while at the same time stimulating continued development and growth. An assessment of the opportunities which exist to expand the role and the functions of Bahamian agriculture point to areas where such improved contribution could take place:

- o The Bahamian economy is too dependent on the service sector, especially on tourism, and therefore needs to redress its structural balance; agriculture provides such an opportunity (Chapter II).
- o The country utilizes only a fraction, maybe 10 to 15%, of the estimated 170,000 acres of land considered suitable for agricultural use (Chapter IV).
- o The average annual value of the net foreign exchange food bill is \$120 million, which accounts for about 25% of non-petroleum imports and has shown a growth rate of about 14% per year over the past five years (Chapter II).
- o Agriculture seems to provide the most feasible vehicle through which economic development of the Southeastern Islands could be enhanced in the short term; an improved agricultural sector in these islands would undoubtedly serve to reduce migration towards Nassau (Chapters II and IV).
- o Although water is a scarce resource throughout the country, there are ample possibilities for irrigated agriculture in The Bahamas. In the Northern Islands, for example, only 7,300 acres, out of a potentially irrigated area of 40,000 acres, are presently under irrigation (Chapter IV).
- o As tourism increases so does the demand for food and the need to produce it locally (Chapter II).
- o The country's favorable climatic conditions and its proximity to major markets, especially in the United States, provide excellent possibilities for export agriculture (Chapter II).
- o There is ample scope for improvement of productivity through a better provision of agricultural services like research and extension (Chapter III).

5.02 It is from this overall perspective that the concept of the proposed project emerges. The ultimate goal of the project is to improve the structural balance of the Bahamian economy, through the implementation of a well-coordinated set of activities and programmes directed at stimulating the development of the agricultural sector. The project seeks to do so by providing the agricultural sector and its institutions with the necessary infrastructure, services and incentives for agricultural development.

5.03 The most immediate project objectives are the following:

- o to increase agricultural production directed to the domestic market, making the Bahamian economy less dependent on the importation of foodstuffs;
- o to make agriculture a more viable economic alternative, particularly for the populations of the Southeastern Islands, so that they may receive better incomes and contribute more to the economic development of the country;
- o to promote export agriculture in order to improve the country's agricultural trade balance; and
- o to strengthen the technical and managerial capabilities of the Ministry of Agriculture, Trade and Industry so that it can better serve and promote agricultural development in The Bahamas.

5.04 The project will address the main problems and obstacles which presently hinder agricultural production and development, through a set of activities or subprojects directed towards the following areas:

1. Crop Development
2. Livestock Development
3. Research, Extension and Training
4. Agricultural Marketing
5. Feeder Roads

5.05 The Crop Development Subproject has four development proposals or components: Orchard Crops, Selected Miscellaneous Crops, Specialty Crops and Export Crops. Three of these are geared mostly to the small-scale agriculture of the Southeastern Islands, and the fourth has to do with the large potential for export agriculture of the Northern Islands. The main emphasis of the models or proposals designed for the Southeast is on tree crops, a possibility which has been greatly neglected in the recent past. Such tree crops would be destined for both domestic and export markets. The four components were designed taking into consideration the availability of soil and water in the two project sub-areas, the possibilities for rainfed agriculture and the different irrigation approaches associated with the selected crops and availability of water. The less attractive conditions for on-farm investment in the Southeast are expected to be overcome through a number of incentives to be provided by the Government. Farm family incomes are expected to improve considerably. The areas selected for crop development in

the various islands will be connected to the main road networks by feeder roads.

5.06 The Livestock Development Subproject was entirely designed for those Coppice lands of the Southeastern Islands which, although not suitable for crop production, are nevertheless adequate to support certain small ruminants. For this reason, the subproject focuses only on sheep and goats to be raised under technically improved and economically more efficient conditions. This proposal is expected to benefit a large number of farmers in the Southeast. Other livestock development possibilities for The Bahamas, especially in the area of dairy and cattle (beef) production, are discussed in Annex 2 of this report. These possibilities can be explored either subsequent to, or concurrently with, this project but are not part of its present scope.

5.07 The third subproject -Research, Extension and Training- addresses a major area of concern for agricultural development, namely the institutional capability of the Ministry of Agriculture, Trade and Industry, through its Department of Agriculture and other bodies, to serve and promote agriculture in The Bahamas. This subproject proposes a thorough restructuring of the research and extension services of the Ministry by redesigning functions and objectives, redeploying personnel, expanding technical cadres and pursuing an intensive training programme. The institutional strengthening of MATI is viewed as one the major objectives of the project.

5.08 The fourth subproject is Agricultural Marketing, seen as the activity which will make the investment proposals advanced by the project viable. The Agricultural Marketing Subproject has three components:

- (i) **The Produce Exchange System**, which includes the Produce Exchange at Potter's Cay, Nassau, and eleven Packing Houses distributed throughout the project participating islands;
- (ii) **The Mail Boat System**, which provides inter-island transportation of agricultural produce between the Family Islands and New Providence; and
- (iii) **The Market Information Service**, which will process and provide information to allow for the organization of agricultural production and marketing in The Bahamas.

5.09 Given the peculiar geographical configuration of The Bahamas - that of an archipelago of many relatively small islands occupying a large territory -, marketing becomes a crucial element in any attempt to expand and develop agriculture. For the same reason, it is expensive to provide a country like The Bahamas with a minimum necessary marketing infrastructure and services. Marketing infrastructure has to be built on a certain scale, capable of accomodating expansion of production and sales projected for years ahead and not on the basis of the present situation. Also, marketing services have to be in place in a timely manner so as to cope with

perishable or highly perishable produce. That is the reason why this subproject is the most expensive one.

5.10 The fifth and last subproject is related to the Feeder Roads to be built or upgraded in order to link the areas selected for crop development to the main road networks of the participating islands. An estimated 30 miles of new roads will be built on seven of the eleven participating islands.

5.11 It is the strategy of this project that the various development activities proposed will only be accepted and adopted if, first, there is a market for them and, second, if there is a marketing structure to deal with them. By proposing a marketing subproject of the magnitude of the one designed for this project, The Bahamian Government is, in a sense, giving a vote of confidence to the ample possibilities of Bahamian agriculture and to the resilience and resourcefulness of Bahamian farmers. Also, the Government is showing its degree of commitment towards taking a significant qualitative step in the modernization of the agricultural sector and towards the betterment of thousands of lives which depend on it.

B. BRIEF DESCRIPTION OF THE SUBPROJECTS

1. CROP DEVELOPMENT SUBPROJECT^{1/}

Background

5.12 Historically, the Southeastern Islands of The Bahamas have been an area of intense agricultural activity. In the past, farm sizes were meant to accommodate enough cultivation to ensure crop production for family needs. Shifting cultivation was the most common practice. This subsistence-type agriculture began to change as a consequence of changed technical opportunities. While the opportunities exist in terms of availability of agro-chemicals and mechanical power, the costs involved have been high. With the access to markets in the populated centres of New Providence and Grand Bahama, courageous attempts have been made by Southeastern farmers to develop an agricultural economy.

5.13 The approach taken in the design of this subproject was to make crop production a major participant in the Bahamian economy by focusing on alleviating the major constraints it faces. From an agronomic standpoint, the four areas of concern are the following: (a) choice of crops to be farmed; (b) land preparation; (c) water resources; (d) support services. These considerations apply to the project area as a whole -Northern and Southeastern Islands- since this subproject takes both sub-areas into account.

Overall objectives

5.14 The subproject is intended to increase farm family incomes, particularly in the Southeastern Islands, by addressing identifiable constraints to agricultural production and development, achieve a higher degree of self-sufficiency in agricultural production and earn foreign exchange through large-scale production of export-oriented crops.

Selection of crops

5.15 Given the existing climatic conditions and soil types in the project area, there is a large number of crops that could successfully be grown. Over 40 crops were identified as having been sold to the Produce Exchange, in Nassau.

5.16 A list of 29 crops was selected for this subproject (Table 5.1) by taking into account the following considerations:

¹ Annex 1 presents a detailed description of the Crop Development Subproject.

- (a) Crop production priority of the different islands as evidenced by volume of purchases and volume of receipts at the local Packing Houses and at the Produce Exchange, in Nassau.
- (b) The quantity and value of imported fruits which in recent years is typified by the imports of 1987.
- (c) The major crops of interest to the tourist industry in relation to the production possibilities of the participating islands.
- (d) The principal crops of subsistence farming, namely, corn, pigeon peas, cassava and sweet potato, which have been traditionally grown in the project area.

These crops would be given priority in terms of policy decisions regarding agricultural production as well as research and extension services.

TABLE 5.1- 29 SELECTED CROPS OF PRIORITY INTEREST FOR THE BAHAMAS

TREE CROPS	VEGETABLES	STORAGE GRAIN & TUBER CROPS	OTHER
TANGERINE PERSIAN LIME GRAPEFRUIT ORANGE AVOCADO GUAVA COCONUT BANANA PAPAYA MANGO	TOMATO CABBAGE SWEET PEPPER OKRA CUCUMBER PUMPKIN LETTUCE WATERMELON CANTELOUPE IRISH POTATO SWEET POTATO ONION	CORN PIGEON PEAS BEANS CASSAVA	PINEAPPLE HOT PEPPER THYME

5.17 The tree crops have a history of excellent growth under the rainfed conditions of the area as well as a good local and export market potential. The short-term crops have historically been widely cultivated and are in strong demand at the local market.

Orchard Crops

5.18 From among the twenty-nine crops, eleven (11) have been selected as the priority crops for inclusion in a new orchard crops development programme directed to the Southeastern Islands. The programme involves the use of each of grapefruit, persian lime, orange or mango intercropped with a short-term crop chosen from tomato, cabbage, sweet pepper, cucumber, watermelon, Irish potato or onion.

Selected Miscellaneous Crops

5.19 The purpose of this component is to improve the present level of production of existing farms. With a view to encouraging and supporting the vertical expansion of agricultural production in both sub-project areas, a list of sixteen (16) crops was chosen (Table 5.2) and consist of:

- (a) those shown above as orchard crops,
- (b) banana, with good potential for import substitution, and
- (c) the principal subsistence crops of corn, pigeon peas, cassava and sweet potato.

**TABLE 5.2A SELECTED MISCELLANEOUS CROPS FOR
IMPROVED PRODUCTION IN THE BAHAMAS**

TREE CROPS	VEGETABLES	OTHER
<p>PERSIAN LIME GRAPEFRUIT ORANGE MANGO BANANA</p>	<p>TOMATO CABBAGE SWEET PEPPER CUCUMBER WATERMELON IRISH POTATO SWEET POTATO ONION</p>	<p>PIGEON PEA CORN CASSAVA</p>

Export Crops

5.20 For a horizontal expansion of crop production in the North, directed primarily to an export market and providing import substitution for products in high demand on the local market, the following fourteen (14) crops were selected:

Table 5.2B CROPS DESTINED TO THE EXPORT MARKET

TREE CROPS	VEGETABLES
<p>PERSIAN LIME GRAPEFRUIT ORANGE MANGO AVOCADO BANANA PAPAYA</p>	<p>TOMATO CABBAGE SWEET PEPPER CUCUMBER WATERMELON IRISH POTATO ONION</p>

Banana, Irish potato and onion are the crops with the largest potential for import substitution.

Specialty Crops

5.21 Finally, six specialty crops destined for an export market are to be introduced and established initially in the Southeastern Islands and South Andros. They are: Passion Fruit, Annatto, Cashew, Neem, Tamarind and Pimento.

Identification of Components

5.22 A total of four components have been designed for the crop development subproject:

- Component 1: Development of new Orchard Crop Farms in the Southeastern Islands, with an inter-cropping system of selected short-term crops.
- Component 2: Improvement of the existing farming activities throughout the country, related to Selected Miscellaneous Crops, to enable farmers to achieve higher levels of production and personal income.
- Component 3: The introduction of Especialty Crops, initially to the Southeastern Islands and destined for export.
- Component 4: Horizontal expansion of crop production in the North directed primarily to the Export Market is recommended by the project as part of the promotion activities of the Ministry of Agriculture.

COMPONENT 1: ORCHARD CROPS

Background

5.23 The technical and economic evidence points strongly towards the fact that Bahamian farming systems should be moving towards larger size farms with a mix of short-term crops and permanent tree crops. What constitutes a desirable mix in any one location has to take into consideration markets, environmental suitability and support systems in the form of research and extension services.

5.24 Tree crops do particularly well in all islands of the project area. They are more consistently productive under rainfed conditions than the short-term crops requiring planting schedules to coincide with the rainy seasons. Tree crops can accommodate erratic rainfall which is of usual occurrence in the Southeastern Islands.

5.25 Land preparation involving deep ripping allows rapid root growth of tree crops to sufficient depths for secure anchorage and the permanency of the crop once it is established has significant appeal in low labour requirements, except for harvesting.

5.26 The tree crops selected for the project are: Persian Lime, Grapefruit, Orange and Mango. Citrus fruits are remarkably easy to grow because of their tolerance to the highly alkaline conditions that predominate in Bahamian soils. The same applies to mangoes grown with the choice of proper root stock. While citrus fruits and mangoes are highly responsive to supplemental irrigation, mangoes in particular do surprisingly well under the low (<40 ins.) rainfall conditions of the Southeastern Islands.

5.27 In the land clearing and preparation procedures for establishment of tree crops not only can the initially prepared lands be used for production of a short-term crop, but also, with proper selection, inter-cropping can be practised until the tree crops come into bearing and a cash flow is generated in the interim. The crops selected for inter-cropping with tree crops are: Tomato; Cabbage; Watermelon; Cucumber; Sweet Pepper; Irish Potato; Onion. A detailed cost of production and estimated revenue for each of the selected tree crops and short-term crops is shown in Annex 1 (Appendices 2A to 2K and Tables V-6A and V-6B).

Objectives and Justification

5.28 The objective of this Component is to help farmers to achieve a farm income which is in concert with the national per capita income and to provide permanency to the ownership of orchard developed farm lands. Security of tenure is of paramount importance for the achievement of the project's objectives. The justification arises from the fact that an eroding drift of farming families to major populated centres would be stymied by the opportunity for resident inhabitants to engage in gainful and profitable employment activities.

Constraints

5.29 (a) Land Clearing: Land clearing and preparation represents a critically important factor in the development of agriculture in the different islands of the project area. The distinct improvements that it will create are:

- i. A more sustained production system.
- ii. Higher yields and better returns per acre.
- iii. A higher adoption rate and application of improved technology in the areas of machine use, irrigation, pest control and fertilization.
- iv. Increased output per unit of input on cultivated areas.

5.30 The results of detailed experiments involving 2000 acres of land at Andros, suggest that a 1977-78 figure for land clearing and preparation would be about \$150 per acre for Class II and Class III lands (See land classification in Chapter IV and Annex 1 of this report). That figure has risen to approximately \$1000 per acre in

today's terms. In the Southeastern Islands the costs (\$1500 per acre) are approximately 50% higher, given the fact of the higher costs for transportation of the heavy equipment being used and the hardness of rock being pulverized. The land clearing and preparation methods developed in 1977 are appropriate for today's needs. A strategy to concentrate on fruit crop production of cleared lands comes out of the fact that, once cleared and prepared, minimum tillage or no further tillage of the land is required for continuous crop production.

5.31 (b) Research and Extension Services: The increase in acreage of orchard crops in the area has arisen outside of organized research. The focal areas of research specifically related to Bahamian problems have therefore not been emphasized. Questions relating to cropping associations, varieties, cultural practices, fertilizer formulation quantity and content as well as pesticide use at the level of commercial production need to be seen within the context of specific environments. Improvement in the standard and quantity of orchard crop production is a classical role of the Extension Service - a service that currently does not exist in the Southeastern Islands. There is a need to interact with growers to address practical difficulties such as finding appropriate stock and scion material, obtaining fertilizers and pesticides, and solving the more diffuse problems which will only be possible through local research.

The Plan

5.32 An intercropping programme aimed at the ultimate production of an orchard crop under rainfed conditions is the basic design. A model involving onion as the intercrop and mango as the orchard crop was developed to represent any combination of the tree and vegetable crops suggested above. The cost of production and expected revenues are detailed in Annex 1 (Table V-6) where there is an indication of all the assumptions inherent to the model. The stream of net benefits before financing, which reflects the return to all resources engaged in production, has a Financial Internal Rate of Return (FIRR) of 43% and its Net Present Value (NPV), at a 12% discount rate, is \$73,000.

5.33 Some general features assumed are outlined below: (a) Land clearing and preparation will be provided by the Government as a grant; such grant can be recovered by the incremental production of the short-term crop of the first acre only (b) Farm equipment consisting of a backpack sprayer, a mist blower and other small tools are provided as a loan in kind, to be repaid by the farmer; (c) Likewise, all inputs necessary to establish the first three acres of the onion/mango combination will be provided as a loan in kind; (d) The total value of such loan per farmer is \$4,000; (e) Improved agronomic practices as well as desirable agro-chemical inputs are in place.

5.34 Detailed costs of production and expected revenues for each of the selected tree and short-term crops are shown in Annex 1, Appendices 2A to 2K. The assumptions made in the case of the mango-

onion mix are applicable to the other tree crop/short-term crop mixes.

5.35 The orchard crops selected were Persian Lime, grapefruit, orange and mango, while the short-term intercrop could be any one of tomato, cabbage, sweet pepper, cucumber, watermelon, irish potato or onion. Several possible combinations may be selected for the different islands and this can be done by using data presented in Annex 1, Appendices 2A to 2K, and Table V-2B. For example, the tree crops of the selected crops suitable for Long Island, i.e. Persian Lime and mango, could either be intercropped with Irish potato or onion. Similarly, for Crooked Island, any citrus crop, but preferably Persian lime and tomato. The cost of production and revenue figures indicated in Annex 1, Appendices 2A to 2K can be used to develop the expected income of the farmer depending on the crop mix chosen. Crop mixes would be dictated by the extension personnel making use of information as to the most desirable crop for a particular island (See Annex 1, Table V-2B).

5.36 In the development of this Component, the following programme is envisaged:

(a) Each participating farmer agrees to develop a five-acre plot. The Ministry of Agriculture will carry out land clearing and preparation, at an estimated cost of \$1,500 per acre, or \$7,500 for the whole farm. This will be provided to the farmer as a grant, to encourage him to join the project. Farm equipment (backpack sprayer, mist blower and small tools) as well as all inputs to establish the first three acres of the farm will be provided as a loan in kind, for a total value of \$4,000, to be repaid by the farmer.

(b) The participating farmer contracts to establish a short-term crop on the first clearing and preparation of the land, and agrees to follow with the establishment of a tree crop on the previously cultivated land. This procedure is repeated annually over a five-year period.

(c) The Extension Service will manage the distribution of inputs and will supervise the collection of payments on interest and principal, according to the scheme proposed by the project (Credit Guarantee Fund for the loan).

(d) All labour is assumed to be hired labour. If the farmer, as expected, commits his own labour, this means that his cash flow in the model, which reflects the returns to his management skills and capital, will be increased by an amount equivalent to the number of days he worked.

(e) The farmer will repay the loan by paying interest at the rate of 11% annually, beginning in the second year of operation, within the Credit Guarantee Loan facility.

(f) Repayment of the principal will be deferred to the end of Year 6.

(g) When the five acres are established as an orchard, it is suggested that the Government provide an ownership title to the farmer at a previously agreed valuation.

Beneficiaries

5.37 The primary beneficiaries of this component will be the currently classified subsistence farmers of The Bahamas, whose number amounts to approximately 1,400 (Table 5.3). A very conservative estimate was adopted that, of these, only 140 (or 10%) are expected to join this programme. Such farmers would be located on the six Southeastern Islands and on South Andros, at an average of 20 farmers per island.

5.38 In addition to the number of subsistence farmers, there are a smaller number of farmers in the Southeast (370) who, in addition to supplying family needs, produce additional quantities of produce for sale locally or to the Packing Houses. Although these have been considered as commercial farmers by the project, they are still small-scale farmers who could benefit from this component. Therefore, while the number of direct participants of this component has been estimated as 140, the number of its potential beneficiaries is 1,770.

TABLE 5.3 SUBSISTENCE AND COMMERCIAL FARMER DISTRIBUTION IN THE PROJECT AREA

ISLAND	NUMBER OF FARMERS		
	SUBSISTENCE	COMMERCIAL	TOTAL
ELEUTHERA	50	350	400
ANDROS	380	120	500
NEW PROVIDENCE	90	40	130
ABACO	105	25	130
GRAND BAHAMA	40	30	70
SUB-TOTAL	665	565	1230
LONG ISLAND	140	180	320
CAT ISLAND	185	65	250
EXUMA	200	70	270
ACKLINS	75	25	100
CROOKED ISLAND	65	20	85
MAYAGUANA	70	10	80
SUB-TOTAL	735	370	1105
TOTAL	1400	935	2335

Support Services

5.39 The Ministry of Agriculture, through the Extension and Research Services, and through the Produce Exchange/Packing Houses system will provide each farmer with technical, managerial and marketing inputs as well as a \$4,000 loan, in kind, to initiate the project.

Markets

5.40 The expected markets for the short-term crops are the local market on each island and the country's market, which includes the tourism industry, through the proposed new Produce Exchange system. The expected markets for the orchard crops are the same ones as for the short-term crops, plus an export market as larger-scale, commercial production develops.

Environmental Impact

5.41 These observations on environmental impact are valid for all crop development proposals advanced by this project and, in fact, go beyond the scope of the project to apply to any agricultural development project in The Bahamas. Against the background fact that the preservation of freshwater lenses for potable water will always be a high priority in The Bahamas, it is most important that the use of agro-chemicals be limited to absolute minimum quantities consistent with their effectiveness. In the implementation of agricultural projects in the South and in the North, it should be expected that there will be a difference in the kind and quantities of fertilizers and pesticides that will be used in those two sub-areas.

5.42 Given the historically limited use of agro-chemicals in the South and the investment costs associated with their use, excessive use is not to be anticipated in that area. While the project visualizes that in the initial years a variety of vegetable crops will be introduced in the area, the ultimate plan is to put in place orchard crops, where the pesticide requirements are likely to be less than those for vegetable crops. It is also expected that the drier climatic conditions of the South will be less conducive to the development and persistence of most pests likely to be found in the northern area.

5.43 With respect to the production activities of the North, a wider variety and larger quantities of agro-chemicals per unit area might be expected both from the standpoint of more humid conditions necessitating greater control of pests as well as the fact that highly commercial enterprises with a view to maximizing production often over-fertilize and make use of excessive pesticide applications as an insurance measure.

5.44 In the short term, there is no great concern to possible contamination of the underground waters based on the following considerations: (a) Movement of chemicals in solution to great

depths within the soil profile is unlikely. The very important question of ensuring a lack of fresh water contamination can effectively and efficiently be handled by imposition of a monitoring system at sites with high agro-chemical activity; (b) In the highly calcareous environment of all soils of the area, the chemical interactions of fixation and immobilization will dominate in surface soil layers; (c) Microbial activity will slow down, and in some cases eliminate, the ultimate possible toxic chemicals reaching the underground water occupying lenses with depths of 40 feet or greater.

5.45 For the crops and cropping patterns anticipated in both sub-project areas, a list of expected pesticides that might be used is shown in Annex 1, Appendix 1A to 1K. It outlines in some detail important characteristics of the compounds. They are relatively safe chemicals which, if used according to the manufacturers specifications, present no hazard.

TABLE 5.4
PROJECT LOAN FACILITY
REQUIREMENTS TO ESTABLISH 5-ACRE ORCHARD FARMS
(US\$)

	Y E A R S				TOTAL
	1	2	3	4	
CREDIT REQUIREMENTS PER FARMER					
SPRAYER + SMALL TOOLS	350				
ONION INPUTS - ACRE 1	460	391			
ACRE 2		460			
ACRE 3			460		
MANGO SEEDLINGS - ACRE 1		640			
ACRE 2			640		
ACRE 3				640	
TOTAL PER FARMER	810	1,491	1,100	640	4,041
FINANCING (LOANS IN KIND)	800	1,500	1,100	600	4,000
REQUERIMENTS PER ISLAND (x 20)	16,000	30,000	22,000	12,000	80,000
TOTAL SEVEN ISLANDS	112,000	210,000	154,000	84,000	560,000

Costs

5.46 The Orchard Crops Component will have a total cost of \$1,610,000, of which \$1,050,000 refer to land clearing and preparation to be provided by the Government as a grant, and \$560,000 represent the total amount of credit in kind to be delivered to the participating farmers.

Socio-Economic Benefits

5.47 The socio-economic benefits expected to result from the implementation of this component are several and reflect a turning point in the agriculture of the Southeast. They are discussed in detail in the financial and economic analysis of the project conducted in Chapter VII of this report. In summary, they are the following:

- * The potential of the area for production of tree crops under rainfed conditions is utilized; besides, irrigation will be possible in the crop development areas selected by the project;
- * Farming will become a permanent activity, concentrated on one site, and conducive to higher and more stable incomes;
- * Land ownership titles will fix the farmer to the land, create incentives for further on-farm investment, attract new people to farming and reduce outmigration;
- * Labour requirements will increase substantially, by this way creating employment;
- * The incremental crop production will contribute to making the country more self-sufficient in food production, and to save foreign exchange.

5.48 Of special importance to the Bahamian Government is the issue of outmigration of the populations of the Family Islands to Nassau and Freeport. Assured of a good standard of living and having acquired property - which is a feature of the project - the farmer will have a strong incentive to stay on his native island.

COMPONENT 2: SELECTED MISCELLANEOUS CROPS

5.49 The improvement of agricultural production and productivity in The Bahamas must be based on a two-pronged strategy of vertical expansion, resulting in increased yields per acre of present farming activities, and horizontal expansion, in the sense of bringing abandoned farm lands back into production as well as moving towards the more favoured areas located over good underground water reserves.

Objectives

5.50 The main objective of this Component is to improve crop production and productivity on the existing farms of The Bahamas by bringing about the two kinds of expansion mentioned above.

Crop Selection

5.51 The crops selected for this component are the following:

- (a) The crops included in the Orchard Crops Component (See Table 5.2). The rationale is that these crops are in strong demand in the local market, and a history of familiarity with their husbandry, albeit insufficient, exists in Bahamian agriculture. Production of short-term crops without inclusion of a tree crop is a viable option as a farming system for beneficiaries in both project sub-areas.
- (b) Subsistence crops, namely corn, pigeon peas, cassava and sweet potato. These crops are the most amenable to vertical expansion, given the present situation of untested varieties and the lack of use of adequate agro-chemicals as well as farm machinery.
- (c) Banana. Currently, this crop has the best potential for import substitution in The Bahamas. Current import exceeds \$1.25 million. The cost of production and expected revenue for the selected crops are outlined in Annex 1 (Appendices 2A to 2K and Tables V-6A and V-6B).

Constraints

5.52 **Seasonality of Crops** - in the attainment of greater self-sufficiency, the seasonality of production for fruit and vegetables is probably of greater importance than total quantity produced in that seasonal gluts result in waste. The seasonality of different fruits and vegetables in the project areas, as evidenced by supply to the Produce Exchange, is shown in Table 5.5. A most desirable situation would be to have demand and supply coinciding in the same periods. The difficulty is that in scheduling production of short-term crops, climatic factors have a great impact on yields and indeed on the survival of the crop. Consequently, planting schedules should be dictated by climatic factors rather than demand, which tends to be evenly distributed throughout the year.

5.53 **Irrigation:** Under rain-fed conditions, it is necessary to program crop establishment to coincide with the period of higher rainfall. The net result is cycles of gluts at harvest periods. The introduction of irrigation facilities permits a measure of control in maximizing crop yields but a major consideration is costs, particularly for limited acreage.

5.54 **Research and Extension:** Research and Extension Services are currently inadequate for the project area, and the present levels of production reflect that deficiency.

5.55 **Farm Size** - It was shown in the Chapter IV, Table 4.4, that 42.5% of farmers occupy less than 2 acres of land in The Bahamas. An additional 28% occupy 2-5 acres. For a viable operation providing returns that approach the national per capita income, a minimum of 5 acres would be required for most crops. Consequently, increased farm sizes are to be envisaged.

Production

5.56 **Seasonality:** The seasonal availability of domestic produce is shown in Table 5.5. The major component of the seasonality problem from the standpoint of production is the weather. Heavy rains, with an accompanying more humid atmosphere, greatly increases disease problems. In addition however is the natural seasonality of tree crops coming in to bearing. Table 5.6, which was prepared on the basis of Table 5.5, outlines deficiency periods, and proposes solutions to the problems via research and extension activities.

TABLE 5.5 DEFICIENCY PERIODS OF SELECTED FRUITS AND VEGETABLES AS REFLECTED IN PRODUCE EXCHANGE PURCHASES AND PRODUCTION APPROACHES TO A SOLUTION.

CROP	PERIOD OF DEFICIENCY	LIKELY CONSTRAINT	APPROACH TO SOLUTION
GRAPEFRUIT	APRIL TO SEPT	SEASONALITY OF PRODUCTION	SELECTION OF VARIETIES, SHOCK TREATMENT
ORANGE	APRIL TO AUG	SEASONALITY OF PRODUCTION	SELECTION OF VARIETIES, SHOCK TREATMENT
MANGO	SEPT TO APRIL	SEASONALITY OF PRODUCTION	SELECTION OF VARIETIES, MANIPULATION OF FLOWREING
AVOCADO	FEB TO JULY	SEASONALITY OF PRODUCTION	SELECTION OF VARIETIES
PINEAPPLE	AUG TO SEPT	SEASONALITY OF PRODUCTION	CHEMICAL MANIPULATION OF FRUITING
TOMATO	AUG TO OCT	HIGH RAINFALL AT PLANTING	ADAPTABLE VARIETIES TO ACCOMMODATE RAINFALL PATTERN
CABBAGE	JULY TO DEC	HIGH RAINFALL AT PLANTING	ADAPTABLE VARIETIES AND MOUNDING
SWEET PEPPER	AUG TO NOV	HIGH RAINFALL AT PLANTING	ADAPTABLE VARIETIES AND PESTICIDE PROGRAMME
WATERMELON	JAN TO JUNE	LOW RAINFALL AND NUTRITION	IRRIGATION, VARIETY CHOICE AND PLANT NUTRI-TION
CASSAVA	MAY TO NOV	PLANTING SCHEDULING	ADAPTABLE VARIETIES, AND DELAYED HARVESTING
IRISH POTATO	MAY TO NOV	PLANTING SCHEDULING & TEMPERATURE	ADAPTABLE VARIETIES AND LOCATION
HOT PEPPER	FEB TO APRIL	INAPPROPRIATE PLANT SCHEDULING	PROPER PLANT SCHEDULING
ONION	AUG TO MARCH	INAPPROPRIATE VARIETIES	SELECTION OF VARIETIES FOR PHOTO PERIOD SENSITIVITY

5.57 **Irrigation** ^{1/}: Irrigation represents one of the major inputs significantly impacting on crop production. Constraints to its use arise firstly from irrigation water that is in competition with potable needs and secondly, from high capital costs (including installation costs) and operational costs. The impact of irrigation on selected miscellaneous crops is shown in Table 5.7.

5.58 Against the background of identifying areas with sufficient availability of water for irrigation needs, models with costs were developed by the mission irrigation specialist for the following situations:

- i. **Commercial Supplementary Unlimited Irrigation System** using a gun sprinkler for 35 acres of fruit or vegetables in the Northern Islands.
- ii. **Commercial Supplementary Unlimited Irrigation System** using drip for 32 acres of vegetables in the Northern Islands.
- iii. **Commercial Supplementary Limited Irrigation System** using a gun sprinkler for one (1) acre of mixed crops in the Southeastern Islands.

5.59 In the case of the system designed for one-acre mixed crops farms in the Southeastern Islands, if the capital costs (including installation costs) were amortized over a 10-year period (\$107) and the operational cost of \$ 54.75 per acre taken into account, the additional expenditure of approximately \$162 per acre for irrigation would see sweet pepper providing an estimated revenue of \$12,000 per acre (See Table 5.7) compared to \$6,000 per acre under rainfed conditions (Annex 1, Appendix 2G). Similarly for banana, revenues of \$ 5,400 per acre (Annex 1, Appendix 3E) would increase to \$10,800 per acre (See Table 5.7).

1/ Annex 3 presents a detailed description of irrigation and its possibilities in The Bahamas.

TABLE 5-6 ESTIMATED CROP YIELDS UNDER RAINFED AND IRRIGATED CONDITIONS

CROPS	RAINFED CONDITIONS		IRRIGATED CONDITIONS & IMPROVED HUSBANDRY (Lb/AC.)
	CURRENT (Lb/AC.)	IMPROVED HUSBANDRY (Lb/AC.)	
IRIS POTATO	8,300	15,000	20,000
SWEET PEPPER	7,300	20,000	40,000
CABBAGE	12,000	25,000	36,000
WATERMELON	15,500	20,000	40,000
ONION	8,000	12,000	16,000
SWEET POTATO	6,000	10,000	15,000
CORN	1,000	4,000	6,000
PIGEON PEA	1,100	2,000	2,500
CASSAVA	11,800	18,000	23,600
BANANA	15,300	20,000	40,000
PERSIAN FRUIT	10,800	17,000	22,800
GRAPEFRUIT	21,400	33,000	45,000
ORANGE	6,550	20,000	27,000
CUCUMBER	15,600	25,000	40,000
TOMATO	12,400	25,000	35,000

Research and Extension

5.60 The proposed establishment of a Research and Extension Centre in the Southeastern Islands and the strengthening of the institutions at Bahamas Agricultural Research Centre (BARC) and Gladstone Road Agricultural Complex (GRAC) will provide substantial support in the thrust for increasing crop yields. Specific areas to be attended to would be the choice of varieties, irrigation and agro-chemical inputs that optimize the effect of fertilizers or control pests reacting to a change in environment. A detailed presentation relating to individual crops is outlined under the selection of crops (Paragraph 5.51).

Farm Size

5.61 An increase in farm size to a minimum of five acres is anticipated for most crops to ensure a desirable farm income. While the larger farm sizes will increasingly demand the use of farm machinery and equipment, at the level of 5 acres most farmers would need to look to some co-operative arrangement for equipment use. In this regard the need to develop co-operatives might be attractive and would need the support of the Extension Service. A history of interest in co-operatives exists in The Bahamas and currently there are seven (7) active co-operatives of agricultural orientation in the two project areas.

Markets

5.62 In anticipation of increased crop production, the possible marketing outlets to be recognized are firstly the local market operating through the Produce Exchange and secondly, the local market directed to the tourist industry. Since the tourist industry requires fairly large volumes of fruits and vegetables at peak season, the matter of producing in a manner to address seasonality is of utmost importance. With hotels located in different islands, a strategy could be developed to have each island producing more competitively the needs of its tourist industry. From the selected fruits and vegetables involved in the project, crops have been matched with island potential for production (Annex 1, Tables V-4A and V-4B).

Costs

5.63 This component has no direct costs. Its implementation and development will be a consequence of the implementation of the project itself, i.e. the provision of agricultural infrastructure and/or services like Extension, Research, Training, Marketing, Market Information Service, and Feeder Roads.

Benefits

5.64 The socio-economic benefits arising from this component are the same as in the previous one, except that the emphasis here is on improving current operations, on bringing abandoned agricultural land back into cultivation, and principally on encouraging former farmers to go back into farming. The incremental benefits expected to accrue from this component, all based on very conservative assumptions are presented in Table 5.7 below.

Beneficiaries

5.65 The beneficiaries of this component are the totality of 2,400 farmers of The Bahamas, a number that is far below the 4,400 farmers reported by the 1978 Agricultural Census. Therefore, the potential beneficiaries of this component are all those former farmers who could be wooed back into farming by the services to be offered by the project.

TABLE 5.7 THE BANUMAS: SUPPLY OF AGRICULTURAL PRODUCT
 "WITHOUT PROJECT" AND "WITH PROJECT" SITUATIONS
 CROP DEVELOPMENT MODEL 2

	Y E A R S																		TOTAL INCREMENTAL	
	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		YEAR 7		YEAR 8-20					
	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q		
A. MODEL 2: MISCELLANEOUS CROPS																				
1. ACRES UNDER CULTIVATION 1/ INCREMENTAL	9,000		9,900		10,900		11,800		12,500		13,125		13,500		13,500		50	4,500		
2. YIELDS (TONS/ACRE) 2/	1.33		1.36		1.38		1.40		1.42		1.44		1.46		1.46		10			
3. TOTAL PRODUCTION (TOW) INCREMENTAL	12,000		13,440		15,000		16,500		17,800		18,900		19,700		19,700		64	7,700		
4. RETURNS PER ACRE (\$) 3/ INCREMENTAL	700		770		808		850		870		890		900		900		29	200		
5. VALUE OF PRODUCTION (\$'000) 4/ INCREMENTAL	6,300		7,623		8,807		10,030		10,875		11,681		12,150		12,150		93	5,850		
			1,323		2,507		3,730		4,575		5,381		5,850		5,850					

(See notes on the following page)

NOTES ON TABLE 5.7

1. Of the 170,000 acres of cultivable land in The Bahamas, it is estimated that only 17,000 acres, or 10%, are presently being cultivated, due to the dramatic decrease in farming activities over the last five to eight years. Of those, about 7,000 acres are allocated (although not fully utilized yet) to two large, export-oriented citrus enterprises on Abaco Island. That would leave 10,000 acres for "domestic production", mostly farmed by subsistence and commercial farmers on Andros and on the Southeastern Islands. The figure of 9,000 acres is a lower estimate of total area under cultivation. The increases in area under cultivation from Year 2 to Year 7, an increment of 50% over "without project" acreage, are conservative estimates of "old" areas being brought back into production because of the incentives offered by the project, and do not therefore represent "new" agricultural areas.

2. Some substantial improvements in agricultural yields are expected to take place under the project, due to a combination of better land preparation, provision of technical assistance by the Extension Service and, in some cases, irrigation. Nevertheless, a very conservative approach was adopted here, in which yields increase only 10% over a 6-year period.

3. Returns per acre will improve due to the production of better quality produce and to improved farming and marketing practices. Figures try to reflect the fact that a larger supply of better quality produce, coupled with sound marketing procedures, will eventually lower prices to the consumer and, therefore, to the farmer.

4. Due to the whole spectrum of improvements expected to take place under the project - adaptive research, extension services, market information service, improved marketing infrastructure and systems -, the total value of production is expected to practically double in six years, causing, in turn, a substantial improvement in farmers' incomes throughout the country. The incremental figures for value of production are shown in its usual accumulated pattern while the others are shown on a year-by-year basis so that the annual increments may be noted.

COMPONENT 3: SPECIALTY CROPS

5.66 Despite the wide variety of crops growing in The Bahamas, there are a number of crops with special characteristics which could be readily accommodated in the Southern region and South Andros. Indeed, a precedent exists in the current production of cascarilla on Crooked Island and, to a more limited extent, in the other islands. Such an approach allows for the participation of the Southeastern Islands in a programme geared to access international markets despite the constraints of soils and climate.

Objectives

5.67 By selecting crops of special characteristics that can accommodate the existing constraints of soils and climate of the Southeastern Islands, access special international market niches.

Crop Selection

5.68 The conditions taken into consideration for crop selection were:

- (a) Calcareous soils and rugged terrain dominate the Southeastern Islands.
- (b) Rainfall is low, i.e. 30 to 40 ins. annually.
- (c) A low level of crop care can be tolerated, since the crops are known to be relatively free from attack by pests and diseases.
- (d) The crops chosen lend themselves to on-farm storage prior to sale.
- (e) High market value crops make small scale production acceptable and manageable from an employment standpoint.
- (f) High international market demands prevail.

5.69 Detailed information concerning each crop is shown in Annex 1. Of the crops indicated below, only tamarind is grown to any extent in The Bahamas, but a concentration of a greater number of trees per unit area would be required to ensure minimum volumes adequate for harvesting and shipping. The crops chosen are:

ANNATTO	(<i>Bixa orellana</i>)
NEEM	(<i>Azadirachta indica</i>)
CASHEW	(<i>Anacardium occidentale</i>)
PIMENTO	(<i>Pimenta dioica</i>)
TAMARIND	(<i>Tamarindus indica</i>)
PASSION FRUIT	(<i>Passiflora edulis flavicarpa</i>).

The Plan

5.70 A profile of activities and requirements follow:

- (a) Crop: A total of 6 crops are involved and a minimum of 4 crops will be introduced to any one island in the Southeastern project sub-area as well as in South Andros.

- (b) **Location:** Selected islands chosen with a primary concern for rainfed conditions and soil type.
- (c) **Planting Material:** The approach to ensure that the effort has very positive results, with wide farmer participation, should come out of the Government taking the initiative of securing, propagating and then distributing the planting material. This programme could readily be carried out in tandem with that designed for the ultimate development of crops in the Southeastern Islands. Planting materials would be released through the Extension Department of the Ministry of Agriculture and controlled in a manner to ensure annual planting by participants.
- (d) **Strategy For Development:** The participating farmers and beneficiaries would be selected and chosen on the basis of their willingness to provide all inputs of production except the planting material. As a condition for continued participation, they would have to abide by the instructions and advice of extension personnel.
- (e) **Extension Services:** Extension agents will be active in the supervision, planting material release, and interacting with local farmers. Fertilizer application and other desirable inputs are to be encouraged. Crop management and periods of establishment will be outlined.

Markets

5.71 In the first year of the programme only passion fruit would be expected to come into bearing, followed by annatto within two years, and most other crops within five years. The principal activity to promote and provide market information would be extended through the Ministry of Agriculture. The Produce Exchange would be the channel to ensure marketing of products initially.

Costs

5.72 A projected development of trees covering 280 acres in seven islands (Table 5.8) would take place over a two year period at a cost of \$79,000 (See Annex 1 Table V-12B). The costs of the extension services and those incurred by the participants are not included.

TABLE 5-8

ACREAGE, LOCATION AND COST OF NEWLY INTRODUCED PLANTS
TO THE SOUTH BAHAMAS. 1989.

ISLAND	NEEM AC	ANNATTO AC	CASHEW AC	PASSION FRUIT AC	PIMENTO AC	TAMARIND AC	TOTAL ACRES
S. ANDROS		5	10	10	5	10	40
LONG IS.		10	10	10	10		40
CAT IS.	10	10		10	10		40
EXUMA		10		10	10	10	40
ACLINS	10	5	10		10	5	40
CROOKED IS.	10	5	10	5	5	5	40
MAYAGUANA	10	5	10	5		10	40
TOTAL ACRES	40	50	50	50	50	40	280
PLANTING MAT. (ea.)	2,800 seedl.	10,000 seeds.	3,500 seeds.	14,500 seeds.	3,500 seedl.	2,800 seedl.	37,100
COSTS \$							
IMPORT.	14,000	500	500	250	17,500	14,000	46,750
PROPAG.		10,000	3,500	14,500			28,000
DISTRIB.	450	750	600	1,200	600	450	4,050
TOTAL	14,450	11,250	4,600	15,950	18,100	14,450	78,800
COST/ACRE	361.25	225.00	92.00	319.00	362.00	361.25	281.43

Socio-Economic Benefits

5.73 The main socio-economic benefits would be the following:

- (i) Continuing development of the above-mentioned agricultural crops with export potential and, consequently, greater possibilities for foreign exchange earnings.
- (ii) As anticipated, widespread participation by farmers in the South could fuel the expansion potential to the North by private investors.
- (iii) Definitive participation of newly introduced extension agents will have great credibility to farmers when dealing with crops previously unknown to local farmers.
- (iv) Development of a new viable economic activity.

Targeted Beneficiaries

5.74 Direct beneficiaries will be a total of 140 participant farmers to be taken from the seven islands mentioned in Table 5.8 (20 farmers per island).

COMPONENT 4: EXPORT CROPS

5.75 In the North, large tracts of land, suitable soils and sufficient water resources to ensure adequate irrigation set the stage for agricultural production, allowing it to access and re-enter world markets with fruits and vegetables. One of the early difficulties relating to land preparation has successfully been overcome, as evidenced by large citrus and papaya groves in the North.

Objectives

5.76 The main objective of this component is to call the attention to the need for a continuous promotion of export agriculture in The Bahamas, since the potential for crop production is far beyond the possibilities of the domestic market. The component also shows that there is a tradition of export agriculture in The Bahamas and that many successful enterprises are presently producing for the export market. Consequently, no project actions are designed and therefore there are no costs associated to this component.

The Experience

5.77 Eleuthera - Eleuthera is typified by the diversity of products it produces. A 1200-acre farm in South Eleuthera owned by Bahamas Star Company is actively producing Sunrise Solo papaya under drip irrigation for export to the U.S. market. Avocado is also being produced for the local market. An estimated 15 to 20 investors occupy farms with acreages up to 200 acres, principally in the North section and avocado, mango, persian lime, grapefruit and banana are the principal tree crops. Pineapple, vegetables and pigeon peas are produced commercially and canning facilities are in place but not currently being used. An estimated 8,476 acres of minimum potential agricultural land have been identified at 6 locations in Eleuthera (Table 5-9). A possible 1,242 acres suitable for irrigation could be put in production.

5.78 Andros - In the 1950s, the Parker Brothers explored the possibility of commercial agriculture in North Andros, and with great success established a significant market share for cucumbers in the U.S. and Canada. In 1978, over 450 acres in the Twin Lakes region were cultivated to cucumbers, strawberry, okra and sweet pepper for export. With the advent of the research centre in Andros, a diversity of agricultural projects were carried out and recorded information as to crop capabilities came out of investigations. Tree crops, vegetables, pastures and other crops were studied. In 13 different areas within North and Central Andros, 62,819 acres of minimum potential agricultural land have been identified. Of this total, 26,271 acres have been designated as suitable for irrigation (Table 5-9).

5.79 Abaco - The Bail lands of approximately 10,000 acres allocated for sugarcane production were abandoned in 1972. Currently 5,000 acres of these lands are occupied by Harmon Limited, 2,080

acres of which have been established to citrus, principally grapefruit, and destined for the Japanese market. The Bahama Star company occupies 3,000 acres of prime land in Abaco, dedicated exclusively to citrus production, principally grapefruit but also Persian lime. Marketing is carried out directly by the Company and the established market is the U.S. Bulk transportation of produce by their own vessels is made to Florida, and packaging takes place in their Miami-based warehouses. A fair number of smaller farms, from 5 to 25 acres, have an interest in bananas, canteloupe, watermelon and vegetables destined to the local market. Proper infrastructure such as irrigation is not in place. 18,015 acres of land scattered over 10 locations in Abaco have been classified as minimum potential agricultural land with adequate water resources for irrigation (Table 5.9) and 14,775 of them have been considerable as suitable for development.

5.80 Grand Bahama - Grand Bahama Growers Ltd., occupying 2,000 acres, is actively producing Sunrise Solo papaya, 200 acres of which are already established under drip irrigation, and an additional 200 acres of land actively being prepared for the further establishment of papaya. The Bahama Star Company has 1,000 acres identified principally for Sunrise Solo papaya production. The company is also involved in the establishment of a large-scale guava project. Freeport Citrus Company currently has 360 acres of Persian Lime in full bearing and an additional 240 acres which have been cleared in preparation for expansion.

5.81 On Grand Bahama Island is concentrated the largest number of medium-sized commercial farms varying from 25 to 100 acres. The principal interests are in citrus, papaya, banana, tomato, cabbage and sweet pepper. Irrigation is in place. High technology is not apparent on these smaller farms. The minimum potential agricultural land (Table 5.9) identified in Grand Bahama is 60,025 acres at 5 different locations. 5,435 acres have been designated as being suitable for irrigation.

TABLE 5.9 SELECTED AGRICULTURAL LAND OF 40ft MINIMUM LENS THICKNESS IN THE NORTH SUB-PROJECT AREA

ISLAND	NUMBER OF LOCATION	MINIMUM POTENTIAL POTENTIAL AGRICULTURAL LAND	AREA SUITABLE FOR IRRIGATION IN FIRST PHASE
		ACRES	ACRES
ELEUTHERA	6	8,476	1,242
ANDROS	13	62,819	26,271
ABACO	10	18,015	14,775
GRAND BAHAMA	5	60,025	5,435

Source: Developed in conjunction with the mission Irrigation Specialist and the Land and Surveys Department.

Targeted Crops

5.82 The targeted crops for production in the North area were determined on the basis of export potential and the attractiveness relative to import substitution. They are:

Persian Lime	Tomato
Grapefruit	Cabbage
Orange	Sweetpepper
Mango	Cucumber
Avocado	Watermelon
Banana	Irish Potato
Papaya	Onion

Import Substitution

5.83 Import of bananas to The Bahamas was in excess of \$1.25 million in 1988 and this represents the trend over the last few years. The crop is therefore a prime target for import substitution. Wind is the greatest problem for growers of bananas, and this accounts for the universal popularity of the dwarf types. Technical practices observed indicate that, in as much as many farmers were engaged in production, standards were low. Inadequate use of fertilizers and poor cultural practices was widespread. On many farms banana cultivation was of secondary interest. Pure stand commercial cultivations have a definite place in agricultural development. In addition to banana, the two most likely candidates for increased production as it relates to import substitution is onion and Irish potato. In both cases the major constraint is seasonality of production under rainfed conditions. The matter of appropriate varieties, irrigation and storage techniques will need to be a concern of the Research Services of the Ministry.

Infrastructural Requirements

5.84 For large-scale production of any of the selected crops targeted for export, irrigation is mandatory. This arises from the fact that, in addition to the desirability of maximizing yields, price competitiveness on an international scale is of paramount importance. In the selection of primary fruits and vegetables for export production, the recent wholesale prices in Miami (Annex 1, Table V-16) were used as a reference for arriving at desirable levels of production per acre that would make Bahamian produce competitive. In most instances the price ranges in Miami are considerably less than those obtained for locally produced fruits and vegetables. The implications are that, from the export standpoint, economies of scale from higher production levels and or lower production costs will need to be in place. The substantial difference in yield with the provision of irrigation is indicated in Table 5.7. Irrigation is therefore an overriding consideration in production.

5.85 With respect to the North, irrigation installations and their respective operational costs have been developed for ¹ :

- (a) A 32-acre vegetable crop production under drip irrigation.
- (b) A 40-acre citrus crop production under drip irrigation.
- (c) A 35-acre fruit or vegetable production under gun (sprinkler) irrigation.

5.86 The indicative costs are a sound basis for judgement, at the pre-feasibility stage, regarding a potential investment, but feasibility studies would naturally have to follow. With the great concern for maximizing production, site selection assumes an importance equal to that of the installation of irrigation facilities. In this respect, the most suitable areas from the standpoint of the availability of an irrigation water supply were identified (Table 5.9) and should be of major service at the preliminary stages of investment promotion.

Markets

5.87 A prominent feature of current investments in fruit and vegetable production in the North is the fact that most producers are producing for their own markets. This is especially true for the major producers farming in excess of 1,000 acres. A definitive marketing strategy will therefore be needed for the small to medium-scale producers looking to the export market. This has been dealt with in some detail by the Marketing Subproject, in this Chapter and in Annex 4 of this report. In the very short term, the export opportunities to Florida (Annex 1, Table V-14) have been identified as a priority approach to production. In view of the fact that most tree crops only come into production three to four years after being planted, papaya is an attractive alternative for intercropping in that only 8 to 9 months are required for fruits to nature.

Research and Extension

5.88 While the very large-scale producers, i.e. those occupying in excess of 1,000 acres, can and do bring in their own technology with on-going retainer contracts, this is less likely for the medium to small-scale producers who will increasingly look to Government sources by way of Research and Extension for assistance. At the research end, the areas of work have previously been identified (See Research, Extension and Training Subproject). A possible role for the Extension Service relates to assistance that could be provided in the organization of co-operatives that would facilitate production and marketing of crops for the smaller scale producers. (A list of presently active co-operatives is shown in Component 2: Selected Miscellaneous Crops).

¹ See Annex 3 of this report.

Beneficiaries

5.89 The targeted beneficiaries are not restricted to farmers currently involved in agricultural production but is open to the employment demands generated in large-scale agricultural projects.

2. LIVESTOCK DEVELOPMENT SUBPROJECT: SHEEP AND GOATS ^{1/}

Background

5.90 The Bahamian agricultural sector contributes about 5% of the GDP and employs 5.6% of the work-force. The livestock sector in particular contributed over the last 10 years 60-80% of the agricultural production or between \$17-34 million. The poultry industry has been a dominant contributor to the sector by generating from 94 to 98% of the value of production. This reflects a very minimal contribution by cattle, sheep, goats and swine.

5.91 The most critical feature of the character of the livestock industry is the sharp division of dependency on imported inputs. As such it is classified into: (a) Intensive operations such as poultry and swine enterprises which are supported wholly by imported feedstuffs and other inputs, and; (b) The non-intensive operations which include small and large ruminants such as sheep, goats and cattle which survive on local forages.

5.92 Both the poultry and swine industries are sited primarily in the Northern Islands of New Providence and Grand Bahama. The easy access to imported feedstuffs and the markets serve as the major factor influencing their location of operation.

5.93 The core of the productive sheep and goat population and the small number of cattle are well distributed in the Southern Islands on Coppice Lands with the vast acreage of scrub lands with forage trees and shrubs.

5.94 According to the above-mentioned pattern, the respective livestock groups have structured their operations around access to their prime source of feedstuff. However, only the poultry industry has shown a tightly organized structure to meet the market requirement. The swine industry is not organized, and its profitability is dependent on supplementary feed inputs. Sheep and goat production dominate the ruminant sector as very little cattle-rearing is pursued. The importation of livestock products with the exception of poultry, therefore assume a large portion of the import bill. Table 5.10 presents the volume of meat imports and the extent of local supplies.

^{1/} Annex 2 presents a detailed description of the Livestock Development Subproject.

TABLE - 5.10

THE BAHAMAS: MARKET SIZE FOR MEATS, POULTRY
AND SOURCES OR SUPPLY 1988

MAJOR ITEMS	UNITS	M A R K E T A N N U A L			VALUE \$000
		TOTAL MARKET	LOCAL SUPPLY	FOREIGN SUPPLY	
SWINE	000LB	9,385	300	9,085	10,248
BACON AND HAM	000LB	3,954	---	3,954	4,310
SAUSAGE	000LB	5,056	---	5,056	6,675
FRESH OR					
CHILLED BEEF	000LB	11,711	39	11,672	21,286
SHEEP MUTTON	000LB	3,333	5	3,329	3,735
GOAT MUTTON	000LB	358	5	353	283
FRESH POULTRY	000LB	26,386	18,338	8,048	23,946
EGGS	000DOZ	5,341	5,194	147	5,535
TOTAL	\$000				76,018

5.95 Within the livestock groups, given the achievements of the poultry industry, the questionable profitability of swine production and the low profile of cattle, the prospects for sheep and goats making a contribution offers some promise. This is especially so as they can thrive on local forages and provide a source of meat or income among the Coppice Island farmers.

5.96 The South should concentrate on goats and sheep for which there is a very large market. The main reasons are: (a) the infrastructure required for goats and sheep is relatively minimal in the sparsely populated islands; (b) the terrain is suitable for them; (c) the shipping logistics is less tedious: they could be shipped live.

5.97 Brief Description: This Subproject proposes to develop the national herd of 20,000 head sheep and goats, consisting of 3,214 breeding ewes (sheep) and 3,949 breeding does (goats), so it can make a more significant contribution to the economy. Through the application of appropriate technology and husbandry, it is proposed over a 5 year period to improve the stock, facilities, feeding programme and security of stock to ultimately increase sheep production by 24% and goat production by over 100% of the 1988 status of production.

5.98 The Subproject Area: Coppice lands are located primarily in the Southern Islands as non-cultivable lands. The Coppice lands are characterized by being dense brush lands consisting of a range of forage shrubs and trees with a wide span of nutritional value to ruminants. These lands are usually rocky and inter-spersed with soil which can support undergrowths of other plant material. To the extent that space such as these exist it is planned that the quality of the undergrowth can be enriched by periodically sowing grass and legume seeds. These forms of forage resources are intended to be the feed base for the expanded sheep and goat production programme.

5.99 Objetives: (a) To encourage the development of a stronger sheep and goat industry to reduce the importation of mutton and increase farmers' income especially in the Southeastern Islands; (b) to encourage farmers to upgrade their stock to increase mutton production; (c) to discourage the slaughter of females; (d) to produce skins for use in crafts and other industries.

5.100 Beneficiaries: It is estimated that the Subproject will incorporate about 149 farmers into the sheep and goats production. The estimated number of herds and acreages is as follows:

ISLAND	NUMBER OF HERDS	ACREAGE
EXUMA	11	425
ABACO	2	25
LONG ISLAND	39	1600
ELEUTHERA	39	1600
CAT ISLAND	42	1600
ACKLINS	5	125
CROOKED ISLAND	2	50
ANDROS	5	125
MAYAGUANA	2	50
OTHERS	2	20
	149	5620

5.101 Based on herd models of 50, 100, 150 and 200 doe units, the proposed development of herds/flocks over the five-year period among the respective islands are presented in Table 5.11 and 5.12:

TABLE 5.11 TOTAL INCORPORATION OF HERDS INTO THE PROJECT BY SIZE AND BY YEAR

YEAR	HERD SIZES				TOTAL
	50	100	150	200	
1	19	9	---	---	28
2	22	15	3	1	41
3	24	12	1	1	38
4	14	9	1	2	26
5	9	6	1	---	16
TOTAL	88	51	6	4	149

TABLE 5.12

INCORPORATION OF HERDS INTO THE PROJECT
BY ISLAND, SIZE AND YEAR

ISLAND	PROJECT YEAR	HERD SIZES (EWES/DOES)			
		50	100	150	200
ACKLINS	1	1	-	-	-
	2	1	-	-	-
	3	2	-	-	-
	4	1	-	-	-
	5	1	-	-	-
SUB TOTAL		5	-	-	-
CROOKED ISLAND	1	1	-	-	-
	2	-	-	-	-
	3	1	-	-	-
	4	-	-	-	-
	5	-	-	-	-
SUB TOTAL		2	-	-	-
ANDROS	1	1	-	-	-
	2	2	-	-	-
	3	1	-	-	-
	4	1	-	-	-
	5	-	-	-	-
SUB TOTAL		5	-	-	-
MAYAGUANA	1	1	-	-	-
	2	1	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
SUB TOTAL		2	-	-	-
OTHER	1	1	-	-	-
	2	1	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
SUB TOTAL		2	-	-	-

ISLAND	PROJECT YEAR	HERD SIZES (EWES/DOES)			
		50	100	150	200
EXUMA	1	1	0	-	-
	2	2	2	-	-
	3	1	1	-	-
	4	1	3	-	-
	5	0	0	-	-
SUB TOTAL		5	6	-	-
ABACO	1	1	-	-	-
	2	-	-	-	-
	3	1	-	-	-
	4	-	-	-	-
	5	-	-	-	-
SUB TOTAL		2	-	-	-
LONG IS.	1	4	3	-	-
	2	5	5	1	1
	3	6	3	1	-
	4	3	2	-	1
	5	2	2	-	-
SUB TOTAL		20	15	2	2
ELEUTHERA	1	4	3	-	-
	2	5	3	1	-
	3	6	5	-	1
	4	3	2	-	1
	5	2	2	1	-
SUB TOTAL		20	15	2	2
CAT ISLAND	1	4	3	-	-
	2	5	5	1	-
	3	6	3	-	-
	4	5	2	1	-
	5	5	2	-	-
SUB TOTAL		25	15	2	-
TOTAL		149	88	51	4

5.102 Production: The natural scrub lands, or the Coppice lands, will form the core resource for sheep and goat production. To create nutritious undergrowth, the periodical sowing of grass/legume seeds will be encouraged. The project seeks to incorporate on-going operations which have access to these lands and to use the stock and facilities as the basis for equity and financial support. The expected increments in production are to be achieved mainly through the introduction of improved breeds and discrete feeding practices. Herd sizes of 50, 100, 150 and 200 breeding does are proposed ^{1/}. With the introduction of electric fencing there can be more organized feeding of extensive areas while simultaneously having reasonable protection from predators.

5.103 Production Targets: the production targets from the national breeding herd for the project 5-year period are presented in Table 5.13. The increments are held at approximately 3% units per annum since herd development and adjustments to the project will be relatively slow during the first 5 years of the project.

TABLE 5.13 PROJECTED FIVE-YEAR MUTTON PRODUCTION

I T E M	PROJECT YEARS				
	1	2	3	4	5
SHEEP MEAT (,000 LB) % 1988 CONSUMPTION	118.5 3.5	167.4 5.0	237.7 7.1	336.5 10.1	476.7 14.0
GOAT MEAT (,000) % 1988 CONSUMPTION	120.8 33.6	161.3 45.1	215.2 60.1	286.6 94.0	382.3 133.2
TOTAL (000 LB) % 1988 CONSUMPTION	239.3 6.5	328.7 8.9	452.9 12.3	623.1 16.9	859.0 23.2

5.104 Support Services Required. The sheep and goat industry will require the following services:

- a) The introduction of new bloodlines of sheep and goats and the registration of pedigree stock for development of superior stock rearing based on economic production parameters.
- b) The generation and evaluation of performance data for line selection within breed groups at the Research Centres.

^{1/} See Annex 2, Schedule I. Four production models are developed, for 50, 100, 150 and 200 doe units, with costs for a start-up operation.

Based on the models developed in Schedule I, adjustments are made to reflect on-going situations which require upgrading of facilities, stock and feeding programmes. The models are presented in Schedule II and are used to form the basis for estimating the project development cost. The strategy of incorporation is therefore based on the upgrading and putting new life in on-going situations.

- c) The sale of high quality seedstock to farmers through the development of livestock improvement centres among the islands (3 centres).
- d) Training in sheep and goat husbandry to both extension agents and farmers.
- e) The organization of appropriate quarantine measures on-farm or otherwise by the Veterinary Division.
- f) The development of slaughter slabs with appropriate facilities to produce wholesome meat on the islands with high concentration of sheep and goats in Andros, Exuma, Long Island, Eleuthera. Estimated cost is \$ 40,000 each.
- g) Extensive training and demonstration will be required at the extension agent and farmer levels. Facilities are basically in place at Gladstone Road Agricultural Complex (GRAC), and Bahamas Agricultural Research Centre (BARC) to accommodate such sessions. More effort will be required on the part of the Department of Agriculture to execute these already budgeted programmes.
- h) It is expected that the new extension thrust will be working closer with farmers to collect and disseminate information and assess performance.
- i) The multiplication programme to be brought under the supervision of an animal breeder at the Research Station. (New Staff)

5.105 Resource Requirements: The competences required for the Sheep and Goats development subproject include:

- 1 Animal Breeder (to be trained from current staff)
- 1 Forage Crop Production Agronomist (to be trained from current staff)
- 4 Animal Health Assistants (New Staff)
- (a) The Animal Breeder is to be obtained at BARC so as to cover the main sheep and goat production areas. This individual, depending on availability, should be on staff by project year 3 the latest.
- (b) Forage crop agronomist to be stationed at BARC and trained similarly to the Animal Breeder.
- (c) The Four (4) Animal Health Assistants are to be assigned to this major livestock area as Long Island, Andros, Eleuthera and either Cat Island or Exuma. These personnel are to be drafted from the 12 Agricultural Extension Agents referred to in the Crop Development Subproject.

5.106 Technical Cooperation: (a) **Extension Agents:** The difficulty encountered in recruiting and maintaining extension staff with competence to deliver at a satisfactory level of professionalism has slowed development in the agricultural industry. The on-site requirement for staff especially in the Southern Islands is a major concern. To cope with this situation, it is proposed that negotiations be pursued with the CARICOM Secretariat to serve as a regional agent to recruit manpower on a contract basis to serve as extension agents covering technical agriculture in the Southern Islands. Recruits to these jobs would be required to have a Diploma in Agriculture, a minimum of 4 years working experience plus participation in the CARICOM middle management training in Agriculture. The lines of authority, accountability and compensation are to be worked out to mutual satisfaction; (b) **Animal Health Assistants:** To be treated as in (a) with graduates having REPHA Diploma.

5.107 Terms of Reference:

(a) **Agricultural Extension Agents:** The agricultural Extension Agents are to act as the link between farmers and the rest of the Agricultural Communities/Sector and in particular the Department of Agriculture. Their responsibilities include: i) Assisting the farmers in farm planning and supplying the necessary farm expertise required to assist in directing crop and livestock production through to the marketing process; ii) demonstrating production techniques; iii) channeling farmers' problems to researchers for solution; iv) communicating new research technology and research results to the farmers. The foregoing services will increase efficiency, productivity and, therefore, incomes and quality of farm life.

(b) **Animal Health Assistants:** The animal health assistants will act as the link between the livestock farmers and the Department of Agriculture, in particular the veterinary division in association with the Ministry of Public Health. Their responsibility would include: i) assisting with the Veterinary Division extension services which covers periodic deworming, castrations, vaccinations and other clinical herd health care field practices; ii) to provide effective on farm services in the containment and eradication of local and exotic animal diseases; iii) to assist with the education of farmers in the production management of the range of domestic livestock.

5.108 Infrastructure: Infrastructure required to accommodate imported stock: the Department of Agriculture will be required to arrange importation on behalf of the Government. Stock will be held for on-farm quarantining at GRAC. Upon approval by the Veterinary Division, animals will be sold to farmers. A nucleus herd of each breed is to remain at GRAC for purebred breeding. Similarly pairs of the respective breeds will be kept at Breed Improvement Centers for breeding and sale of off-springs. Such centers will be located on Eleuthera, Long Island and Cat Island. The basic facilities will consist of a shelter to accommodate up to 5 does and a ram located on one acre of land. The centers are to serve as demonstration units for improved technology and management showing in particular the use

of electric fencing to restrain animals in prescribed areas and as a deterrent to dogs.

5.109 Slaughter Slabs: To accommodate the proposed increments in production in the areas of high sheep and goat concentration, the establishment of slaughter slabs is recommended. The facilities proposed are a building with a yard, unloading ramp and holding pens, equipment which includes a hoist, racks and rails for small stock, scalding tank, cool room and appropriate tools for the slaughter of sheep and goats and pigs in particular. It is proposed that four slaughter slabs with chilling facilities be established at Long Island, Andros, Eleuthera and Exuma.

5.110 Breeding Stock: The importation of male and female stock to upgrade the national sheep stock is based on the following breeds:

- (a) Sheep:
 Wiltshire from the United Kingdom
 Barbados Black Belly from Barbados
 Katahdin from Texas USA
 Florida Native from Florida USA
 Dorsett from Florida USA

I. NUMBER OF FEMALE BREEDING STOCK TO BE IMPORTED

BREED	PY1	PY2	PY3	PY4	PY5
BARBADOS BLACK BELLY	25	33	44	59	78
KATAHDIN	25	32	44	59	77
DORSETT	12	16	22	29	38
FLORIDE NATIVE	25	33	44	59	78
WILTSHIRE	13	16	21	29	39
TOTAL	100	130	175	235	310

II. NUMBER OF MALE BREEDING STOCK TO BE IMPORTED

BREED	PY1	PY2	PY3	PY4	PY5
BARBADOS BLACK BELLY	15	15	20	30	30
KATAHDIN	10	10	15	20	20
FLORIDA NATIVE	10	10	15	20	20
DORSETT	5	5	10	10	10
WILTSHIRE	10	10	15	20	20
TOTAL	50	50	75	100	100

- (b) Goats (Male):
 Nubian from USA
 Saanen from USA
 La Mancha from USA

I. NUMBER OF MALE BREEDING TO BE IMPORTED

BREED	PY1	PY2	PY3	PY4	PY5
NUBIAN	5	10	10	20	20
SAANEN	2	4	4	8	8
LA MANCHA	3	6	6	12	12
TOTAL	10	20	20	40	40

5.111 Loan Requirement: The financial support required to initiate the national sheep and goat herd improvement programme is \$1,106,004. Based on a 70:30 loan equity ratio and taking into account variations in loan requirement based on equity participation, a total of \$618,00 will be required for loans to 149 farmers, according to the following scheme:

No. FARMERS	HERD SIZE	LOAN AMOUNT FOR FARMER	TOTAL (US\$)
88	50 DOE UNIT	\$ 3,000	264,000
51	100 DOE UNIT	\$ 5,000	255,000
6	150 DOE UNIT	\$ 9,500	57,000
4	200 DOE UNIT	\$10,500	42,000
TOTAL	149		618,000

5.112 Details of a proposed allocation of development loan facility on an island basis is presented in Annex 2, Appendix 1.

5.113 Total Cost of the Subproject (Estimated): It is recommended that the Government of The Bahamas support the development of the sheep and goat industry as it is a resourceful part of the livestock profile which can make a significant contribution to the economy. The program of support involves loans to 149 farmers, importation of improved stock and improvement in services.

COMPONENTS	US\$
- DEVELOPMENT PROGRAM : Loans to Farmers	618,000
- IMPORTATION OF STOCK	746,800
- SLAUGHTER SLABS	160,000
- LIVESTOCK IMPROVEMENT CENTRES	6,000
- EXTRUDER TO OFFAL UNIT	30,000
	1,560,800

Note: Cost of personnel, training and research station development are presented in the Research, Extension and Training Subproject.

3. RESEARCH, EXTENSION AND TRAINING SERVICES SUBPROJECT

Objectives

5.114 Within the overall context of the project, the objective of the Research, Extension and Training Services Subproject is to provide the Department of Agriculture with adequate capabilities to carry out the shift of farm families operating at the subsistence level to a commercial farming level.

Justification

5.115 The development of agriculture in countries such as The Bahamas, with limited availability of land and water, must be based on the adoption of technologies that will maximize production. Scientific research is the source of such technologies whether it is original or whether it adapts technology to the country's specific conditions. The ready transfer of research information and results to farmers for their adoption and use is facilitated by extension services. Of equal importance is the fact that a properly organized extension service is the major source of providing information that prioritizes the research effort. In order to provide the essential link in the technology transfer process between agricultural research and farmers, extension personnel will not only require pre-service training, but also on-the-job training.

RESEARCH

5.116 Research Services are an integral part of the mandate of the Ministry of Agriculture in The Bahamas. The Ministry maintains research institutions at the Gladstone Road Agricultural Complex (GRAC) on New Providence Island, and at the Bahamas Agricultural Research Center (BARC) on Andros Island. There are no research facilities nor any investigational work relating to agriculture in the Southeastern Islands. This is so despite the fact that soil, climatic conditions and potential farming systems in the southeast are quite different from what exists in the Northern Islands.

5.117 The research facility at GRAC had an early beginning in 1968 as the Central Agricultural Station. Its stated objectives were: (a) to test locally the results of research carried out in other countries in order to provide a sound basis for extension programmes in The Bahamas; (b) to serve as a demonstration center for techniques in plant and animal husbandry; (c) to provide a center for instruction and training courses for field staff, farmers, school teachers etcetera.

5.118 By 1980 a Food Technology Unit and an Animal Nutrition Unit were added and the Centre formally became known as Gladstone Road Agricultural Complex. The stated purpose of the centre is: (a) to conduct research projects aimed at increasing crop and livestock production and; (b) to promote all aspects of the agricultural industry.

5.119 The following observations are pertinent and they form the basis of the detailed plan outlined for a Research Services:

- o Physical facilities of an office complex, maintenance buildings, laboratories, greenhouses, staff houses, farm machinery, laboratory equipment are in place and to the largest extent are in good condition.
- o There are 57 positions in the Ministry of Agriculture of officers with at least training to the Bachelor's degree level. Most of those assigned to Research or Extension activities are shown to be at GRAC, in New Providence.
- o Of the fifteen professional members of staff at GRAC, only one junior member has received training to the Master's degree level. All other staff members hold a Bachelor's degree.
- o There are thirteen (13) vacant positions in the Ministry where the required training is at the Bachelor's degree level.
- o Several officers have not received formal academic training in their particular area of work.
- o Recent graduates with Bachelor's degrees see themselves as occupying a research position.
- o There is no soils laboratory.
- o There is no library.
- o An existing plant propagation unit provides seedlings or plants for the public.
- o Most officers are willing to pursue further training the Master's degree level.
- o There is six veterinary officers in the Ministry of Agriculture, two of whom are stationed at GRAC.

5.120 The Bahamas Agricultural Research Center (BARC) is located in North Andros. It was established as a result of The Bahamas Agricultural Research Training and Development Project (BARTAD) sponsored jointly by the Commonwealth of The Bahamas and USAID. The project, initiated in 1973, had as its objectives:

- o To establish a Research and Training Center.
- o To develop 16 Pilot Test Farms.
- o To conduct research on the best types of grasses and legumes, and to conduct fruit and vegetable research.
- o To study the economic and marketing aspects of livestock enterprises.

- o To conduct sociological research.
- o To determine the most economical means of bringing land into production.
- o To find out the best pastures and feed crops for livestock production.
- o To determine the best livestock breeds for The Bahamas.
- o To provide and/or make arrangements for academic training for selected Bahamian candidates.

Over the 5-year period of the project, ending in 1978, all of the objectives were met.

5.121 Unfortunately, the research activities were not continued after 1978. Yet BARC currently employs 8 degree-level agriculturists, one of whom is a Veterinary Surgeon and an additional 30 full-time employees. The situation at BARC is much the same story as at GRAC from the standpoint of research activities and organization.

5.122 Physical facilities are excellent with several staff houses and an apartment building with several single family units. A training centre with dormitory complex is also in place. Maintenance buildings, farm machinery and passenger vehicles are in excess of \$1 million in value. There are 386 acres of pasture, 11 acres of orchard and 7 acres reserved for agronomic studies. The interest in crops and animals is quite varied, largely as a hold-over from the BARTAD project. However, the lack of research training by staff members limits research activity. Field plots of diverse crops on an ad hoc basis were established. Tree crops established during the BARTAD project are not being used experimentally.

The Food Technology Unit

5.123 The Food Technology Unit came into existence in 1980 and was intended to play a role in research and the processing of Bahamian agricultural products as well as provide technical advice to the private sector and administer the regulations of the Food Act of The Bahamas. A service as well as a research function was therefore envisaged. In terms of physical plant it has microbiology, chemistry and product development laboratories as well as a pilot plant. The product development laboratory and pilot plant have limited space. Equipment is adequate for current activities, but in many respects under-utilized.

5.124 There are twelve (12) professional positions requiring training to at least the bachelor's degree level and of these there were six vacancies. No one is adequately trained to carry out research in the food technology field. With the present professional staff seeming to be less than fully occupied, it is obvious that in terms of present activities the number of professionals apportioned to the unit is excessive. In most instances officers had received general

training in the sciences but not specific to the disciplines in which they had been assigned to. It will be necessary to have officers receive further training. This should be done in concert with the imposition of technical assistance that is being recommended for institutional strengthening.

EXTENSION

5.125 For development to take place in Bahamian agriculture, a whole spectrum of information covering from market knowledge to technical assistance is urgently needed for farmers, so they may cope and compete with one of the most advanced agricultural economies in the world. The most critical factor in the development of a modern agricultural sector will be the help and support extended to farmers particularly in the Southeastern Islands. Since the Department of Agriculture has an Extension Service which is charged with this specific responsibility, a resolution of the problem requires merely making it fully operational. In this respect, it will be mandatory to ensure proper training of personnel and deployment of this personnel to the farming communities.

Project Implementation

5.126 The format for implementation of the Research, Extension and Training Services Subproject, covering both project sub-areas, would be built around a project management council consisting of:

- o Project Leader
- o Director of Agriculture
- o Deputy Director - Research
- o Deputy Director - Extension
- o Deputy Director - Production and Marketing
- o Consultant in Research Management
- o Consultant in Extension Design and Management

5.127 The qualifications of the Project leader are as follows: A senior executive with several years management experience at the highest organizational level and familiarity with the agricultural sector of The Bahamas within the context of its technical and administrative responsibilities. Training to at least the Master's degree level in the agricultural field and preferably Economics, Agribusiness or Project Management. A training officer would be part of the support staff assisting the project leader during the period of project implementation.

5.128 General considerations:

- o There should not be an institutional separation of research and extension, with the Director of Agriculture with overall responsibilities for both.
- o A strong central organization and backed up by sufficient funds around 1.0% of the agricultural GDP.

- o Some degree of autonomy outside of the bureaucratic structure of Ministry of Agriculture.
- o Internal links to national planning and, policy-making (Land survey, waterworks, forestry, science).
- o External links to Universities (UWI, Florida, Hawaii) CARDI, other institutions, World Tropical Institutions, International Research Centres.
- o The research centres must be provided with libraries.
- o Problem-oriented adaptive research with stated objectives at the outset.
- o Recognition that technology transfer is still possible against the background of limited or unskilled manpower and weak national research effort.
- o Externally acquired technology information can be transferred initially and to be followed up and updated with local adaptive research taking care to ensure that there is an active participation by research, officers in translating research results into recommendations for farmers.
- o There should be clearly defined job descriptions for personnel who are supervised and evaluated on the basis of job specifications.
- o Training to be carried out at the three research centres and in the field at different islands.
- o In the implementation plan is built in provision for monitoring the efficiency and usefulness of ongoing research programme and the extension service.

Research Projects

5.129 Soil/Plant/Water Relations: A very strong research capacity will be required in this area. Chapter IV of this report presented the soil and water characteristics of The Bahamas and their implications to agriculture. Inadequate utilization of soil and water reduces the potential production of all crop plants. It will be most desirable to ascertain and determine how agricultural production can be maximized, taking into account economic considerations, under rainfed conditions as they exist in the Southeastern Islands as well as under irrigated conditions where the volume of water that can be apportioned to farming is limited. Upgrading and maintenance of soil fertility and the introduction of efficient irrigation and drainage procedures will ensure production increases for all major crops (Table 5.7). This research should be of an applied nature so as to permit immediate commercial use of

experimental results ^{1/}. All activities should be conducted in sites which represent very closely the soils and environment of the major producing areas.

5.130 Recommended research activities should include:

- o Phosphorus fixation in a calcareous medium.
- o Soil fertility experiments varying time, methods and amounts of macronutrient application. In all cases crop response must be measured and economic analysis be considered.
- o Evaluation of the effects of micronutrients in crop production.
- o Studies with organic sources of nutrients such as green manure, animal waste and bio-fertilizers.
- o Mulching practices to maximize water use.
- o Development of methods of soil preparation which maximize water absorption and retention.
- o Development of simple irrigation methods which are efficient in water utilization.

5.131 Strong and close cooperation with crop and pasture specialists will be necessary in order to plan and conduct adequate soil research for these crops. Cooperation with the Farm Systems Research effort will be required for the formation of efficient cropping systems. Complete technical reports should be submitted at the end of each year. They will be used for evaluation of progress being made in the programme and also for the evaluation of the output of each research staff.

5.132 Plant Protection Research: The objective of research in plant protection is to develop control methods which can keep at low levels the incidence of diseases and pests on the major crops of economic importance. The research should be of an applied nature with possibilities of immediate use. In some cases, some basic information may be needed in terms of casual agents and the biology of insects. Research should focus on pest and disease problems of the twenty-nine (29) selected crops shown in Table 5.1. The principal areas of concentration in Plant Protection research should be Plant Pathology, Entomology and Weed Science. With Nematology and Virology assuming importance in the longer term recommended research activities are as follows:

5.133 Plant Pathology: The following activities should be carried out:

^{1/} In the area of vegetable production, for instance, adaptive research could be carried out on the basis of original work conducted not only in Florida but also in Brazil where the Brazilian Agricultural Research Company (EMBRAPA), of the Brazilian Government, has achieved impressive results in an environment similar to that of The Bahamas.

- o Survey of the most important diseases limiting production of the twenty-nine (29) selected crops (Table 5-1) and the six (6) specialty crops.
- o Development of efficient methods of disease control which are environmentally safe. Integrated pest management approach should be used. Biological and cultural control methods should have higher priority.

5.134 Entomology: The following activities should be carried out:

- o Survey of the most important insects limiting production of the selected crops.
- o Study of population dynamics of most important insects.
- o Development of efficient methods of insect control which are not inimical to the environment. Biology and cultural methods should have higher priority.

5.135 Weed Science: The following activities should be carried out:

- o Survey of weeds occurring in the most important production sites of the project areas.
- o Establishment of levels of damage caused by weed competition.
- o Development of methods of weed control giving emphasis to biological and mechanical methods.

5.136 Nematology and Virology: The following activities should be carried out:

- o Survey of occurrence of nematodes in the most important production sites.
- o Establishment of levels of damage caused by nematodes.
- o Development of efficient methods of control which are environmentally safe.
- o Survey of occurrence of virus in major crops of the most important production sites.
- o Establishment of the levels of damage caused by virus.
- o Development of methods of virus control, giving emphasis to varietal resistance and tissue culture techniques for production of virus-free planting material.
- o Identification of virus vectors and their control.

The impact of pest and disease control on the environment should be constantly and closely monitored.

5.137 Crops Research: The following areas should be pursued:

Vegetables: There is a wide range of vegetables currently grown in the project areas and for those of priority interest (Table 5-7) the recommended research activities are as follows:

- o Introduction of varieties, evaluation and selection over a range of environments.
- o Studies on soil fertilization using chemical and organic sources of nutrients.
- o Survey of pest and disease occurrence in the most important production sites.
- o Studies of insect population dynamics and disease evolution.
- o Development of methods of disease and insect control giving emphasis to environmentally safe procedures.
- o Studies on inter-cropping systems including a variety of companion crops. Soil fertilization for mixed crop systems should also be addressed.
- o Studies on crop rotation with the objective to maintain crop yields at higher levels for longer periods of time. Monitoring of soil borne pathogens will be necessary.
- o Formulation of production packages for tests on farms.

5.138 The preparation of technical reports at the end of each year should be mandatory so as to evaluate the progress of the programme and the output of each scientist. The Asian Vegetable Research and Development Centre (A.V.R.D.C.) and the Brazilian Agricultural Research Company (EMBRAPA) have a long tradition of research on tropical vegetables and should be very helpful in providing information related to possible research activities.

5.139 **Tree Crops:** The major agronomic problems which limit tree crop production in the sub-project areas are the occurrence of diseases, nematodes and insects. Inefficient production systems characterized by inadequate plant density, fertilization procedure, weed control and pest and disease control were obvious. Research in tree crops should be of an applied nature in such a way that results may be obtained in a relatively short period of time and be of immediate use to farmers. Research activities should be conducted in locations which are representative of the production sites. Recommended activities are as follows:-

- o Introduction of varieties and species from other countries and evaluation and selection of varieties and species introduced to different production sites (screening).
- o Soil fertility and plant nutrition studies in order to develop efficient fertilization procedures.
- o Development of efficient cropping systems including inter-cropping, plant spacing and density, weed control.

- o Methods of nematode control particularly as it relates to bananas, papaya and citrus, giving priority to biological and cultural procedures.
- o Studies of combination of root stocks and scions in order to identify the most adopted and efficient combinations particularly for mangoes.
- o Methods of control of virus diseases particularly for papaya.
- o On-farm testing of technological packages assembled in light of actual knowledge including, later, new research findings from the programme.

5.140 The preparation of complete technical reports at the end of each year should be a requirement facilitating an assessment of the development of research programmes and an evaluation of the research personnel.

5.141 Corn - One of the major subsistence crops grown in the sub-project areas, severe problems exist that limit production including, cultivation of low yielding varieties susceptible to diseases and pests, utilization of inefficient cropping systems with inadequate crop mixtures, little or no use of fertilizers and poor weed control. The following research activities are recommended:

- o Introduction and evaluation of germplasm from international research centres and evaluation and selection of superior material based on a multiple stage selection scheme conducted over different environments (screening).
- o Systematic pest and disease survey with studies on insect population dynamics and disease evolution.
- o Development of methods of disease and pest control which are efficient and environmentally safe.
- o Inter-cropping experiments involving several other annual species as well as tree crops as companion crops. Fertilization treatments should be included in these experiments.
- o Crop rotation studies involving root crops and food legumes.
- o On-farm tests of production systems based on proven technology.
- o Multiplication and maintenance of seed stocks of selected varieties.

5.142 The submission of technical reports at the end of each year with comprehensive analysis and interpretation of experimental data should be used in the evaluation of research personnel.

5.143 Pigeon Pea: Pigeon pea is the most widely grown crop in the project area. Its higher quality and content of proteins is a very important factor as far as human nutrition is concerned and

especially in the project area where it is the major subsistence crop. Current yields are extremely low due principally to a high incidence of disease infestation, lack of use of fertilizers, inefficient production systems and the lack of selected varieties.

Research activities recommended are as follows:

- o Systematic introduction of varieties from international centres and evaluation of those varieties in different environments and selection of the most promising for further studies (screening).
- o Studies of plant density and spacing arrangements for different climatic conditions in the project sub-areas.
- o Evaluation of alternative inter-cropping systems using corn, cassava, and other companion crops.
- o Soil fertilization studies giving emphasis to organic and inorganic nutrient sources.
- o Experiments of planting and harvesting time.
- o Survey of the most important insects and diseases occurring in the producing regions. Insect distribution, population dynamics and development of efficient methods of insect and disease control giving emphasis to procedures which are environmentally safe.

5.144 At the end of each year, a complete and comprehensive technical report must be submitted by each team member. All data should be fully analyzed and interpreted.

5.145 Cassava: One of the major subsistence crops grown in the project areas, cassava has been treasured for its ability to survive under rigorous conditions. Yields are much lower than actual potential due to use of low yielding varieties susceptible to pests and diseases as well as inadequate production systems. Research activities to be carried out are as follows:

- o Introduction of varieties from International Research Centres and evaluation of varieties in different environments with selection of the best material considering overall performance (screening).
- o Experiments on plant density, spacing arrangements in different producing regions using, first, the local varieties and later the best varieties which have been identified.
- o Evaluation of inter-cropping systems using an array of companion crops and planting arrangements.
- o Soil fertilization studies. Fertilizer tests in inter-cropping systems, with the objective to increase production and maximize economic returns.

- o Studies of planting and harvesting time.
- o Survey of diseases, and pests limiting cassava production.
- o Studies of population dynamics and disease evolution of the most important insects and diseases.
- o Development of cost-effective methods of weed control giving emphasis to procedures which use little or no chemical products. On-farm tests of technological packages.

5.146 It is mandatory that at the end of each year a comprehensive technical report of all experimental activities be submitted by each investigator to the team leader. All results must be fully analyzed and interpreted with suggestions to the Extension Service on how to diffuse more efficiently each conclusive result that may contribute to improvement of cassava production in the project areas.

5.147 Farming Systems Research: The main components of a farming system are: environment, crops, livestock, social and economic components. These components plus their interactions will determine the nature and magnitude of each specific farming system. The purpose of the Farming System Research Programme (FSRP), which should be located principally at CIAREC, is to increase crop and livestock production at the subsistence and small farmer level, develop management technologies suitable for these farmers, increase the employment level in the rural sector and improve the general level of nutrition of the rural people while increasing the overall quality of farmers' life.

5.148 The nature of FSRP should be the adaptation of scientific knowledge and technologies developed by the disciplines and crops research in such a way that an economical and efficient production system is developed. Results of this research must reach the small farmer. Therefore through the Research and Extension service most activity should be conducted in the farmers' holdings or in similar conditions. The FSR group will be the natural link between experimental centre research and the extension service.

5.149 A well conceived FSRP should:

- o identify, describe and characterize the most important production systems of the sub-project areas;
- o identify proven technological innovations which could alleviate specific constraints; and,
- o Design and test, on the farm, improvements in existing systems or newly developed systems.

EXTENSION

5.150 The following will be necessary for the proposed Extension Service:

- o An operational and functional linkage between extension and research must be in place in the Ministry of Agriculture.
- o There is a need for technical information documentation, and library service for professional staff in differing disciplines.
- o In the absence of formalized research activity in the Ministry, extension activity can progress and be effective by making use of imported technology initially.
- o There should be operational or functional linkages between extension and marketing. The size of the market being aimed for and the size of the production base is a major strategic issue to be resolved and communicated to the farming public.
- o An up-to-date farm level data base arising from information collected and analysed to understand what is happening in Bahamian Agriculture is to be facilitated by way of extension agents.
- o Clearly defined job descriptions to ensure efficient utilization of professional and para-professional expertise must be in place.
- o Extension personnel with advisory services taking a priority position should be a requirement for each individual island.
- o The acquisition of motor vehicles and their subsequent upkeep will be a necessary and costly initial investment facilitating a proper extension service.

The following Research and Extension personnel will be located at the head office

<u>POSITION</u>	<u>DESCRIPTION</u>
1R	DEPUTY DIRECTOR RESEARCH
1E	DEPUTY DIRECTOR EXTENSION
2E	ASST. DIRECTOR TRAINING
3E	ASST. DIRECTOR VETERINARY SERVICES
4E	SENIOR EXTENSION OFFICER PLANT SERVICES
5E	EXTENSION OFFICER COMMUNICATIONS
12E	TRAINING OFFICER
13E	TRAINING OFFICER
15E	ENTOMOLOGIST
16E	PLANT PATHOLOGIST
17E	PLANT PROPAGATION (SALES)
18E	BOTANICAL GARDENS - SUPERINTENDENT
19E	ANIMAL CONTROL & ABBATTOIR (VET. SERVICES)
21E	EXTENSION (VET. SERVICES)
22E	EXTENSION (VET. SERVICES)
	10 SECRETARIAL/CLERICAL SUPPORT
	8 OTHER SUPPORT

SUMMARY

<u>CLASSIFICATION</u>	<u>NUMBER</u>
PROFESSIONAL	15
SECRETARIAL/CLERICAL SUPPORT	10
OTHER SUPPORT	8

Associated with GRAC will be the following personnel:

<u>POSITION</u>	<u>DESCRIPTION</u>
2R	SENIOR ASST. DIRECTOR
5R	RESEARCH OFFICER-SOIL FERTILITY
6R	" " PLANT PROTECTION
7R	" " LIVESTOCK
8R	" " FOOD TECHNOLOGY
9R	" " LAND AND WATER DEVELOP.
11R	" " HORTICULTURE/FRUIT
14R	" " PLANT PROTECTION
16R	FOOD TECHNOLOGIST-FOOD TECHNOLOGY
17R	RESEARCH OFFICER SOIL FERTILITY
22R	" " VEGETABLES
25R	" " POST HARVEST PHYSIOLOGY
26R	" " ENTOMOLOGY
27R	" " PLANT PATHOLOGIST
30R	" " PLANT BREEDING
31R	CHEMIST - FOOD TECHNOLOGY
32R	MICROBIOLOGIST - FOOD TECHNOLOGY
33R	STANDARDS - FOOD TECHNOLOGY
34R	PRODUCT DEVELOPMENT - FOOD TECHNOLOGY
6E	SUPERVISOR EXTENSION SERVICES
9E	SENIOR EXTENSION OFFICER
20E	ANIMAL HEALTH - VETERINARY SERVICES
19	TECHNICAL
10	SECRETARIAL/CLERICAL
15	OTHER SUPPORT
26	LABORERS (EQUIVALENT)

SUMMARY

<u>CLASSIFICATION</u>	<u>NUMBER</u>
PROFESSIONAL	19
TECHNICAL	19
SECRETARIAL/CLERICAL	10
OTHER SUPPORT	15
LABORERS (EQUIVALENT)	26

Associated with BARC will be the following personnel:

<u>POSITION</u>	<u>DESCRIPTION</u>
3R	ASSISTANT DIRECTOR
10R	RESEARCH OFFICER-SOILS/PLANT
12R	AGRICULTURAL ENGINEER
13R	RESEARCH OFFICER-VEGETABLES
15R	RESEARCH OFFICER-VET. SCIENCE
19R	RESEARCH OFFICER-TREE CROPS
21R	RESEARCH OFFICER-VEGETABLES
24R	RESEARCH OFFICER-AGRO HYDROLOGY
28R	RESEARCH OFFICER-ANIMAL SCIENCE & PASTURE
7EC	SUPERVISOR OF EXTENSION SERVICES
10E	SENIOR EXTENSION OFFICER-RESEARCH LINK
23E	EXTENSION OFFICER ANDROS
29E	EXTENSION AGENT SOUTH ANDROS
30E	EXTENSION AGENT ANDROS
	8 TECHNICIANS/HERDSMEN
	5 SECRETARIAL/CLERICAL
	8 OTHER SUPPORT STAFF
	16 LABORERS (EQUIVALENT)

SUMMARY

<u>CLASSIFICATION</u>	<u>NUMBER</u>
PROFESSIONAL	2
PARA-PROFESSIONAL	2
TECHNICAL	8
SECRETARIAL/CLERICAL	5
OTHER SUPPORT	8
LABORERS (EQUIVALENT)	16

Associated with CIAREC will be the following personnel:

<u>POSITION</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>
4R	ASST. DIR. RESEARCH	CIAREC
8E	SUPERVISOR OF EXTENSION SERVICES	"
18R	RESEARCH OFFICER-FARMING SYSTEMS	"
20R	" " -HORTICUL./FRUIT	"
23R	" " -VEGETABLE CROPS	"
29R	" " -RUMINANTS & NUTRITION	"
11E	SENIOR EXT. OFFICER-RESEARCH/ EXTENSION LINKAGE	"
28E	EXTENSION OFFICER-LONG ISLAND & OTHERS	"
36E	EXTENSION AGENT-LONG ISLAND	LONG ISLAND
37E	" " -EXUMA	EXUMA
38E	" " -CROOKED ISLAND	CROOKED ISLAND
39E	" " -ACKLINS	ACKLINS
40E	" " -MAYAGUANA	MAYAGUANA
	4 TECHNICIANS	LONG ISLAND
	4 SECRETARIAL/CLERICAL SUPPORT	"
	4 OTHER SUPPORT STAFF	"
	8 LABORERS (EQUIVALENT)	"

SUMMARY

<u>CLASSIFICATION</u>	<u>NUMBER</u>
Professional	8
Para-professional	5
Technical	4
Secretarial/Clerical	4
Other Support	4
Laborers	8

Staffing

5.151 Against the background of current professional staff, as shown in Table 5.14, the detailed professional staff requirements for the Research Service was developed and is shown in Table 5.15. The major responsibilities and the necessary academic qualifications for the incumbents are shown in Annex 1, Tables V-19 and V-20, respectively. A detailed list of the professional and paraprofessional staff for the Extension Service is presented in Table 5.16. The major responsibilities and the necessary academic qualifications are shown in Annex 1, Table V-22 and V-23 respectively. A composite staffing for the Research and Extension Services is shown in Table 5.17. An organizational chart for the Ministry is presented in Chapter III of this report.

TABLE 5.14
LIST OF CURRENT (1989) AGRICULTURAL
POSITIONS WITH MINIMUM REQUIREMENT OF
TRAINING TO THE BACHELOR'S LEVEL
MINISTRY OF AGRICULTURE, THE BAHAMAS

CLASSIFICATION	NUMBER OF POSITIONS	VACANCIES
DIRECTOR	1	
SENIOR DEPUTY DIRECTOR	1	
DEPUTY DIRECTOR	1	
SENIOR ASSISTANT DIRECTOR	1	
ASSISTANT DIRECTOR	3	
SENIOR AGRICULTURAL OFFICER	4	
SENIOR VETERINARIAN	1	
VETERINARIAN	5	1
TRAINEE VETERINARIAN	1	
AGRICULTURAL OFFICER	15	2
ASSISTANT AGRICULTURAL OFFICER	11	4
TRAINEE AGRICULTURAL OFFICER	2	
SENIOR CHEMIST-FOOD TECHNOLOGY	1	1
CHEMIST-FOOD TECHNOLOGY	1	
ASST. CHEMIST-FOOD TECHNOLOGY	2	1
FOOD TECHNOLOGY	1	
TRAINEE FOOD TECHNOLOGY	1	1
ASSISTANT FOOD TECHNOLOGY	2	2
TRAINEE ASST. FOOD TECHNOLOGY	2	
MICROBIOLOGIST-FOOD TECHNOLOGY	1	
ASSISTANT MICROBIOLOGIST-FOOD TECH.	1	1
T O T A L	58	13

TABLE 5-15: COMPOSITE LIST OF PROFESSIONAL EMPLOYEES FOR AGRICULTURAL RESEARCH SERVICES

POSITION	D E S C R I P T I O N
1R	DEPUTY DIRECTOR RESEARCH
2R	SENIOR ASSISTANT DIRECTOR (GRAC)
3R	ASSISTANT DIRECTOR (BARC)
4R	ASSISTANT DIRECTOR (CIAREC)
5R	RESEARCH OFFICER (SOIL FERTILITY)
6R	RESEARCH OFFICER (PLANT PROTECTION)
7R	RESEARCH OFFICER (LIVESTOCK)
8R	RESEARCH OFFICER (FOOD TECHNOLOGY)
9R	RESEARCH OFFICER (LAND AND WATER DEVELOPMENT)
10R	RESEARCH OFFICER (SOILS PLANT)
11R	RESEARCH OFFICER (HORTICULTURE/FRUIT)
12R	SENIOR AGRICULTURA RESEARCH OFFICER ENGINEER
13R	RESEARCH OFFICER HORTICULTURE (VEGETABLES)
14R	RESEARCH OFFICER (PLANT PROTECTION)
15R	RESEARCH OFFICER (VET SCIENCES)
16R	FOOD TECHNOLOGIST (FOOD TECHNOLOGY)
17R	RESEARCH OFFICER (SOIL CHEMISTRY)
18R	RESEARCH OFFICER FARMING SYSTEMS (AGRONOMIST)
19R	RESEARCH OFFICER (TREE CROPS)
20R	RESEARCH OFFICER (HORTICULTURE AND FRUIT)
21R	RESEARCH OFFICER (VEGETABLES)
22R	RESEARCH OFFICER (VEGETABLES)
23R	RESEARCH OFFICER (VEGETABLES)
24R	RESEARCH OFFICER (AGRO. HYDROLOGY)
25R	RESEARCH OFFICER (POST HARVEST PHYSIOLOGY)
26R	RESEARCH OFFICER (ENTOMOLOGY)
27R	RESEARCH OFFICER (PLANT PATHOLOGY)
28R	RESEARCH OFFICER (ANIMAL SCIENCE AND PASTURE)
29R	RESEARCH OFFICER (SMALL RUMMIANTS & NUTRITION)
30R	RESEARCH OFFICER (PLANT BREEDING)
31R	FOOD TECHNOLOGY (CHEMIST)
32R	FOOD MICROBIOLOGIST TECHNOLOGY
33R	FOOD STANDARDS TECHNOLOGY
34R	FOOD PRODUCT DEVELOPMENT TECHNOLOGY

TABLE 5-16:

**COMPOSITE LIST OF PROFESSIONAL AND
PARA-PROFESSIONAL EMPLOYEES FOR
FOR AGRICULTURAL EXTENSION SERVICES**

POSITION	DESCRIPTION
1E	DEPUTY DIRECTOR EXTENSION
2E	ASSISTANT DIRECTOR (TRAINING)
3E	ASSISTANT DIRECTOR (VETERINARY SERVICES)
4E	SENIOR EXTENSION OFFICER (PLANT SERVICES)
5E	EXTENSION OFFICER (COMMUNICATIONS)
6E	SUPERVISOR EXTENSION SERVICES
7E	SUPERVISOR EXTENSION SERVICES
8E	SUPERVISOR EXTENSION SERVICES
9E	SENIOR AGRICULTURAL EXTENSION OFFICER GRAC (SUBJET MATTER CROP CARE)
10E	SENIOR AGRICULTURAL EXTENSION OFFICER BARC (SUBJET MATTER CROPS)
11E	AGRICULTURAL EXTENSION OFFICER CIAREC (SUBJET MATTER LIVESTOCK)
12E	TRAINING OFFICER
13E	TRAINING OFFICER
14E	LIBRARIAN
15E	ENTOMOLOGIST
16E	PLANT PATHOLOGIST
17E	PLANT PROPLANT PROPAGATION (SALES)
18E	BOTANICAL GARDENS
19E	ANIMAL CONTROL & ABATTOIR (VET SERVICES)
20E	ANIMAL HEALTH (VET SERVICES)
21E	EXTENSION (VET SERVICES)
22E	EXTENSION (VET SERVICES)
23E	EXTENSION OFFICER (ANDROS)
24E	EXTENSION OFFICER (ABACO)
25E	EXTENSION OFFICER (ELEUTHERA)
26E	EXTENSION OFFICER (GRAN BAHAMA)
27E	EXTENSION OFFICER (CAT ISLAND)
28E	EXTENSION OFFICER (LONG ISLAND)
29E	EXTENSION OFFICER (SOUTH ANDROS)
30E	EXTENSION AGENT (ANDROS)
31E	EXTENSION AGENT (ABACO)
32E	EXTENSION AGENT (ELEUTHERA)
33E	EXTENSION AGENT (ELEUTHERA)
34E	EXTENSION AGENT (GRAN BAHAMA)
35E	EXTENSION AGENT (CAT ISLAND)
36E	EXTENSION AGENT (LONG ISLAND)
37E	EXTENSION AGENT (EXUMA)
38E	EXTENSION AGENT (GROOKED ISLAND)
39E	EXTENSION AGENT (ACKLINS)
40E	EXTENSION AGENT (MAYAGUANA)

TABLE 5-17

COMPOSITE STAFFING FOR RESEARCH AND EXTENSION SERVICES

CLASSIFICATION	HEAD OFFICE	GRAC 1/	BARC 2/	CIAREC 3/	ABACO	ELEUTEHRA	GRAND BAHAMA	CAT ISLAND	TOTAL
PROFESSIONAL	15	19	12	8	1	1	1	1	58
PARAPROFESSIONAL			2	5	1	2	1	1	12
TECHNICAL		19	8	4					31
SEC./CLERICAL	10	10	5	4	1	1	1	1	33
OTHER SUPPORT	8	15	8	4					35
LABOURER (EQUIV)		26	16	8					50
T O T A L	33	89	51	33	3	4	3	3	219

- | |
|---|
| 1/ GLADSTONE ROAD AGRICULTURAL COMPLEX
2/ BAHAMAS AGRICULTURAL RESEARCH CENTER
3/ COPPICE ISLAND AGRICULTURAL RESEARCH AND EXTENSION CENTRE |
|---|

The Coppice Islands Agricultural Research and Extension Centre (CIAREC)

5.152 Given the expanded role that agriculture is to play in the development and economic diversification of the Southeastern Islands, an agricultural research and extension centre will be needed in that region. The development of this regional research and extension facility should provide farmers with greater access to technical information and timely input supply that are relevant and appropriate to the specific needs of the Southeast. The following activities will be carried out:

- o Agricultural research of an adaptive kind having a direct bearing on the Southeastern Islands.
- o Extension specialist assistance to farmers in all Southeastern Islands.
- o Short courses in agricultural production, livestock management and market information.
- o Seminars on agricultural issues peculiar to the area that affect farmers.
- o Serve as a base for input supplies when necessary.

5.153 This centre, to be located in Long Island, will serve the research and extension needs of the Southeastern Island in particular and those of The Bahamas as a whole. The site will have sufficient land space to accommodate field experiments involving crops and livestock. A minimum area of ten (10) acres is proposed. The buildings to be constructed will include:

- o Research/Extension Station

- o Staff housing
- o Storage/Machinery shed

Research/Extension Station

5.154 The station building will be designed to accommodate both Research and Extension Personnel. A total of 4,800 sq. ft. will be needed, according to the following:

* Reception/Waiting	300 sq. ft.
* 2 Executive offices	500 " "
* 6 Standard offices	900 " "
* Multi-purpose laboratory	1,000 " "
* Conference Room	300 " "
* Library	200 " "
* Toilet Facilities	500 " "
* General storage	300 " "

4,000 x 20%
circulation etc.

Staff Housing

5.155 Staff housing for the professional research and extension personnel will be provided. The total of 13,000 sq. ft. will be required as follows:

13,000 sq. ft. to include:

* 2 three-bedroom houses for Directors	3,000 sq. ft.
* 6 townhouse type apartment block for officers	9,000 sq. ft.
* Central wash-house, garbage etc.	1,000 sq. ft.

13,000 sq. ft.

Storage/ Machinery Shed

5.156 A storage shed to house fertilizers, seeds and other agricultural inputs as well as to provide parking for machinery will be required. A total of 1,000 sq. ft. is adequate. A total cost of \$1.133 million is assigned for land and buildings. With respect to the multi-purpose laboratory, it is envisaged that sufficient and appropriate equipment will be provided from the agricultural budget.

Graduate Training

5.157 Critical to the successful implementation of the project relating to an organized Research, Extension and Training Division is the provision of sufficient trained personnel and expertise to

implement the project and assure its continuing operation. It is proposed that over the initial five year period of the project, a total of twenty five (25) selected candidates from the Ministry of Agriculture be sent for training in Research and Extension in specific areas of specialization at selected Universities as outlined in Annex 1, Tables V-26A to V-26 C. This would be on a phased basis with eight candidates in each of the first and second years of the project and nine candidates in the third year of the project. With a projected requirement of two years to complete the Master's degree programme, all twenty five (25) candidates would be trained within the five-year period. The estimated cost of \$267,058, is shown in Annex 1, Tables V-26A to V-26C, and summarized in Annex 1, Table V-27 as twice the cost to accommodate two years of research training.

Technical Assistance

5.158 At the project implementation stage, much of the current staff would not have had the experience or training to adequate levels that would ensure leadership in determining designing and prioritizing research extension and training activities. In this period technical cooperation will be required. A schedule of the proposed consultants is shown in Annex 1, Table V-28. The two central positions (A and B) relating to the setting up of a Research and Extension organization are relatively short-term, but with some continuity on an intermittent basis. The additional five positions are of longer term to ensure, firstly, proper start-up and continuation of initiated projects in the differing disciplines and, secondly, allowing for some interaction with research personnel returning after being trained for research.

5.159 Total costs for technical cooperation are estimated at \$690,000 over the project period (Annex 1, Table V-28). All costs are in foreign exchange. A summary is provided in Annex 1, Table V-27.

5.160 Transportation Needs: Arising out of the increased activity of extension services on all islands in the project area as a whole, it is to be expected that transportation will be needed to facilitate access and communication with farmers. A total of thirteen (13) pick-up trucks at a cost of \$195,000 foreign exchange will be required and is shown in Annex 1 Table V-27.

5.161 Technical Cooperation in Training: Against the background of limited exposure by the current staff in the Ministry to extension training, an efficient and speedy process to achieve both objectives would be an organized programme developed and conducted with technical assistance. The UNDP, as an international agency, would be disposed to offer such assistance. The categories of extension personnel to be accommodated should be:

- o Administrative/supervisory.
- o Technical or subject matter specialists.
- o Extension officers.
- o Extension agents (para-professionals)

Summary of Costs

5.162 A summary of the costs related to the Research, Extension and Training Services Subproject is shown below:

<u>COMPONENTS</u>	<u>US \$</u>
I. COPPICE ISLANDS AGRICULTURAL RESEARCH AND EXTENSION CENTRE	1,133,000
II. POST-GRADUATE TRAINING PROGRAMME	534,116
III. CONSULTANCIES	690,000
IV. MOTOR VEHICLE PURCHASES	195,000
TOTAL	2,552,116

Benefits

5.163 Within the context of the overall objectives of the project, research, extension and training will be instrumental in increasing productivity and production in the agriculture of the participating islands. Immediate support to farmers and long-term institutional building within MATI beyond the investment period are additional benefits.

5.164 An effective extension service is based on a day-to-day interaction with farmers on each island. Operational and functional linkages between research and extension are mandatory and should result from the project outlined. An institutionalized training programme for extension personnel as well as external training for the farming public has been addressed in the project design.

5.165 The socio-economic considerations and benefits regarding to the development of agriculture have been dealt with in great detail in other sections of this report. What is being emphasized here is the fact that the most serious constraint to the development of a productive agricultural sector in The Bahamas lies in the absence of research, extension and training facilities. Therefore, these areas must be addressed immediately and given the highest priority. In most countries the principal agent to ensure such facilities is the government since the benefits derived are not merely restricted to farmers - the most active participants -but refer to the country as a whole.

Beneficiaries

5.166 There are three major farming systems in The Bahamas consisting of subsistence farmers, medium and small-scale commercial farmers and large-scale corporate farming. The structuring of the Research, Extension and Training Division and the execution of the components

of the project would be of benefit to all farming enterprises. While the number of corporate farmers are few, the enterprises nevertheless are on a scale that dwarfs the total area occupied by subsistence, small and medium commercial farmers whose numbers are shown in Table V-3. While corporate farmers in most instances bring in their own technologies and rely on external technical consulting, the other beneficiaries cannot afford this option and are therefore the primary beneficiaries of Research and Extension Services. It is to be expected that as research efforts are widened, corporate farmers will increasingly come to rely on local expertise.

4. AGRICULTURAL MARKETING SUBPROJECT

5.167 The Agricultural Marketing Subproject proposes a number of modifications required to enhance the developmental role and operating efficiency of marketing of agricultural produce in The Bahamas, through the following components:

- o The Produce Exchange System - which includes the Produce Exchange at Potter's Cay, Nassau, and eleven Packing Houses distributed throughout the project participating islands;
- o The Mail Boat System - which provides inter-island transportation of agricultural produce between the Family Islands and New Providence; and
- o The Market Information Service - which will process and provide basic information to allow for the organization of agricultural production and marketing in The Bahamas.

5.168 It is assumed that this system can be made effective and financially viable if its developmental role, the specific functions of each of its components, and the manner in which these components are interrelated are clearly defined. Furthermore, in order to upgrade the overall efficiency of the system, it is necessary to undertake physical modifications and renovation of equipment of existing warehouse and processing facilities, as well as to refurbish the 'Mail Boats', the inter-island transportation vessels.

OBJECTIVES OF THE MARKETING SYSTEM

a. Assist Farmers and Serve Consumers

5.169 The agricultural marketing system proposed in this project has two overriding goals: to assist Bahamian farmers in marketing fruits and vegetables required to satisfy market demand, and to provide a wide assortment of agricultural produce to urban consumers in the main cities of The Bahamas. To achieve such goals, the marketing system will rely on the project's objectives of promoting crop diversification and year-round production, and of providing essential agricultural services to farmers. As a consequence of pursuing those objectives, the project and, within it, the marketing system, will help to save foreign exchange and reduce the country's dependence on

foreign food supplies, to consolidate farming on the Family Islands as a viable economic activity, and to improve the structural balance of the Bahamian economy.

b. Promote Import Substitution and Exports

5.170 The system will also assist Bahamian farmers in promoting import substitution and exploiting export opportunities for produce. In the latter case, the trend will likely be towards medium- and large-size farms. Advances in this area will also result in additional foreign exchange earnings or savings, and in improvements in the structural balance of the country's economy.

c. Support Development of Marketing Institutions

5.171 The system will support the establishment of an Agricultural Market Information Service to conduct market research and guide production. Local agricultural marketing institutions will also be supported, particularly the retailer organizations serving low-income consumers in urban areas.

d. Seek Financial Self-Sufficiency

5.172 The Produce Exchange system will strive to attain financial self-sufficiency, moving away from the high government subsidies and financial losses which characterize present operations.

e. Generate Productive Employment

5.173 The efficient operation of the system will generate productive employment in farming and marketing. As the marketing system operates with increased efficiency, it can lower marketing costs and margins, hence reducing the prices paid by consumers. This increases the real income to consumers, which in turn motivates an expansion of the demand for foodstuffs and other commodities. As demand increases, so do employment opportunities in farming and along the marketing chain.

FUNCTIONS OF THE MARKETING SYSTEM

a. Demand Forecasting and Production Planning

5.174 The Produce Exchange (PE) in Nassau will be the center of the system, the "eyes and ears" of the market, in permanent contact with local and foreign buyers of Bahamian produce. It will maintain updated information on volumes traded and on prices of fresh fruits and vegetables. It will forecast consumption and market trends for these products. The PE relationship with farmers will take place through the Packing Houses, while that with consumers will be conducted through retailers and institutional clients.

5.175 Based on projected consumption levels and historical production patterns, the PE will be able to assign production quotas to each island. Or, alternatively, given the aggregate marketable volume, farmers may offer specific volumes or acreages. Allocation of production quotas to farmers would be conducted in coordination with and through the network of Packing Houses. The process will count on each island's extension agents working in coordination with the Packing Houses. The timely and coordinated supply of all these services is critical to assure the success of the project.

5.176 Planting and production decisions will be adopted in accordance with predicted market situations. This is the only way of preventing the seasonal gluts which cause sizable losses to farmers and the PE alike. It is also the logical way of mitigating seasonal shortages, by programming local production and imports. This approach entails a major change from current procedures adopted at the PE. The system will no longer "attempt" to sell what is delivered to it, but it would rather guide and assist producers to take advantage of well-identified market opportunities.

b. Wholesaling

5.177 With respect to farmers, the PE will act as a commission wholesaler or broker, not taking title to the commodities traded, but solely providing an intermediary marketing service to growers and buyers. The PE will perform only wholesale functions, buying in quantity, grading and sorting, boxing and hiring transportation services, and selling to other wholesalers, retailers, and institutional clients.

5.178 Under the project, the PE will sell produce to local and export buyers, deducting a 15% commission to cover its operating costs as a broker.

5.179 Although the system plans to rely on upgraded mail boats, it will not necessarily have do so in the future. The system should promote the development of an efficient and reliable inter-island transportation system for agricultural produce, be it through the mail boats or other arrangements. It is essential that a negotiated and permanent working relationship be established between the marketing system and mail boat operators and formalized by written contracts.

5.180 In performing its wholesaling functions, the system will promote development of foodstuff retail institutions, such as neighbourhood stores, market stall vendors, and consumer commissary stores. It should not engage in retailing activities. It is proposed that the existing retail outlets at Kemp Road and Jumbey Village be closed or transferred to the private sector. The PE system will sponsor a voluntary retailer chain to increase the overall efficiency of produce distribution in The Bahamas. To perform an effective wholesaling function and establish a loyal voluntary retail chain, the PE system will be prepared to import, during certain periods of the year, those items which Bahamian farmers cannot produce in sufficient quantity.

c. Packing and Storing

5.181 The Produce Exchange system, through the Packing Houses on the Family Islands and the PE facility in Nassau, will provide packing and cold storage services to farmers.

MANAGEMENT AND OWNERSHIP

5.182 Under more favourable conditions, the Produce Exchange and the Packing Houses should be run by private sector operators, under government regulation and control, to minimize government intervention and assure increased efficiency. However, given the project's developmental, geo-political and social goals, as well as the high initial investment costs of its marketing subproject, the Government will have to continue to participate in the system, at least until the latter achieves a sufficient level of efficiency to be able to attract private sector interest. Therefore, under the project, a special unit inside the Ministry of Agriculture will operate the system at the beginning.

5.183 It is, however, the intention of the Ministry of Agriculture that, in the near future, either an existing public corporation or, if necessary, a new one, be put in charge of the marketing system in order to pave the way for its divestment and privatization. A suggestion on how such a corporation could be organized and run is presented in Annex 4 of this report.

OPERATION OF MARKETING SYSTEM

STAFFING

5.184 It is necessary to rationalize current staffing at the Produce Exchange and Packing Houses, and in this way reduce costs and increase efficiency. Annex 4 shows proposed staffing for the PE and Packing Houses. PE staff would be reduced from 36 to 28, and the annual payroll lowered from Bh\$ 360,215 to Bh\$ 254,832. The retail outlets in Kemp Road and Jumbey Village are to be closed down or transferred to the private sector. Hence, personnel working in these outlets will be taken off the PE payroll. Packing House staff is to be reduced from 78 to 70, decreasing payroll costs from Bh\$ 639,721 to Bh\$ 505,512. These changes will save a total of Bh\$ 363,922 in salary expenses.

5.185 Staffing is to be further rationalized by the establishment of three levels of hiring, which will depend on the volume of operations, and by changes in functional assignments, with increased personnel in sales, maintenance, and control. Personnel in grading and produce handling operations are all either year-round or seasonal labourers.

5.186 The project will require the implementation of a technical assistance and training package during its initial phase. This package will be geared to strengthen the managerial efficiency of

the system. As part of it, it is recommended that two expatriate professionals be hired to serve as PE general manager and plant manager respectively, for the first two years of the project. In the first year of implementation, two local persons will be selected as management-trainees, to replace the expatriate personnel when they complete their contract terms.

5.187 The expatriate professional who is to serve as general manager will need to have an academic background in business administration or in agricultural marketing, at least a five years' experience in managing foodstuff wholesale/retail operations, and skill in training personnel. The expatriate who is to serve as plant manager should have at least five years of practical work in produce marketing organizations, and be proficient in warehousing, refrigeration, and product handling operations. He should also have the experience and expertise needed to handle PE personnel.

5.188 In the first two months of project implementation, the general manager will select the individuals to be hired as Packing House managers, who will answer directly to him. In the first six months, he will select the individuals to be management trainees for the positions of general manager and plant manager. These individuals will receive a mix of on-the-job and classroom training, to be provided by the expatriate personnel and by short-term consultants. The latter, both local and expatriate, will be hired to assist PE executives and train personnel in the areas of accounting, inventory and personnel management, marketing and merchandising, and data gathering.

RENOVATION OF THE PRODUCE EXCHANGE AT POTTER'S CAY

5.189 There are a number of options for the physical renovation of the Produce Exchange facilities at Potter's Cay, Nassau, ranging from the upgrading of the existing building as it is, without any significant layout changes nor product/traffic flow modifications, to building a completely new facility, either on the same site or somewhere else. Such options are comprehensively discussed in Annex 4 of this report. The one which appears to be the best alternative to the project, and the one being recommended, is called **Upgrading and Expansion of the Existing Facility, with Layout Modifications**. This is presented in Annex 4 as Alternative 2.

5.190 The cost of carrying out a major modification and expansion of the present facility at Potter's Cay will be approximately \$1,750,000. The layout plan for this option (presented in Figs. 8A and 8B, Unit 1, of Annex 4), entails a substantial modification of the facility, by building a new input storage area on the west end, eliminating the existing cold storage chambers to install packing and sorting activities on the north side, and by establishing a loading dock for trucks on the South side. New cold storage chambers, of the dimensions recommended in Annex 4, would be installed in the area presently used for grading. Employee bathrooms and offices would be built in the northeast corner of the building.

5.191 Most of the serious drawbacks observed in the present facility would be resolved by this investment alternative. Cold storage capacity for produce will be expanded to the levels recommended by this project. The cold storage section will consist of a group of four large chambers facing a central corridor. Separate and adequate input storage space will be provided next to the packing and sorting area. Loading and off-loading operations will be concentrated in the center, eliminating both existing docks. A new truck-loading dock will be constructed on the south side. One ripening room will be built between the produce packing area and the cold storage section.

5.192 The principal remaining problem has to do with the lack of sufficient perimetral area to establish a protective fence and a controlled traffic gate for vehicles and pedestrians, and to allow for ample vehicle circulation and parking. There will be limited possibilities for future expansion.

RETAIL OUTLETS IN NASSAU

5.193 It is recognized that both the Kemp Road and Jumbey Village outlets play a limited role in the marketing of produce. Reduced sales volumes, limited product assortment, overstaffing and sizable payroll costs turn both outlets into money-losing operations. In addition to representing a burden on public finances, such outlets are a poor example of produce retailing and present a negative image of public sector management.

5.194 Three possible courses of action may be followed with respect to PE retailing activities. They are discussed in detail in Annex 4. In summary, the first option is to properly strengthen this activity so that effective and meaningful state-owned retailing actions are carried out. The second one is to abandon retailing altogether, concentrating PE system efforts on wholesaling functions. A third alternative, which is the one recommended by the project, involves a combination of the previous two, namely, the concentration of the PE system on wholesaling, the privatization of existing retail outlets, and the formation of a voluntary retailer chain. To implement this, resources have been programmed by the project to provide the necessary technical assistance and training to PE personnel in charge of chain management.

MAIL BOAT TRANSPORTATION SERVICES

5.195 Mail boats have been the traditional means of transportation of agricultural produce from the Family Islands to Nassau. These services, however, are deficient and originate sizable economic losses to the PE as a consequence of produce spoilage, breakage and pilferage. Such losses must be prevented if the PE system is to become financially viable. To assure the provision of adequate transport services by mail boat operators, a number of recommendations are made and discussed at length in Annex 4 with respect to (i) contractual relationships with mail boat owners and captains to prevent losses; (ii) organizational aspects, and (iii) incentives to change and upgrade the operations.

THE PACKING HOUSES

5.196 The Packing Houses on the Family Islands play an essential role in the collection, grading, sorting and boxing of produce sent to the Produce Exchange. As such, the Packing Houses are a vital link connecting the farmer to the PE system and the market. An expansion of their role is proposed by the project, so that they may become **Agricultural Service Centres** and provide a series of auxiliary services to farmers. Out of tradition and convenience, though, this document will continue to refer to them as Packing Houses.

5.197 The main proposals advanced by the project for the upgrading of the Packing House System are presented in detail in Annex 4. In summary they are the following:

a. Physical Infrastructure and Equipment

(i) **Physical Modifications** - a number of physical modifications, including expansion, are going to be carried out in the existing Packing Houses. New input storage rooms and rooms for the extension agents are to be built.

(ii) **Equipment** - Grading and sorting equipment in North Andros and North Eleuthera are to be replaced by new machinery; the remaining ones are to be repaired. New cold room equipment will be installed in North Andros. New compressors and evaporators need to be purchased for the other six facilities. New equipment will be installed in the four new facilities.

(iii) **New Facilities** - Four new Packing Houses will be built on Mayaguana, Long Island, South Andros and Crooked Island.

b. Operating Procedures

(i) **Decentralized Management** - Even though the Packing Houses and the PE are parts of the same system, each Packing House should be viewed as a separate enterprise. Packing House managers will be selected with the approval of the General Manager of the PE in Nassau, but will have autonomy to select and dismiss personnel working in their facilities. Each Packing House manager will be given incentives to increase operational efficiency, by reducing operating costs and spoilage. Separate consideration to each Packing House is essential for sound monitoring of performance. PE system executives need to know how each Packing House is doing and have the capacity to analyze each situation separately, so they may be able to adopt the necessary measures.

(ii) **Prices and Margins** - Within the marketing system, prices and margins will be calculated in the following manner:

- * The PE detects market opportunities in The Bahamas or abroad, and estimates **minimum** prices to be paid to farmers. These prices will be obtained by estimating **minimum** sale prices by the PE, deducting a fixed percentage commission (usually 10 %

and no more than 15 % in this line of business), and subtracting mail boat transport costs (Bh\$ 2 per box).

- * The PE in Nassau communicates minimum price and estimated saleable volumes of each produce item to the Packing Houses, which, in turn, communicate it to farmers.
- * Once products are actually marketed and sold, and final sale prices are determined, the prices to be paid by the PE to Packing Houses will have to be calculated. When the sale price is higher than the estimated minimum, the PE will pay Packing Houses the corresponding differential. If sale prices were to be lower than the minimum, the PE will absorb the loss, hence the need to carefully estimate minimum prices.
- * Packing Houses will establish a margin per box to cover their operating costs. Based on current prices charged by private sector packers in Florida, such margin should range between Bh\$ 2 and 4 per box. This price, multiplied by the number of boxes processed and shipped, provides the gross income of the Packing House, from which operating costs have to be deducted.

MARKET INFORMATION SERVICE

5.198 The establishment of a Market Information Service is a crucial element to assure successful implementation of the project. The proposed service will provide the following kinds of market information:

- * Acres planted per crop, expected yields and harvesting periods, for each island;
- * Acres used by livestock, kinds of livestock, number of animals per breed, estimate of supply, for each island;
- * Forecast of monthly demand for the the main products, covering the coming quarter, broken down by types of consumers;
- * Produce prices paid to farmers, per island;
- * Weekly wholesale and retail prices for each product, at Nassau, Freeport and Miami;
- * Volumes marketed on each island during the previous week;
- * Volumes expected to arrive in Nassau, in the coming week, either from local sources or from a foreign supplier.

5.199 The above information will have to be made readily available to the relevant users: wholesalers (especially the Produce Exchange), retailers, institutional consumers and farmers. It will have to be disseminated daily and weekly via bulletins and radio. A large board containing relevant price information will also be placed at the Produce Exchange and Packing Houses.

5.200 Information collection will be conducted by the extension agents and Packing House managers on each island, and by designated Produce Exchange personnel in Nassau. The processing of such information will be done at the Department of Agriculture by two junior professionals. Information dissemination will be done mostly by radio and also by printed bulletins. These tasks will be part of the normal extension and marketing services of the Ministry of Agriculture and do not represent a cost to the project.

TECHNICAL ASSISTANCE AND TRAINING

5.201 The overall requirements for technical assistance and training in marketing under the project are summarized below. Detailed information on what kind of technical assistance will be needed, and how much, is provided in Annex 4 of this report. As recommended by the project, during the first two years of project implementation, both the general manager and the plant manager of the Produce Exchange will be expatriate personnel. They will provide training to the two local trainees who will be hired for that purpose by the Exchange and whose salaries are already included in the Exchange budget. Because of this, such training will have no cost to the project. It is proposed that the two expatriate experts be paid from local funds. The costs of this component are the following:

	\$	
<u>Technical Assistance</u>		
General Manager of PE (24m/m x \$10,000):	<u>240,000</u>	(Local Funds)
Plant Manager of PE (24m/m x \$ 8,000):	<u>192,000</u>	(Local Funds)
SUBTOTAL LOCAL FUNDS	432,000	
Other Tech.Assist. ...(43m/m x \$ 9,000):	387,000	
Training by Expatriate Experts.....(7m/m x \$ 9,000):	63,000	
Training by Local Experts.....(21.5m/m x \$ 5,000):	<u>107,500</u>	
SUBTOTAL FOREIGN FUNDS	<u>557,500</u>	
T O T A L	989,500	

SUBPROJECT COSTS

5.202 The following are the investment and operating costs of the Marketing Subproject (in US dollars):

	TOTAL	LOCAL	FOREIGN
Buildings	2,687,095	537,419 [20%]	2,149,676 [80%]
Equipment	1,829,339	365,868 [20%]	1,463,471 [80%]
Incr.Working Cap.	780,000	-	780,000 [100%]
Tech.Assist./Train.	989,500	432,000 [44%]	557,500 [56%]
TOTALS	6,285,934	1,335,287 [21%]	4,950,647 [79%]

5. FEEDER ROADS SUBPROJECT

5.203 The purpose of this subproject is to make economically viable the areas chosen for crop production which are located on top of freshwater lenses, by linking them, through feeder roads, to the main road networks of the islands.

5.204 An estimated thirty (30) miles of new roads will be built on seven islands of the project area. Such roads will be built as dirt roads on the rocky limestone soils typical of the Bahamian environment. This will facilitate their construction and maintenance, since such soils are easily compacted and are also highly permeable, with practically no surface run-offs. As agriculture develops, it may become advantageous, in a later phase, to surface these access roads.

5.205 The islands to be assisted with feeder road construction are the six less developed islands of the Southeastern sub-area, plus Eleuthera. The construction cost for this kind of road is \$35,000/mile, and their maintenance cost is \$5,000/mile/year. Total mileage and construction costs for this component are as follows:

ISLANDS	MILES	US\$
ELEUTHERA	11.7	409,500
EXUMA	2.6	91,000
LONG ISLAND	1.4	49,000
CAT ISLAND	10.5	367,500
ACKLINS	1.6	56,000
CROOKED	1.2	42,000
MAYAGUANA	1.0	35,000
T O T A L	30.0	1,050,000

5.206 The designs of the feeder roads to be built or on each island will be superimposed on the maps which show the areas selected for crop development, presented in Annex 6 of this report.

C. ENVIRONMENTAL ISSUES ^{1/}

5.207 The Commonwealth of The Bahamas needs a comprehensive plan for natural resources management. Utilization of land and water for agricultural purposes will depend on how other competing uses for those two natural resources are established on a priority basis. Areas must be allocated to forestry reserves, to water reserves for urban use, and to conservation of flora and fauna. A recommendation for a master plan of land and water use is made in Annex 3 of this report (Development of Irrigation Projects in The Bahamas).

5.208 Annex 5 provides a broader and more detailed assessment of environmental issues in The Bahamas. Said assessment goes beyond the scope of this project, to refer to the country as a whole. Given the geographical characteristics of the country, the peculiar configuration of the most important islands, and the fact that the economy is highly dependent on tourism, the Bahamian environment is a fundamental issue for consideration by policymakers.

5.209 As far as this project is concerned, the environmental impact of its technical proposals relates, primarily, to a considerable expansion of agricultural land under irrigation. The irrigation project design considers that there are some 50,962 acres on which irrigated agricultural development can take place. The impact of agrochemicals is hard to determine, and will depend on data related to existing resource reserves, and on proposals for future agricultural use. Such an expansion will bring with it considerable land clearance and preparation; road construction; and upgrading of infrastructure and marketing facilities. To mitigate the more serious impacts of these proposals, the environmental assessment of the project proposes a number of actions that will reduce the negative impacts.

5.210 Road construction damage can be greatly mitigated by the use of unsurfaced secondary and tertiary roads, together with adherence (as far as possible) to the existing forest road network.

5.211 Salinization is unlikely to be a problem, unless there is an excessive use of water for irrigation, or abstraction from the halocline or saline zone. This must be controlled by adequate forms of licensing, pump sizes and continuing checks on abstraction rates and quantifies. A set of recommendations in this area is provided in Annex 3 of this report.

5.212 To improve the institutional situation, there are proposals for specific actions that can be implemented by the Government of The Bahamas without any further project inputs. These include the appointment of a conservation officer within the Ministry of Agriculture; the formation of a system of inter-departmental liaison; the setting up of an Environmental Affairs Committee under the Ministry of Health; and the setting up of a cabinet committee of

^{1/} A detailed assessment of environmental issues in The Bahamas is provided out in Annex 5 of this report.

Ministers to supervise the phased development of a national land use policy.

5.213 Agrochemical use may be a potential problem. At present, few pesticides are used in the Family Islands, and any increase in their use may negatively affect these community water supplies. Such multiple use carries with it a risk that must not be ignored. There is a further potential risk in the long term accumulation of fertilizer and pesticide residues in the soils and aquifers if irrigation is intensive.

5.214 The environmental impact assessment provided in Annex 5 reduces the potential area for irrigation proposed in this project from some 50,000 acres to 31,500, a 37 percent reduction, and phases its expansion in three periods covering 20 years. The expansion of irrigated areas proposed for the first five years, 7,022 acres, is above what this project foresees and, therefore, poses no limits to its execution. That limit would only be exceeded if, eventually, the export crop development proposal - designed mostly for the Northern Islands - becomes the object of an unprecedented rate of adoption. Nevertheless, considerable care will have to be taken in the execution of the development proposals put forward in the project.

D. TECHNICAL CO-OPERATION

5.215 The strengthening of the technical and managerial capabilities of the Ministry of Agriculture, as mentioned before, is one of the main objectives of the project. Besides, the success of the execution of the project will depend, to a very large extent, on how promptly administrative restructuring is carried out and training programmes are implemented.

5.216 In various sections of this report and in some of its technical annexes, an extensive institutional analysis of MATI and other participating institutions is offered. Deficiencies and weaknesses have been identified in all areas, and a set of recommendations has been proposed to remedy them. The way that most of these recommendations can be executed is through technical co-operation. The following paragraphs present in detail what kind of technical co-operation will be needed in the different areas and how much it will cost. Details of the technical co-operation and its costs can be found in section E of this chapter, Costs of the Project.

5.217 The estimated cost of the technical co-operation to be carried out under the project is about US\$2,435,116. This includes both training of local personnel and hiring of consultants for technical assistance in several areas. It is suggested that most of such technical co-operation be executed with non-reimbursable funds from the financing agency.

E. COSTS OF THE PROJECT

5.218 All project costs will be presented in US\$ equivalent values. There are three groups of costs:

- a) The investment and operating costs envisaged for the five year period of execution of the project. Estimated costs: US\$11,774,334.
- b) The credit loan facility requirements for farmers (on-farm investment in crops and livestock), Estimated costs: US\$1,257,000.
- c) The technical cooperation which will be needed for the execution of the project, including training, and technical advisory services. Estimated costs: US\$2,435,116.

5.219 The Investment and Operating Costs

The investment and operating costs are estimated at the equivalent of US\$11,774,334. They refer to the direct costs of the project and exclude escalation, contingencies and financial charges^{1/}. The total costs by category and subcategory is as follows:

THE INVESTMENT AND OPERATING COSTS

CATEGORY AND SUBCATEGORY	TOTAL US\$	%
ENGINEERING AND ADMINISTRATION	1,002,545	8.6
BUILDINGS AND ROADS	4,411,450	37.5
LAND CLEARING AND PREPARATION	1,050,000	8.9
OTHER INVESTMENT	747,000	6.3
INCREMENTAL WORKING CAPITAL	780,000	6.6
MACHINERY, EQUIPMENT AND VEHICLES	2,428,339	20.6
a. MACHINERY	1,380,835	
b. EQUIPMENT	752,500	
c. VEHICLES	295,000	
LAND	20,000	0.2
ASSOCIATED COSTS	1,335,000	11.3
a. PERSONNEL	240,000	
b. UTILITIES	120,000	
c. SUPPLIES	125,000	
d. MAINTENANCE	850,000	
GRAN TOTAL	11,774,334	100.0

^{1/} The financial charges will be determined when the loan is negotiated between the country and the financing agency.

5.220 The Credit Component

This cost is estimated at the equivalent of US\$1.257,000, as follows:

LOAN FACILITY REQUIREMENTS	TOTAL COST	
	US\$	₡
1. ORCHARD CROPS <u>1/</u>	560,000	44.5
2. SPECIALTY CROPS <u>2/</u>	79,000	6.3
3. SHEEP AND GOATS <u>3/</u>	618,000	49.2
T O T A L	1,257,000	100.0

- 1/ Crop Development Subproject. This originates from an expected participation of 20 farmers from each of the 6 Southeastern Islands plus South Andros, each receiving US \$ 4,000 over the 5-year period of the project. Total Farmers: 140. Estimated area: 700 acres.
- 2/ Crop Development Subproject. This originates from development of tree crops covering 280 acres of the 6 Southeastern Islands plus South Andros, over a 2-year period.
- 3/ This is the financial support required to initiate the national sheep and goat herd improvement programme. The expected participation is about 149 farmers with herd sizes of 50, 100, 150 and 200-doe unit.

5.221 Technical Co-operation

This cost is estimated at the equivalent of US\$2,435,116. A detailed exposition justifying the especial treatment for the technical co-operation for execution of the project was presented in Section D of this chapter. It is suggested that the technical co-operation for the project be financed with non-reimbursable funds of the financing agency.

1. Short Term Courses.

This item includes training of local personnel, and technical advisory services provided through consulting services.

For Extension Agents - US \$ 78,000

DESCRIPTION	No. OF PARTICIPANTS	DURATION (DAYS)	UNIT COST \$	No. 1/ COURSES	COST (US\$)
COMMUNICATIONS/ATTITUDE AND SELF ESTEEM	10	2	600	2	12,000
MANAGEMENT SKILLS	10	1	300	2	6,000
FARM PLANNING AND BUDG.	10	1	300	2	6,000
EXTENSION METHODOLOGY	10	1	300	2	6,000
CARE & MANAGEMENT OF CROPS	10	1	300	2	6,000
USE AND MANAGEMENT OF FARM EQUIPMENT AND TOOLS	10	1	300	2	6,000
CARE AND MANAGEMENT OF LIVESTOCK GROUPS	10	1	300	2	6,000
ESTABLISHMENT AND CARE OF CROPS	10	1	300	2	6,000
IRRIGATION AND WATER MANAGEMENT	10	1	300	2	6,000
FARM ACCOUNTING	10	1	300	2	6,000
PUBLIC HEALTH 2/	--	-	---	-	12,000

1/ Training may be in years 1 and 2.

2/ Environmental aspects: In order to improve the extension services and to provide a greater measure of control of agrochemical use and pest control, it is recommended that extension officers be receive training as Public Health Inspectors. An initial complement of 4 such officers is recommended, at a cost of \$ 12,000 (\$ 3,000 each).

For farmers 1/ = US \$144,000

DESCRIPTION	No. OF PARTICIPANTS	DURATION (DAYS)	UNIT COST \$	No. 1/ COURSES	COST (US \$)
ORCHARD CROP PRODUCTION	30	1	300	2	18,000
VEGETABLE CROP PRODUCTION	30	1	300	2	18,000
POST-HARVEST HANDLING OF CROPS (FRUITS AND VEGETABLES)	30	1	300	2	18,000
SMALL STOCK HUSBANDRY	30	1	300	2	18,000
PEST, DISEASES AND THEIR CONTROL	30	1	300	2	18,000
SOIL AND WATER MANAGEMENT	30	1	300	2	18,000
FARM BOOK-KEEPING	30	1	300	2	18,000
SELF ESTEEM AND PERSONAL DEVELOPMENT	30	1	300	2	18,000

1/ Training may be given over a two year period and repeated every two years.

POSITION	YEAR	AREA OF SPECIALIZATION	US \$
1. SOIL FERTILITY	I	SOILS MAJOR, CROPS MINOR	22,960
2. HORTICULTURIST	I	CITRUS CROPS	22,960
3. HORTICULTURIST	I	ROOT CROPS	11,600
4. AGRICULTURAL ENGINEER	I	IRRIGATION	31,494
5. LIVESTOCK	I	LIVESTOCK	26,170
6. EXTENSION	I	EXTENSION ANIMAL SCIENCE	11,600
7. EXTENSION	I	EXTENSION AGRONOMY	29,500
8. HORTICULTURIST	I	VEGETABLE CROPS HERBICIDE	11,600
9. ENTOMOLOGIST	II	ENTOMOLOGY	29,500
10. EXTENSION	II	EXTENSION CROP CARE	27,530
11. HORTICULTURIST	II	TREE CROPS (NON-CITRUS)	20,920
12. FOOD TECHNOLOGIST	II	FOOD TECHNOLOGY	29,840
13. PLANT BREEDER	II	PLANT BREEDING	17,284
14. PATHOLOGIST	II	PATHOLOGY	18,488
15. AGRICULTURAL ENGINEER	II	FARM MACHINERY AND LAND PREPARATION	23,000
16. LIVESTOCK	II	RUMINANT PRODUCTION AND NUTRITION	11,600
17. LIVESTOCK	III	PASTURES FORAGE UTILIZATION	11,600
18. SOIL CHEMIST	III	SOIL CHEMISTRY	22,800
19. AGRONOMIST	III	FARMING SYSTEMS	11,600
20. MICROBIOLOGIST	III	FOOD MICROBIOLOGY	25,822
21. PHYSIOLOGIST	III	POST-HARVEST PHYSIOLOGY	11,600

1/ Annex 1, Tables V-26A, V-26B and V-26c, presents a detailed description of the graduate training for twenty-five (25) selected candidates, including: year, position, recommends institution (university), area of specialization, courses, research activity and expenses (tuition, room and board, books, travel, insurance).

POSITION	YEAR	AREA OF SPECIALIZATION	US \$
22. EXTENSION	III	AGRICULTURAL EDUCATION	24,420
23. HORTICULTURIST	III	VEGETABLE CROPS	22,968
24. AGRO-HYDROLOGIST	III	AGRO-HYDROLOGY	31,470
25. CHEMIST	III	ANALYTICAL CHEMISTRY	25,830

TECHNICAL ADVISORY SERVICES = US\$1,679,000

The technical advisory services to institutions participating in the project in disciplines or specialties for which high-level professionals are not available in The Bahamas will be provided through consultants or consulting services that will be contracted for as the following areas:

DESCRIPTION	Y E A R			US \$ (THOUSANDS)
	1	2	3	
	MAN/MONTHS	MAN/MONTHS	MAN/MONTHS	
1. GENERAL MANAGER OF PE	12	12	-	240
2. PLANT MANAGER OF PE	12	12	-	192
3. OTHER TECHNICAL ASSISTANCE IN MARKETING	43	-	-	387
4. TRAINING IN MARKETING BY EXPATRIATE EXPERTS	6	1	-	63
5. TRAINING IN MARKETING BY LOCAL EXPERTS	12.5	9	-	107
6. RESEARCH MANAGEMENT	12	3	1	120
7. EXTENSION DESIGN AND MANAGEMENT	12	3	1	120
8. SOIL FERTILITY	12	12	3	90
9. LIVESTOCK	12	12	3	90
10. CROP PRODUCTION	12	12	3	90
11. CROP PROTECTION	12	12	3	90
12. FOOD TECHNOLOGY	12	12	3	90

5.222 DETAILED DESCRIPTION OF THE INVESTMENT AND OPERATING COSTS

A detailed description of the investment and operating costs of the project is given below:

ENGINEERING AND ADMINISTRATION - US\$1,002,545

This item includes the funds needed for: (a) final design of the buildings; (b) supervision of the execution of the works.

SUBCATEGORY	US \$
- FINAL DESIGN (PLANS, ELEVATIONS, SECTIONS, DETAILS, OTHER)	340,545
- WORKS SUPERVISION	662,000
T O T A L	1,002,545

BUILDINGS - US\$4,411,450

Marketing Subproject 1/

US\$ 2,106,450

i. Renovated Produce Exchange	US\$ 1,500,000
30,000 sq.ft. space to include: 6,000 sq.ft. of precessing area 5,440 sq. ft of cold storage 1,360 sq. ft input storage space 1,500 sq. ft sales office space 800 sq. ft. of ripen room All central air-conditioning Floor drains New loading areas Separate garbage storage	

1/ Source: Annex 4.

ii. Renovation of Seven Packing Houses	US\$ 255,450
2,000 sq.ft. of processing area 4,275 sq.ft. of input storage area 1,680 sq.ft. of Technical Assistance office area.	
iii. Construction of Four New Packing Houses	US\$ 351,000
9,520 sq.ft. of processing area 900 sq.ft. of input storage area 960 sq.ft. of Technical Assistance office area.	

Source: Annex 4.

Research and Extension Services Subproject -US\$ 1,113,000

i. Research station (4,800 sq. ft.)	US\$ 288,000
4,800 sq. ft. to include: .Recp/waiting 300 sq. ft. .2 exec. offices 500 .6 standard offices 900 .Multi-purpose lab 1,000 .Conference room 300 .Library 200 .Toilet facilities 500 .General storage 300 4,000 x 20% circulation, etc.	

Source : Annex 1.

ii. Storage shed	1,000	US\$ 45,000
iii. Staff Housing for Research Station (13,000 sq. ft.)		US\$ 780,000
.13,000 sq. ft. to include: .2 three bedroom houses for directors 3,000 sq.ft. .6 townhouse type apt. block for officers 9,000 .Central wash-house garbage etc. 1,000		

Livestock Development Subproject - US\$142,000

<p>i. Four Slaughter Slabs to be established at Long Island (year 1), Eleuthera (year 2), Andros (year 3) and Exuma (year 4) each of them with a yard, unloading ramp and holding pens:</p> <ul style="list-style-type: none"> - Area of Building : 15 x 40 feet (600 sq. feet x US\$30/ft = US\$18,000) - Area of unloading (400 sq. feet x US\$10/ft = US\$4,000) - Cool room = 10 x 10 x 10 feet (1,000 cubic ft. = US\$12,000) 	<p>US\$ 136,000</p>
<p>ii. Livestock Improvement Centres (3) Brees Improvements Centres to be located on Eleuthera, Long Island and Cat Island. The basic facilities to consist of a shelter to accommodate up to 5 does and ram located on one acre of land</p>	<p>US\$ 6,000</p>

Source: Annex 2.

Feeder Roads Subproject - US\$1,050,000

<p>i. An estimated 30 miles of new roads will be built (US\$35,000/mile).</p>	<p>US\$1,050,000</p>
--	-----------------------------

Source : Chapter V.

INVESTMENTS IN OTHER GOODS - US\$746,800

Livestock Development Subproject - US\$746,800

This item includes the cost for importing male and female stock to upgrade the national sheep and goat herds:

MACHINERY, EQUIPMENT AND VEHICLES - US\$2,428,339

i) Machinery US\$1,380,839

CLASSIFICATION	MARKETING
GRADING MACHINES	1,310,839
FORK LIFTS	70,000
T O T A L	1,380,839

Source: Annex 4, Tables 4.2A and 4.2B.

ii) Equipment = US\$752,500

CLASSIFICATION	MARKETING
OFFICE (DESK, CHAIRS, FILE CABINETS, OTHER)	55,000
OTHER EQUIPMENT	163,500
COMPUTER SYSTEM	40,000
COOL/COLD STORAGE	440,000
TOTAL	698,500

Source: Annex 4, Tables 4.2A and 4.2B.

CLASSIFICATION	LIVESTOCK
EQUIPMENT FOR FOUR SLAUGHTER SLABS (HOIST, RACKS AND RAILS, SCALING TANK, ETC.)	24,000
EXTRUDER FOR OPHAL UNIT	30,000
T O T A L	54,000

Source: Annex 2.

iii) Vehicles = US\$ 295,000

CLASSIFICATION	SUBPROJECTS (US\$)				TOTAL (US\$)
	MARKETING 1/		RESEARCH AND EXTENSION		
	No.	UNIT COST	No.	UNIT COST	
REFRIGERATED TRUCKS	2	50,000	--	--	100,000
PICK-UP TRUCKS 2/	-	--	13	15,000	195,000
T O T A L					295,000

1/ Source: Annex 4, Table 4.2.

2/ Source Annex 1.

LAND = US\$20,000

A minimum area of 10 acres will be sufficient to accommodate the Coppice Islands Agricultural Research and Extension Centre (CIAREC). This Centre will be located in Long Island.

ASSOCIATED COSTS = US\$1,335,000

	US \$
PERSONNEL 1/ - LIVESTOCK SUBPROJECT	240,000
UTILITIES - RESEARCH AND EXTENSION SUBPROJECT	120,000
SUPPLIES - RESEARCH AND EXTENSION SUBPROJECT	125,000
MAINTENANCE - RESEARCH AND EXTENSION SUBPROJECT - FEEDER ROADS SUBPROJECT 2	850,000 250,000 600,000

-
- 1/ There is a reassignment of personnel in the Research and Extension Subproject. Only four Animal Health Assistants are hired as new staff in the Livestock Subproject. A detailed list of the staffing and their reassignment is presented in Annex 1, Tables V-17 to V-24.
 - 2/ Maintenance costs for direct road is \$5,000/mile. This is multiplied by 30 miles and four years.

F. FINANCING

a) Investment and Operating Costs

5.223 The total costs of the project would be financed by a loan of US\$ 7,910,262 in foreign exchange from the IDB, (67% of total costs) and by local counterpart funds amounting to US\$3,864,072 (33% of total costs). The source of financing by investment categories, would be as in the table below:

COST BY INVESTMENT CATEGORY AND SOURCES OF FINANCING (US\$)

CATEGORY AND SUBCATEGORY	SOURCES		TOTAL
	IDB (FOREIGN EXCHANGE)	LOCAL CONTRIBUTION	
ENGINEERING AND ADMINIST.	300,763	701,782	1,002,545
BUILDINGS AND ROADS	3,529,160	882,290	4,411,450
LAND CLEARING AND PREP.	-----	1,050,000	1,050,000
INVESTMENTS IN OTHER GOODS	747,000	-----	747,000
INCREMENTAL WORKING CAPITAL	780,000	-----	780,000
MACHINERY, EQUIPMENT AND VEHICLES	2,428,339	-----	2,428,339
- MACHINERY	1,380,839	-----	1,380,839
- EQUIPMENT	752,500	-----	752,500
- VEHICLES	295,000	-----	295,000
LAND FOR CIAREC	-----	20,000	20,000
ASSOCIATED COSTS	125,000	1,210,000	1,335,000
- PERSONNEL	-----	240,000	240,000
- UTILITIES	-----	120,000	120,000
- SUPPLIES	125,000	-----	125,000
- MAINTENANCE	-----	850,000	850,000
TOTAL	7,910,262	3,864,072	11,774,334
PERCENTAGES (%)	67	33	100

b) Credit

5.224 The credit loan facility, which amounts to \$1,257,000, will be utilized to finance both the Orchard Farm and the Specialty Crops development models proposed by the project, for a total amount of \$639,000. For the implementation of the five sheep and goat farm models a total of \$618,000 will be needed. All these funds will be distributed and collected through the Bahamas Agricultural and Industrial Corporation (BAIC), which is being reorganized to execute several components of the project.

c) Technical Co-operation

5.225 The technical co-operation needed for the execution of the project is estimated at \$2,435,116. It is suggested that \$432,000 of this total be financed by local funds, and \$2,003,116 be financed by non-reimbursable funds from the Inter-American Development Bank. The local counterpart funds correspond to the hiring of the General Manager and the Plant Manager, respectively, for the Produce Exchange at Potter's Cay, Nassau, and would translate a commitment on the part of the Ministry of Agriculture to the adoption of a completely new operational system for agricultural marketing in The Bahamas.

CHAPTER VI PROJECT EXECUTION

A. EXECUTION MECHANISM

6.01 Based on the analysis of the institutional capabilities of the Ministry of Agriculture, Trade and Industry, particularly of the Department of Agriculture, as presented in Chapter III, it is considered necessary to strengthen the organizational structure of the Department of Agriculture and to reorganize the Bahamas Agriculture and Industrial Corporation (BAIC). Both agencies are of vital importance for the proper execution of the project.

6.02 Once the Department of Agriculture and the Bahamas Agricultural and Industrial Corporation (BAIC) have been strengthened, through technical cooperation or other mechanisms, it is proposed that a Coordinating Unit, under the Department of Agriculture, be created to execute the project. This Coordinating Unit will serve as a link with the financing entity and will be directly responsible for the supervision and administrative control of the execution of the project. Each Division, depending on its area of specialization, will be responsible for the technical and operational aspects each of the project's components.

6.03 Given the unique characteristics of the land tenure system described in previous chapters, it has been proposed that the Bahamas Agricultural and Industrial Corporation (BAIC) be responsible for the administration of rural credit, providing that there is clear evidence that the BAIC has been strengthened and updated to manage the rural credit system.

6.04 Execution of any possible technical cooperation will be the sole responsibility of the Coordinating Unit, with advisory assistance from the Divisions of the Department of Agriculture, for the different areas of specialization.

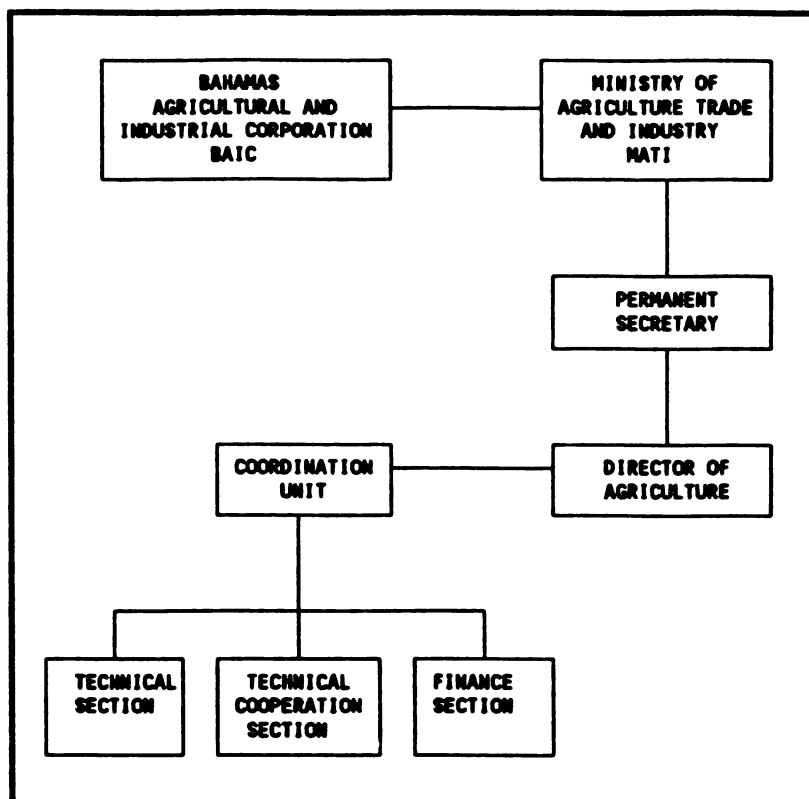
6.05 The Coordinating Unit will be created prior to executing the project, and will be operative only during project execution. Its principal functions will be to:

- (i) serve as a liaison with the MATI, as the executing agency, and funding agency.
- (ii) coordinate the administrative-accounting system for the project execution.
- (iii) supervise compliance with the work and investment schedule of the project.
- (iv) coordinate and execute technical cooperation to be carried out in conjunction with the project.

6.06 The organization and operations of the Coordinating Unit will be based on an organizational chart and regulations that specify the duties and responsibilities, in accordance with the functions described in this Chapter.

6.07 The Coordinating Unit will consist of three sections for operations (see Table 6.1, Organizational Chart of the Coordinating Unit):

**TABLE 6.1
COORDINATION UNIT
ORGANIZATIONAL CHART**



- (i) **Technical:** It will monitor supervision carried out by the consulting firm of the construction works and the provision of equipment, verifying the efficiency and capabilities of the personnel assigned by the firm. It will also check the progress made on the works, and provide advisory services to the Department of Agriculture with regard to compliance with and execution of the other components of the project.
- (ii) **Technical cooperation:** It will coordinate and execute technical cooperation to be carried out in conjunction with the project.
- (iii) **Finances:** It will coordinate and execute requests for disbursements and the accounting-financial administration of the project.

6.08 The Coordinating Unit will be managed by the Unit Chief, preferably a engineer with experience in project management. The Unit Chief will be assisted by two professionals, preferably engineers: one with experience in construction and setting up packing and storage centers for agricultural commodities, and the other will be an agronomist with experience in agricultural development. A technical expert in rural training programs will coordinate technical cooperation activities. The finance section will be composed of an auditor-accountant and an assistant account. Support personnel will include a secretary, two drivers and a messenger.

6.09 In addition, the Department of Agriculture will have staff members in each Division involved in the project, according to the needs of each subprogram. A list of the additional personnel required for executing the project is included in Chapter V, The Project.

B. SUPERVISION AND ADMINISTRATION

6.10 With regard to construction works, the execution of the project involves hiring a consulting firm, specialized in supervising the construction and installation of packing houses, produce exchanges and related works, similar to those called for in the project, in order to supervise the works and advise the Ministry on how to oversee execution of same. The firm should be hired for a period that approximates the period required for the construction of the works.

6.11 The general administration and supervision of the project will be the responsibility of the Department of Agriculture of MATI, through the Coordinating Unit and its Divisions. Upon completion of the current restructuring, the BAIC will be in charge of administrating the credit. A detailed description of credit management is provided in Chapter V, The Project.

Chapter VII. JUSTIFICATION

A. TECHNICAL JUSTIFICATION

7.01 The various development proposals advanced by the five subprojects which make up the Agricultural Services Development Project are all based on the actual possibilities of both the country as a whole - in terms of its soils, climate, water availability and agricultural tradition - and the Ministry of Agriculture in particular, by taking into account its technical and managerial capabilities.

7.02 The Crop Development Subproject includes four development proposals. Of these, three (Orchard Crops, Selected Miscellaneous Crops and Specialty Crops) refer specifically to the Southeastern Islands and are totally adaptable to the conditions of the area. Benefits are expected only from the two first development models. The selection of crops, the strategy for their establishment, the rate of adoption of the farm models by local farmers, the use of water, the size of the farms, all were scrupulously designed taking into consideration the real possibilities of the area, the conservation of the environment, the tradition of local farmers and the support capability of the Ministry of Agriculture. The goals are modest and conservative but, at the same time, they represent a large step forward in the agricultural economy of those islands. Technical support will be well within the capability of the Ministry of Agriculture, Trade and Industry (MATI), and the financial support to participating farmers will pose no strains on public finance. Finally, the crop development models are seen as the most immediate and feasible way of improving the standards of living of the populations of the Southeast.

7.03 The fourth crop development proposal (Export Crops) refers to the possibilities for export agriculture in the Northern Islands. Its implementation will depend on the success of the promotional activities of MATI. Because of this, it does not represent a cost to the project, nor any benefits are expected from it.

7.04 The Livestock Development Subproject proposed by the project is circumscribed to the improvement of sheep and goat rearing in the Southeastern Islands. This represents an improvement on what already exists in, and has been the tradition of, the area for a long time. The lands allocated to this activity are those Coppice lands which, although not appropriate for crops, are nevertheless capable of supporting small ruminants. The technical support expected is well within the Ministry's capabilities. Other livestock development possibilities in The Bahamas are suggested in Annex 2 of this report but were not included in the project.

7.05 The Research, Extension and Training Subproject was designed with the purpose of equipping the Ministry of Agriculture with the necessary human and technical resources to enable it to fully discharge its duties of promoting the development of agriculture. Again, the subproject's modest objectives will represent a substantial improvement of the present modus operandi of the Ministry and will be based mostly on a redefinition of functions, redeployment of personnel, and training of existing staff.

7.06 The Agricultural Marketing Subproject is the project's central and crucial component, and the one which will make the other development proposals viable. The physical infrastructure and services to be provided by the marketing subproject are deemed essential to the development of agriculture in The Bahamas as a whole. The Market Information Service will guide farmers on what, how much and when to plant, so that gluts and spoilage of produce may be avoided in the future. The marketing infrastructure, services and operations proposed by the project are considered as major incentives for farmers to participate in the project.

7.07 The Feeder Roads Subproject will give access to the areas selected for crop development. Such areas are located over water reserves that can be used for irrigation. The roads can be easily built and maintained; they will be unsurfaced roads built on the rocky and highly permeable limestone soils of The Bahamas. Road construction will pose no threat to the environment.

B. INSTITUTIONAL AND FINANCIAL JUSTIFICATION

7.08 One of the main project objectives is to strengthen the technical and managerial capabilities of the Ministry of Agriculture, Trade and Industry so that it can fulfill its duties and functions of promoting and supporting the development of agriculture in The Bahamas. In order to achieve this objective, the project proposes a number of activities and actions which will fully equip the Ministry to carry out not only the implementation of the project but also the remaining functions assigned to it.

Institutional

7.09 Based on the analysis of the project executing agency, it is evident that the Department of Agriculture must improve its administrative systems and procedures, as well as its institutional structure. As a result, technical co-operation is being proposed as an instrument for institutional strengthening. As such, it will emphasize the establishment of an appropriate administrative structure for the Department and aim at upgrading the technical divisions, particularly of the marketing division which will be responsible for managing the Produce Exchange System.

7.10 This supervision and monitoring of policies and standards should be clearly be established in the manuals to be prepared as part of institutional strengthening. It should be noted that the Department of Agriculture will decentralize the administration and operation of the Produce Exchange and its branches, the Packing Houses. Such decentralization should lead to the establishment of an autonomous State enterprise, pursuant to the guidelines set forth in Chapter V, The Project, Marketing Subproject, and expanded upon in Appendix 4. The establishment of this enterprise is vitally important to ensure proper management of the marketing system, and to avoid economic losses currently affecting the government budget.

7.11 The Project Co-ordination Unit will have a high-level organizational structure to avoid administrative overlapping. It will be a part of the executing agency and will develop the project in conjunction with the respective Divisions in such a way that, upon completion of the project, the Department of Agriculture will have been equipped to maintain and operate the different components of the project.

7.12 The credit component will be managed by an autonomous corporation, capable of administering the credit, and which is currently being restructured.

7.13 Given the above conditions, the project can be considered viable from an institutional point of view.

Financial

7.14 In order to estimate the impact of executing the project and its subsequent operations on the national budget and on the budget of the Department of Agriculture, an estimate was made of the local counterpart expenditures which could possibly require a loan, and the operating or current expenditures the government would have to incur once the investments are made.

7.15 Projections were based on the assumption that all of the above-mentioned institutional aspects will be implemented, in which case it is expected that a marketing enterprise, known as the Produce Exchange, will be established in the short term, and will be a profitable enterprise, or at least one that does not produce financial losses. A rural credit component will also be implemented, without any subsidies or administrative costs paid by the government budget. The Department of Agriculture is to continue to carry out extension and agricultural research activities. This implies additional costs that will be charged to the Department of Agriculture budget.

7.16 The following table presents a summary of the costs that will have to be covered by the government and the impact on the government budget and on the Department of Agriculture budget.

TABLE 7.1
IMPACT OF THE GOVERNMENT BUDGET
(in Millions Bh\$)

CATEGORY	Y E A R S									
	1	2	3	4	5	6	7	8	9	10
Local Counterpart 1/ Operating Costs 2/	2.870 0.242	0.216 0.242	0.242	0.242	0.242	0.267	0.280	0.294	0.309	0.324
TOTAL LOCAL COSTS	3.112	0.458	0.242	0.242	0.242	0.267	0.280	0.294	0.309	0.324
Government Budget (Increase 5% by year)	737.4	774.3	813.0	853.7	896.3	941.2	988.2	1,037.3	1,089.5	1,144.0
Local Costs in % Budget	0.420	0.060	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Local Counterpart in % Budget	0.390	0.030								
Operating Costs in % Budget	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030

1/ It includes the local contribution to investment costs (\$2,654,100) and to technical co-operation (\$216,000) in years 1 and 2.

2/ It includes the local contribution to the first five years of project implementation (\$1,210,000), and full operating costs from year 6 on, assuming a 5% annual increase starting in year 7.

7.17 The financial estimates presented in Table 7.1 indicate that the local counterpart investment expenditures represent a minimum increase of 0.39% over the national budget. Incremental operating costs will mean an increase of 0.03% in the budget. It is evident that this minimal impact on the government budget will be quite favourable to the Department of Agriculture in particular, and to the agricultural sector as a whole. According to the analysis conducted in the marketing subproject, losses will be eliminated and will reflect savings of about Bh\$2.5 million a year.

7.18 The financial analysis conducted for the project as a whole is presented in Tables 7.2A, 7.2B, and 7.2C below.

TABLE 7.2A
PROJECT FINANCIAL BENEFITS
(\$'000)

YEAR	MISCELL. CROPS	ORCHARD FARMS	SHEEP & GOAT FARM	MARKETING SYSTEM	TOTAL BENEFITS (1)
1				(356.2)	(356.2)
2	1,323.0	(113.4)	(387.0)	511.4	1,334.0
3	2,507.0	52.0	(491.0)	513.6	2,581.6
4	3,730.0	217.8	(283.0)	1,077.0	4,741.8
5	4,953.0	321.3	69.0	1,077.0	6,420.3
6	5,759.0	298.6	372.0	907.0	7,336.6
7	5,850.0	541.9	786.0	1,077.0	8,254.9
8	5,850.0	795.2	747.0	1,077.0	8,469.2
9	5,850.0	1,211.1	785.0	1,077.0	8,923.1
10	5,850.0	1,846.0	749.0	(1,076.3)	7,368.7
11	5,850.0	2,656.0	785.0	907.0	10,198.0
12	5,850.0	3,313.5	752.0	1,077.0	10,992.5
13	5,850.0	3,745.1	786.0	1,077.0	11,458.1
14	5,850.0	3,950.8	750.0	1,077.0	11,627.8
15	5,850.0	3,950.8	783.0	1,077.0	11,660.8
16	5,850.0	3,950.8	750.0	1,077.0	11,627.8
17	5,850.0	3,950.8	783.0	1,077.0	11,660.8
18	5,850.0	3,950.8	750.0	1,077.0	11,627.8
19	5,850.0	3,950.8	783.0	1,077.0	11,660.8
20	5,850.0	3,950.8	750.0	1,077.0	11,627.8

TABLE 7.2B
PROJECT COSTS
(\$'000)

YEAR	ENG. & ADM.	BUILD- INGS	ROADS	LAND CLEAR. & PREP.	INVEST. IN OTHER GOODS	INCREM. WORK. CAPITAL	MACH.	EQUIP	VENI- CLES	LAND FOR CIAREC	ASSOC. COSTS	TOTAL INV. & OPER. COSTS	CREDIT	TECHNICAL CO-OP.	TOTAL COSTS (2)
1	1,002.5	3,361.5	1,050.0	1,050.0	747.0	780.0	1,380.8	752.5	295.0	20.0	267.0	10,706.3	----	1,267.6	11,973.9
2											267.0	267.0	214.0	804.0	1,285.0
3											267.0	267.0	390.0	324.0	981.0
4											267.0	267.0	316.0		583.0
5											267.0	267.0	337.0		604.0
6											267.0	267.0			267.0
7											267.0	267.0			267.0
8											267.0	267.0			267.0
9											267.0	267.0			267.0
10											267.0	267.0			267.0
11											267.0	267.0			267.0
12											267.0	267.0			267.0
13											267.0	267.0			267.0
14											267.0	267.0			267.0
15											267.0	267.0			267.0
16											267.0	267.0			267.0
17											267.0	267.0			267.0
18											267.0	267.0			267.0
19											267.0	267.0			267.0
20											267.0	267.0			267.0

TABLE 7.2C
STREAM OF NET FINANCIAL BENEFITS OF THE PROJECT
(\$'000)

YEAR	TOTAL BENEFITS (1)	TOTAL COSTS (2)	NET BENEFITS (1) - (2)
1	(356.2)	11,973.9	(12,330.1)
2	1,334.0	1,285.0	49.0
3	2,581.6	981.0	1,600.6
4	4,741.8	583.0	4,158.8
5	6,420.3	604.0	5,816.3
6	7,336.6	267.0	7,069.6
7	8,254.9	267.0	7,987.9
8	8,469.2	267.0	8,202.2
9	8,923.1	267.0	8,656.1
10	7,368.7	267.0	7,101.7
11	10,198.0	267.0	9,931.0
12	10,992.5	267.0	10,725.5
13	11,458.1	267.0	11,191.1
14	11,627.8	267.0	11,360.8
15	11,660.8	267.0	11,393.8
16	11,627.8	267.0	11,360.8
17	11,660.8	267.0	11,393.8
18	11,627.8	267.0	11,360.8
19	11,660.8	267.0	11,393.8
20	11,627.8	267.0	11,360.8

FIRR =	33.50%
NPV (12%) =	32,077.88

7.19 The five subprojects proposed are either financially viable in themselves (Crop Development, Livestock Development and Marketing System), or will be easily "paid back" by the incremental production expected to take place under the project (Research, Extension and Training, and Feeder Roads).

7.20 The first of the crop development models, Selected Miscellaneous Crops, represents, as mentioned in previous chapters, the impact of the project on the existing agriculture of the country. In spite of being based on very conservative assumptions, the incremental gains to accrue from this component mean a substantive improvement on the present situation of crop production in The Bahamas (see the first table of the addendum to this chapter). The second model, Orchard Crops, shows a Financial Internal Rate of Return (FIRR) equal to 47.5%, and a Net Present Value (12%) of \$80,600. The other two crop models, Specialty Crops and Export Crops are not considered as sources of benefits to the project, and, except for a small initial investment cost of the first one, they do not represent costs to the project either.

7.21 The four Livestock Development models are financially viable, showing the following results:

	FIRR(%)	NPV(12%) in \$
50-Doe Model	9.8	(1,121)
100-Doe Model	30.3	19,782
150-Doe Model	27.3	23,326
200-Doe Model	33.2	42,423

(Note: The 50-doe model shows a NPV of \$996 at a dicount rate of 8%)

7.22 The stream of benefits accruing from the Marketing Subproject shows a FIRR of 13% and a NPV(12%) of \$373,600. This was done for the "with project" situation only, because the "without project" situation means an annual loss of about \$2.5 million, and therefore the calculation of incremental benefits would mean to add such an amount to the stream of net benefits of the subproject. That would, of course, shoot the rate of return to very high values and turn the whole procedure into a ludicrous exercise.

7.23 The Research, Extension and Training Services Subproject as well as the Feeder Roads Subproject are considered as project costs only. The potential benefits to accrue from them are included in the stream of benefits of the various crop and livestock development models.

C. ECONOMIC ANALYSIS

7.24 The economic and social analysis of the project stems directly from its objectives and goals, and from the detailed features of its components. Within this context, the expected benefits which will accrue to the country as a result of the execution of the project may be classified as tangible or intangible, direct or indirect, although distinctions between these categories are sometimes difficult to make.

TANGIBLE BENEFITS

Increased Production

7.25 An increase in the physical volume of agricultural production is the most common benefit arising from an agricultural project. In the case of the present project, increased production will result from (a) the clearing and preparation of the most suitable lands for crop production and the introduction of new crops and methods of cultivation on the various participating island; (b) the introduction of more efficient methods of livestock raising - especially of small ruminats like sheep and goats - which will make much better use of those Coppice lands on which such activities take place; and (c) the provision of the essential support services to farmers, so that they have the incentive and the confidence to adopt the new proposals.

7.26 A likely added benefit will be that the farm family itself will be consuming more and better agricultural products as a result of the project, since there will be a wider variety of better quality products from which to choose.

Quality Improvement

7.27 It is expected that the increased production resulting from the project will also be of better quality. In the case of The Bahamas, quality improvement is of utmost importance since the project will aim at supplying the tourist hotels and ultimately the export market. Better quality produce receives higher prices, which, in turn, increases the farmer's income.

Timely Sale of Produce by the Farmers

7.28 The marketing infrastructure and services to be provided by the project will make it possible to schedule the sale of produce by the farmers, since storage facilities will be available when harvest time comes. In turn, scheduling of production will be made possible through a combination of extension and marketing information services.

Soil Improvement and Cost Reduction through Mechanization

7.29 Land clearing and preparation in the project area will be carried out by tractors and other equipment. Lighter tractors and other machinery will be kept on the islands to be leased to farmers, so that they may keep the land cleared and cultivated. The use of such machinery will have the effects of improving the texture and quality of the soils (by crushing the limestone and introducing organic materials) and also reducing labour costs.

Losses Avoided

7.30 The availability in all participating islands of Packing Houses equipped with adequate storage facilities will not only encourage farmers to produce more, but will also avoid post-harvest losses, since the various kinds of produce will be properly stored. Losses will also be avoided during transportation because mailboats will be equipped with cooling and other storage facilities. Finally, losses will be avoided at the Produce Exchange, since the renovated building will be provided with adequate and cooling facilities.

Improvement of Income Levels

7.31 Increased production, better quality produce and timely sale of produce will certainly push income levels up throughout the project area. This goes beyond being a purely economic benefit to become a social benefit to which the Government attaches great importance. Higher incomes will encourage people to remain on their islands, thus reducing or stopping outmigration towards Nassau.

Savings on Foreign Exchange

7.32 Import substitution of fruits and vegetables will help to alleviate the presently expensive food and will save foreign exchange.

INTANGIBLE BENEFITS

7.33 Some of the benefits resulting from an agricultural project may be difficult to measure or to assess, either because of their nature or because they manifest themselves in areas which go beyond the scope of the project. These are called intangible benefits. Despite their not being easily evaluated, they represent real benefits, real values, and should be taken into consideration. (The same applies to project costs: some are tangible, others are practically impossible to quantify). In the case of The Agricultural Services Development Project, a number of intangible, but real and important benefits, can be identified.

Improvement of Structural Balance in the Bahamian Economy

7.34 As mentioned previously, the Bahamian economy leans too heavily on the service sectors, especially on tourism. Common sense and the uncertainties of the international environment indicate that this would be a good time to begin to redress that imbalance, by tapping the possibilities offered by agriculture and other sectors.

National Integration

7.35 Being an archipelago strategically located in the North Atlantic, The Bahamas assigns a high priority to the settlement of its territory. The many islands which make up the archipelago must be permanently settled and economically active. Agriculture seems to be the most immediate and viable way of keeping the population on the land, and of providing a way of living that is naturally complementary to tourism, as the latter spreads itself throughout the Family Islands.

Rational Use of Natural Resources

7.36 The project proposes an expansion of agricultural lands, more advanced methods of cultivation, and the use of irrigation as some of its main features. Such proposals lead immediately to a number of questions on how the natural resources of the Bahamas are presently being used, how they should be used in the future and, finally, how all this will affect the physical environment of the country. These concerns are of the utmost importance to a country that relies so much on tourism. In this respect, a number of suggestions and proposals are made in the project. The country needs a comprehensive plan for use of natural resources, and for the utilization of fresh water for irrigation purposes. There is a great need for inter-institutional coordination in this area, and the project advances some ideas on how to achieve this. Such actions are expected to lead to benefits which go far beyond the scope of the project, to apply to the country as a whole.

Institutional Strengthening

7.37 The project involves substantial strengthening of the technical and managerial capabilities of the Ministry of Agriculture, which will be reflected in the research, extension, marketing and other services to be provided by the institution and its affiliated bodies. Institutional strengthening, however, will go beyond the Ministry itself to reach all the institutions involved with agricultural development and natural resources management in The Bahamas, since such institutions - both public and private - will have to coordinate and cooperate among themselves in areas of common concern.

THE EVALUATION METHODOLOGY

7.38 The stream of quantifiable costs and benefits generated by the project will accrue from six sources:

- i) The Selected Miscellaneous Crops Model
- ii) The Orchard Crops Model
- iii) The 50-Doe Sheep/Goats Model
- iv) The 100-Doe Sheep/Goats Model
- v) The 200-Doe Sheep/Goats Model
- vi) The Marketing Subproject

NOTE: As in the financial analysis, no benefits, only costs, are taken into account in the analysis of the Research, Extension and Training Services Subproject and of the Feeder Roads Subproject.

7.39 Three conversion factors were calculated for the economic analysis: The Standard Conversion Factor (SCF); The Conversion Factor for Unskilled Rural Labour (CF₁); and the Conversion Factor for Transportation by Boat (CF₂). Agricultural inputs and equipment, including vehicles for farm use, are completely exempt from taxes in The Bahamas. The rationale and the procedures to calculate the conversion factors are presented in the addendum at the end of this chapter. The values found are the following:

Standard Conversion Factor:	0.85
Unskilled Rural Labour:	0.65
Transportation by Boat:	0.89
Unskilled Boat Labour (estimated):	0.80

7.40 The results of the economic analysis are presented by Tables 7.3A, 7.3B, and 7.3C below.

TABLE 7.3A
PROJECT ECONOMIC BENEFITS
(\$'000)

YEAR	MISCELL. CROPS	ORCHARD FARMS	SHEEP & GOAT FARM	MARKETING SYSTEM	TOTAL BENEFITS (1)
1				(63.8)	(63.8)
2	1,323.0	(113.4)	(387.0)	792.4	1,615.0
3	2,507.0	118.0	(491.0)	797.1	2,931.1
4	3,730.0	345.3	(283.0)	1,399.4	5,191.7
5	4,953.0	496.9	69.0	1,399.4	6,918.3
6	5,759.0	506.2	372.0	1,229.4	7,866.7
7	5,850.0	788.9	786.0	1,399.4	8,824.4
8	5,850.0	1,031.8	747.0	1,399.4	9,028.3
9	5,850.0	1,457.8	785.0	1,399.4	9,492.2
10	5,850.0	2,139.6	749.0	(753.9)	7,984.8
11	5,850.0	3,012.7	785.0	1,229.4	10,877.1
12	5,850.0	3,725.8	752.0	1,399.4	11,727.2
13	5,850.0	4,197.0	786.0	1,399.4	12,232.4
14	5,850.0	4,426.1	750.0	1,399.4	12,425.5
15	5,850.0	4,426.1	783.0	1,399.4	12,458.5
16	5,850.0	4,426.1	750.0	1,399.4	12,425.5
17	5,850.0	4,426.1	783.0	1,399.4	12,458.5
18	5,850.0	4,426.1	750.0	1,399.4	12,425.5
19	5,850.0	4,426.1	783.0	1,399.4	12,458.5
20	5,850.0	4,426.1	750.0	1,399.4	12,425.5

**TABLE 7.3B
PROJECT COSTS
(\$'000)**

YEAR	ENG. & ADM.	BUILD.	ROADS	LAND CLEAR. & PREP.	INVEST. IN OTHER GOODS	INCREM. WORK. CAPITAL	MACHIN.	EQUIP.	VEHICLES	LAND FOR CIAREC	ASSOC. COSTS	TOTAL INV & OPER. COSTS	CREDIT	TECH. CO-OP.	TOTAL COSTS (2)
1	1,002.5	3,361.5	1,050.0	1,050.0	747.0	780.0	1,380.8	752.5	295.0	20.0	267.0	10,706.3	----	1,267.6	11,973.9
2											267.0	267.0	214.0	804.0	1,285.0
3											267.0	267.0	390.0	324.0	981.0
4											267.0	267.0	316.0		583.0
5											267.0	267.0	337.0		604.0
6											267.0	267.0			267.0
7											267.0	267.0			267.0
8											267.0	267.0			267.0
9											267.0	267.0			267.0
10											267.0	267.0			267.0
11											267.0	267.0			267.0
12											267.0	267.0			267.0
13											267.0	267.0			267.0
14											267.0	267.0			267.0
15											267.0	267.0			267.0
16											267.0	267.0			267.0
17											267.0	267.0			267.0
18											267.0	267.0			267.0
19											267.0	267.0			267.0
20											267.0	267.0			267.0

**TABLE 7.3C
STREAM OF NET ECONOMIC BENEFITS OF THE PROJECT
(\$'000)**

YEAR	TOTAL BENEFITS (1)	TOTAL COSTS (2)	NET BENEFITS (1) - (2)
1	(63.8)	11,973.9	(12,037.7)
2	1,615.0	1,285.0	330.0
3	2,931.1	981.0	1,950.1
4	5,191.7	583.0	4,608.7
5	6,918.3	604.0	6,314.3
6	7,866.7	267.0	7,599.7
7	8,824.4	267.0	8,557.4
8	9,028.3	267.0	8,761.3
9	9,492.2	267.0	9,225.2
10	7,984.8	267.0	7,717.8
11	10,877.1	267.0	10,610.1
12	11,727.2	267.0	11,460.2
13	12,232.4	267.0	11,965.4
14	12,425.5	267.0	12,158.5
15	12,458.5	267.0	12,191.5
16	12,425.5	267.0	12,158.5
17	12,458.5	267.0	12,191.5
18	12,425.5	267.0	12,158.5
19	12,458.5	267.0	12,191.5
20	12,425.5	267.0	12,158.5

EIRR =	36.26%
NPV (12%)	35,951.43

7.41 The Economic Internal Rate of Return (EIRR) for the project as a whole is 36.3%, and the NPV(12%) is \$35,951,430. As in the financial analysis, the Marketing Subproject was evaluated in the "with project" situation only, and the economic benefits of not losing about \$2.5 million a year in marketing operations was not taken into account.

THE BAHAMAS
AGRICULTURAL SERVICES DEVELOPMENT PROJECT
(BH-0011)

ADDENDUM TO CHAPTER VII



THE BAHAMAS
AGRICULTURAL SERVICES DEVELOPMENT PROJECT
(BH-0011)

CALCULATION OF THE STANDARD CONVERSION FACTOR (SCF)

Although the Bahamian economy is considered to be an "open" economy, with the Bahamian dollar at par with the U.S. dollar and traded more or less freely, a closer examination of the national statistics of the Bahamas indicates clearly that there is a need to calculate a standard conversion factor (SCF) for project evaluation purposes.

As the table below shows, approximately sixty-five per cent of the tax revenues of the Government of The Bahamas (GOB), comes from import tariffs alone with the remaining revenues distributed among a variety of other sources. If export duties and other international trade tariffs are added to import duties, taxes on international trade respond for seventy per cent of GOB total revenues. This high relative importance of import tariffs is due in part to the fact that there are no taxes on income, profit or capital gains in The Bahamas.

An analysis of the statistics on international trade reveals that both the importation and exportation of petroleum represent an important share of the total figures for the country's international trade and tend to dwarf the data on other trade, especially merchandise trade. The importation and exportation of oil in The Bahamas is carried out by a refinery located in the "enclave" economy of Grand Bahama. Most of the refinery activity consists of trans-shipment of oil, and to include such data in the calculation of the standard conversion factor would be misleading.

A more accurate calculation of the SCF could be obtained from the data on international merchandise trade, as it is done in the present exercise.

TABLE THE BAHAMAS: TOTAL TAX REVENUE OF THE GOVERNMENT, BY CATEGORIES, 1983-86 (millions of (BHS))				
	1983	1984	1985	1986
TOTAL TAX REVENUE	271.1	300.2	349.6	373.6
- Social Security Contributions	25.1	29.2	34.4	34.4
- Taxes on Property	9.0	10.3	10.2	13.6
- Domestic Taxes on Goods and Services	30.4	37.6	34.9	38.4
- Import Duties	183.5	199.0	283.9	242.3
- Export Duties	3.0	4.1	3.7	3.7
- Other Taxes on Int'l Trade & Transportation	11.2	11.8	14.1	15.8
- Other Taxes	16.3	14.4	17.8	28.8
- Tax Refunds	-7.4	-6.2	-4.4	-3.8

Source: IMF, GOVERNMENT FINANCE STATISTICS YEARBOOK, Vol. XII, 1988, Washington, D.C.

Note: There are no taxes on income, profits or capital gains.

In order to arrive at the SCF for the Bahamas, the following established formular was used:

$$SCF = \frac{M + X}{(M + TM)(X - TX)}, \text{ where}$$

M = Value of merchandise imports
 X = Value of merchandise exports
 TM = Value of taxes on imports
 TX = Value of taxes on exports

Using data for the 1983-86 period, the table below shows the calculation of SCF for the Bahamas.

TABLE THE BAHAMAS: CALCULATION OF THE STANDARD CONVERSION FACTOR (Millions of BHS)						
	1983	1984	1985	1986	TOTAL	Average
1. Value of merchandise imports(fob) (M)	822.1	866.2	1,096.2	1,012.8	3,797.3	949.33
2. Value of merchandise exports(fob) (X)	225.1	261.9	295.8	293.4	1,076.20	269.05
3. (M + X) or (1 + 2)	1,047.2	1,128.1	1,392.0	1,306.2	4,873.5	1,218.38
4. Taxes on imports (TM)	183.5	199.0	238.9	242.3	863.7	215.93
5. Taxes on exports (TX)	3.0	4.1	3.7	3.7	14.5	3.63
6. Net taxes on Trade (4-5)	180.5	194.9	235.2	238.6	849.2	212.30
7. Sub-Total (3+6)	1,227.7	1,323.0	1,627.2	1,544.8	5,722.7	1,430.68
8. SCF (3 ÷ 7)	0.85	0.85	0.86	0.85	--	0.85

Source: IMF, INTERNATIONAL FINANCIAL STATISTICS, October 1989, Washington, DC

The SCF for The Bahamas is 0.85. (If total imports and total export figures were used, i.e., if the figures for oil imports and exports were added to the above ones, the calculations would yield a SCF=0.94).

**CALCULATION OF THE CONVERSION FACTOR FOR UNSKILLED AGRICULTURAL
LABOUR IN THE PROJECT AREA (SOUTHEASTERN ISLANDS)**

In view of the lack of updated statistical information on the agriculture of The Bahamas, and taking into consideration the characteristics of the agricultural economy of the Southeastern Islands, the most feasible way of calculating the conversion factor for unskilled rural labour (CF) seems to be, first, to obtain an estimate of the value of the foregone marginal product of labour (m) and, then, to compare it with the observed wage rate in the project area.

One way of calculating m is to estimate seasonal variations in the ratio of labor availability to labour utilization, in the project area, multiply each seasonal ratio by the observed market wage rate in each period, add the results and divide by the number of periods, to get a weighted average ¹/. In symbolic terms:

$$m = \frac{\sum_{j=1}^n \frac{D_j}{S_j} \cdot W_j}{n}, \text{ where}$$

- m = Value of the foregone marginal product of labour
- W_j = Seasonal observed wage rate
- D_j = Seasonal utilization of labour
- S_j = Seasonal availability of labour
- j = 1, 2, ..., n = Number of seasonal periods

An accurate estimation of m would involve sample survey observations of W_j, D_j and S_j over a year. Since such information was not available, and based on interviews conducted in the project area, it was estimated that an agricultural labourer would be employed 80% of his time during the peak season of December to May and only half of his time and during the slack season of June to November. The number of working days in each season was assumed to be 150. The wage rate in both seasons was observed to be \$30/day. Therefore,

- D₁ = 120
- D₂ = 75
- S₁ = S₂ = 150
- W₁ = W₂ = 30
- n = 2

¹/ See World Bank, Social Cost-Benefit Analysis: A Guide for Country and Project Economists to the Derivation and Application of Economic and Social Accounting Prices, Working Paper No. 239, Washington, D.C., 1976, and also Terry A. Powers, Ed., Estimating Accounting Prices for Project Appraisal, IDB, Washington, D.C., 1981.

$$m = \frac{\frac{120 \times 30}{150} + \frac{75 \times 30}{150}}{2} = 19.50$$

An approximate estimate of the conversion factor for unskilled labour CF_1 may be obtained by dividing m by the wage rate:

$$CF_1 = \frac{m}{w} = \frac{19.50}{30} = 0.65$$

Taking into consideration the overall levels of inefficiency of agricultural production and unemployment of agricultural labour observed in the project area, the above conversion factor for labour seems to be a reasonable estimate of the CF_1 and to reflect the prevalent conditions in the area.

TABLE THE BAHAMAS: CALCULATION OF CONVERSION FACTORS FOR TRANSPORTATION BY BOAT

MONTHLY OPERATION AND MAINTENANCE COSTS (Bh\$)

1. MAILBOAT "MARCELLA"

	At Market Prices	Conversion Factors	At Economic Prices
4 Skilled Labourers	6,400	1.00	6,400
3 Unskilled labourers	2,400	0.80	1,920
Fuel	7,000	0.85	5,950
Lubricants	530	0.85	450
Repairs & maintenance	5,000	0.85	4,250
Amortization of Boat	6,000	0.85	5,100
Other Inputs	450	0.85	382
Other Costs (Docking)	224	0.85	190
TOTAL	27,004		24,642

$$CF = \frac{24,642}{27,004} = 0.91$$

2. MAILBOAT "NAY DEAN"

	At Market Prices	Conversion Factors	At Economic Prices
3 Skilled Labourers	6,900	1.00	6,900
5 Unskilled Labourers	1,750	0.80	1,400
Fuel	5,280	0.85	4,488
Lubricants	1,200	0.85	1,020
Repair & Maintenance	3,000	0.85	2,550
Amortization of Boat	--	0.85	--
Other Inputs	400	0.85	340
Other Costs (docking)	224	0.85	190
TOTAL	18,754		16,888

$$CF = \frac{16,888}{18,754} = 0.90$$

**MONTHLY OPERATIONS AND MAINTENANCE COSTS
(BH\$)**

3. MAILBOAT "LADY MARGO"

	At Market Prices	Conversion Factors	At Economic Prices
1 Skilled labourer	1,550	1.00	1,550
3 Unskilled labourers	1,600	0.80	1,280
Fuel	2,000	0.85	1,700
Lubricants	300	0.85	255
Repairs & Maintenance	250	0.85	212
Other Costs (Docking)	132	0.85	112
TOTAL	5,832		5,109

$$CF = \frac{5,109}{5,832} = 0.88$$

4. MAILBOAT "GRAND MASTER"

	At Market Prices	Conversion Factors	At Economic Prices
3 Skilled Labourers	3,900	1.00	3,900
7 Unskilled Labourers	4,100	0.80	3,280
Fuel	6,000	0.85	5,100
Lubricants	550	0.85	467
Repairs + Maintenance	450	0.85	383
Other costs (docking)	132	0.85	112
TOTAL	15,132		13,242

$$CF = \frac{13,242}{15,132} = 0.88$$

CALCULATION OF THE CONVERSION FACTOR FOR TRANSPORTATION BY BOAT

A conversion factor for transportation by boat is necessary in view of the importance of such transportation in The Bahamas, its key role in the transportation of agricultural produce at the present time and the role it will play in the improvement of agricultural marketing systems under the project.

The calculation is based on data related to four mail boats ("Marcella III", "Nay Dean", "Lady Margo" and "Grand Master". These mail boats make a statistically representative sample of the whole mail boat fleet in terms of number (4 out of 20), capacity and equipment (cold storage, cranes, etc.) and distances sailed between Nassau and the Family Islands.

Monthly operation and maintenance costs are transformed into their respective economic prices for the calculation of the conversion factors. The average conversion factor was found to be approximately 0.89. The conversion factor for unskilled labour working on the boats was assumed to be 0.80, since the levels of labour efficiency on the boats are higher than those in agriculture.

BIBLIOGRAPHY

1. J. Price Gittinger, Economic Analysis of Agricultural Projects, (IDE, World Bank), John Hopkins University Press, Baltimore, MD., U.S.A., 1982.
2. Terry A. Powers, Ed., Estimating Accounting Prices for Project Appraisal, Inter-American Development Bank, Washington, D.C., U.S.A., 1981.
3. I.M.D. Little and J.A. Mirrless, Project Appraisal and Planning for Developing Countries, Heineman Educational Books, Ltd., London, U.K., 1974.
4. E.J. Mishan, Cost-Benefit Analysis, George Allen and Unwin Ltd., London, U.K., 1972.
5. World Bank, Social Cost-Benefit Analysis: A Guide for Country and Project Economists to the Derivation and Application of Economic and Social Accounting Prices, Working Paper No. 239, Washington, D.C., 1976.

TABLE V-11 THE BANANAS: SUPPLY OF AGRICULTURAL PRODUCE
 "WITHOUT PROJECT" AND "WITH PROJECT" SITUATIONS
 CROP DEVELOPMENT MODEL 2

	Y E A R S																		TOTAL INCREMENTAL	
	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		YEAR 7		YEAR 8-20		%	Q		
	%	Q	%	Q	%	Q	%	Q	%	Q	%	Q	%	Q	%	Q				
MODEL 2: MISCELLANEOUS CROPS																				
1. ACRES UNDER CULTIVATION 1/ INCREMENTAL	9,000		9,900	10	10,900	10	11,800	8	12,500	6	13,129	4	13,800	8	13,800	375	13,800	50	4,800	
2. YIELDS (TONS/ACRE) 2/ INCREMENTAL	1.33		1.36		1.38		1.40		1.42		1.44		1.46		1.46		1.46	10		
3. TOTAL PRODUCTION (TON) INCREMENTAL	12,000		13,440	12	15,000	12	16,500	10	17,800	8	18,900	6	19,700	4	19,700	800	19,700	64	7,700	
4. RETURNS PER ACRE (\$) 3/ INCREMENTAL	700		770	10	808	5	850	5	870	2	890	2	900	1	900	10	900	29	200	
5. VALUE OF PRODUCTION (\$'000) 4/ INCREMENTAL	6,300		7,623		8,807		10,030		10,875		11,681		12,150		12,150	5,850	12,150	93	5,850	
			1,323		2,507		3,730		4,375		5,381		5,850		5,850		5,850			

NOTES ON TABLE V-11

1. Of the 170,000 acres of cultivable land in The Bahamas, it is estimated that only 17,000 acres, or 10%, are presently being cultivated, due to the dramatic decrease in farming activities over the last five to eight years. Of those, about 7,000 acres are allocated (although not fully utilized yet) to two large, export-oriented citrus enterprises on Abaco Island. That would leave 10,000 acres for "domestic production", mostly farmed by subsistence and commercial farmers on Andros and on the Southeastern Islands. The figure of 9,000 acres is a lower estimate of total area under cultivation. The increases in area under cultivation from Year 2 to Year 7, an increment of 50% over "without project" acreage, are conservative estimates of "old" areas being brought back into production because of the incentives offered by the project, and do not therefore represent "new" agricultural areas.

2. Some substantial improvements in agricultural yields are expected to take place under the project, due to a combination of better land preparation, provision of technical assistance by the Extension Service and, in some cases, irrigation. Nevertheless, a very conservative approach was adopted here, in which yields increase only 10% over a 6-year period.

3. Returns per acre will improve due to the production of better quality produce and to improved farming and marketing practices. Figures try to reflect the fact that a larger supply of better quality produce, coupled with sound marketing procedures, will eventually lower prices to the consumer and, therefore, to the farmer.

4. Due to the whole spectrum of improvements expected to take place under the project - adaptive research, extension services, market information service, improved marketing infrastructure and systems -, the total value of production is expected to practically double in six years, causing, in turn, a substantial improvement in farmers' incomes throughout the country. The incremental figures for value of production are shown in its usual accumulated pattern while the others are shown on a year-by-year basis so that the annual increments may be noted.

FARM MODEL 1
5-ACRE ORCHARD FARM (MANGO/ONION)
(US \$)

CONCEPT	WITH PROJECT												
	Y E A R S												
	1	2	3	4	5	6	7	8	9	10	11	12	13-20
ACRE :	5 A C R E S												
REVENUE													
ONION	(1 ACRE)	(0.85 ACRE)	(0.60 ACRE)	(0.30 ACRE)	(0.30 ACRE)								
YIELD (LB/ACRE)	1,200.00	1,020.00	720.00	360.00	360.00								
PRICE (POINT 1ST. SALE) 2.70/LB.	2.70	2.70	2.70	2.70	2.70								
GROSS REVENUE	3,240.00	2,754.00	1,944.00	972.00	972.00								
MANGO													
YIELD (BOXES/ACRE)		320.00	640.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00	960.00
PRICE (\$7/BOX)		1.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
GROSS REVENUE		2,240.00	4,480.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00
TOTAL REVENUE	0.00	3,240.00	2,754.00	1,944.00	972.00	2,240.00	4,480.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00	6,720.00
INVESTMENT													
LAND CLEARING (3000/ACRE x 5 ACRES)	1,500.00												
LAND PREPARATION (91200/ACRE x 5 ACRES)	6,000.00												
SPRAYER WITH SMALL TOOLS	350.00												
MANGO SEEDLINGS (1 ACRE)		640.00			350.00								
TOTAL INVESTMENT	7,850.00	640.00	0.00	0.00	350.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OPERATING EXPENDITURES													
ONION	(1 ACRE)	(0.85 ACRE)	(0.60 ACRE)	(0.30 ACRE)									
INPUTS	100.00	85.00	60.00	30.00									
SEEDS (4 LB x \$25)	155.00	132.00	93.00	46.50									
FERTILIZERS (1000 LB x \$0.155)													
SPRAY MATERIALS	40.00	34.00	24.00	12.00									
HERBICIDE (1 GALLON x \$40)	24.00	20.00	14.00	7.00									
FUNGICIDE (8 LB x \$3)	21.00	18.00	13.00	6.00									
INSECTICIDE (2.5 QUARTS x \$0.40)	190.00	162.00	116.00	58.00									
BAGS (300 x \$0.40)													
TOTAL ONION INPUTS	440.00	391.00	276.00	137.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ONION OPERATIONS (MAY/NOV)													
PLANTING (2 MO x \$25)		50.00	42.50	30.00	15.00								
FERTILIZING (2 MO x \$25)		50.00	42.50	30.00	15.00								
WEEDING/TRIMMING (10 MO x \$25)		250.00	212.50	150.00	75.00								
SPRAYING (10 MO x \$25)		250.00	212.50	150.00	75.00								
HARVESTING/CURTING/GRADING (15 MO x \$25)		375.00	319.00	225.00	112.50								
TRANSFER TO POINT OF SALE (\$0.00/LB)		120.00	102.00	72.00	36.00								
TOTAL ONION OPERATIONS	0.00	1,095.00	931.00	657.00	321.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FARM MODEL 1
5-ACRE ORCHARD FARM (MANGO/ONION)
(US \$)

CONCEPT	WITH PROJECT												
	Y E A R S												
	1	2	3	4	5	6	7	8	9	10	11	12	13-20
MANGO													
INPUTS		12.00	18.00	24.00	30.00	36.00	42.00	48.00	48.00	48.00	48.00	48.00	48.00
FERTILIZERS (80-320 LB x \$0.15)													
SPRAY MATERIALS				42.00	42.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00
FUNGICIDE (3-8 LB x \$14)				38.00	38.00	76.00	76.00	76.00	76.00	76.00	76.00	76.00	76.00
INSECTICIDE (2-4 QUARTS x \$19)				192.00	192.00	384.00	384.00	384.00	384.00	384.00	384.00	384.00	384.00
PACKING BOXES (320-1200 x \$0.60)				100.00	100.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
FIELD BOXES (20-80 x \$5.00)													
TOTAL MANGO INPUTS	0.00	12.00	18.00	66.00	110.00	488.00	766.00	1,004.00	1,376.00	1,376.00	1,376.00	1,376.00	1,376.00
LABOUR OPERATIONS													
LENTING AND PLANTING (9 MO x \$25)		225.00											
FERTILIZING (1 MO x \$25)		25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
CIRCLE WEEDING (6 MO x \$25)		150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
SPRAYING (6-12 MO x \$25)		150.00	150.00	150.00	150.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
HARVEST (6-18 MO x \$25)						200.00	400.00	600.00	900.00	900.00	900.00	900.00	900.00
GRADE, HOT DTP AND PACKAGE (6-9 MO x \$25)						100.00	200.00	300.00	450.00	450.00	450.00	450.00	450.00
TRANSFER TO POINT OF SALE (\$0.50/BOX)						29.00	58.00	85.00	115.00	115.00	115.00	115.00	115.00
TOTAL MANGO OPERATIONS	0.00	350.00	325.00	325.00	325.00	884.00	1,133.00	1,481.00	1,940.00	1,940.00	1,940.00	1,940.00	1,940.00
TOTAL OPERATING EXPENDITURES ACRE 1	480.00	1,748.00	1,558.00	1,185.00	764.00	1,322.00	1,919.00	2,545.00	3,316.00	3,316.00	3,316.00	3,316.00	3,316.00
OTHER EXPENDITURE: LAND CHARGES (\$20/ACRE)		20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
TOTAL OUTFLOW ACRE 1	8,310.00	3,405.00	1,270.00	1,205.00	1,134.00	1,312.00	1,919.00	2,545.00	3,606.00	3,316.00	3,316.00	3,316.00	3,316.00
NET BENEFIT ACRE 1	(8,310.00)	832.00	1,184.00	739.00	(162.00)	928.00	2,561.00	4,175.00	5,294.00	5,644.00	5,644.00	5,644.00	5,644.00
ACRE 2													
TOTAL REVENUE			3,240.00	2,754.00	1,944.00	972.00	2,240.00	4,480.00	6,720.00	8,960.00	8,960.00	8,960.00	8,960.00
TOTAL OPERATING EXPENDITURES		(480.00)	(1,748.00)	(1,558.00)	(1,185.00)	(1,312.00)	(1,919.00)	(2,545.00)	(3,316.00)	(3,316.00)	(3,316.00)	(3,316.00)	(3,316.00)
MANGO SEEDLINGS		(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)
LAND CHARGES (\$20/ACRE)		(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)
NET BENEFIT ACRE 2	0.00	(480.00)	832.00	1,184.00	739.00	100.00	940.00	2,561.00	4,175.00	5,644.00	5,644.00	5,644.00	5,644.00
ACRE 3													
TOTAL REVENUE			3,240.00	2,754.00	2,754.00	1,944.00	972.00	2,240.00	4,480.00	6,720.00	8,960.00	8,960.00	8,960.00
TOTAL OPERATING EXPENDITURES		(480.00)	(1,748.00)	(1,558.00)	(1,185.00)	(1,105.00)	(766.00)	(1,292.00)	(1,919.00)	(2,545.00)	(3,316.00)	(3,316.00)	(3,316.00)
MANGO SEEDLINGS		(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)	(640.00)
LAND CHARGES (\$20/ACRE)		(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)
NET BENEFIT ACRE 3	0.00	0.00	832.00	1,184.00	1,184.00	739.00	308.00	940.00	2,561.00	4,175.00	5,644.00	5,644.00	5,644.00

CONCEPT	WITH PROJECT												
	YEARS												
	1	2	3	4	5	6	7	8	9	10	11	12	13-20
ACRE 4					3,240.00 (1,748.00) (648.00) (20.00)	2,754.00 (1,558.00) (20.00)	1,344.00 (1,135.00)	972.00 (764.00)	2,240.00 (1,232.00)	4,420.00 (1,919.00)	6,720.00 (2,545.00)	2,950.00 (5,316.00)	8,960.00 (3,316.00)
NET BENEFIT ACRE 4	0.00	0.00	0.00	(400.00)	832.00	1,104.00	399.00	208.00	948.00	2,561.00	4,175.00	5,644.00	5,344.00
ACRE 5					(400.00)	3,240.00 (1,748.00) (648.00) (20.00)	2,754.00 (1,550.00)	1,944.00 (1,105.00)	972.00 (764.00)	2,240.00 (1,282.00)	4,400.00 (1,919.00)	6,720.00 (2,545.00)	8,960.00 (3,316.00)
NET BENEFIT ACRE 5	0.00	0.00	0.00	0.00	(400.00)	832.00	1,204.00	759.00	208.00	948.00	2,561.00	4,175.00	5,644.00
NET BENEFIT BEFORE FINANCING													
A. TOTAL 5-ACRE FARM	(8,310.00)	372.00	1,556.00	2,295.00	2,133.00	3,071.00	5,640.00	8,651.00	13,186.00	18,972.00	23,668.00	26,751.00	29,220.00

FINANCING													
1. GRANTS (LAND CLEAR + PREPARATION)	7,500.00												
2. LOAN RECEIPTS	800.00	1,500.00	1,100.00	600.00									
3. DEBT SERVICE (11% YEAR)		80.00	253.00	374.00	448.00	1,200.00	1,152.00	1,004.00	976.00	888.00			
4. NET FINANCING (1 + 2 - 3)	8,300.00	1,412.00	847.00	226.00	(448.00)	(1,200.00)	(1,152.00)	(1,004.00)	(976.00)	(888.00)	0.00	0.00	0.00
NET BENEFIT AFTER FINANCING													
TOTAL (A + 4)	(10.00)	1,784.00	2,403.00	2,521.00	1,683.00	2,071.00	4,528.00	7,507.00	12,210.00	16,084.00	23,668.00	26,751.00	29,220.00

CROP MODEL: 5-ACRE ORCHARD FARM

N O T E S

1. This farm model is supposed to be representative of all possible combinations of tree crops and short-term crops suggested in this Component, i.e.: Tree Crops: Persian Lime, Grapefruit, Orange and Mango; Short-Term Crops: Tomato, Watermelon, Sweet Pepper, Onion, Cabbage, Cucumber and Irish Potato.

2. Onions start by occupying a whole acre in Year 2 but, because mango seedlings are planted at the end of Year 2, the area allocated to onions is reduced in the following years, until onions are phased out in Year 6, the year in which mangoes start producing. The onion cropping season lasts for four months and the onions are graded in 50lb. bags. Onion prices are 15% than the present (without project) prices to cover for grading and packing on the farm.

3. Mango plant population is 80 trees/acre (spacing: 23'x23'). Mango yields are the following:

Year 6 : 4 doz. or 48 lb/tree

Year 7 : 8 doz. or 96 lb/tree

Year 8 : 12 doz. or 144 lb/tree

Year 9-20: 16 doz. or 192 lb/tree

Fruits are graded and packed in boxes on the farm. Each box contains 9, 12 or 15 fruit (average 12 lb/box).

4. Land clearing and land preparation (ploughing and disking) will be performed on lands located on top of water lenses to allow for irrigation. In order to be cost-effective, both operations are carried out on a one-time basis for the whole 5-acre farm. The areas to be developed have been previously selected, and are shown, for each island, on the respective maps provided in Annex 6 of this report. Land clearing and land preparation are provided as a grant from the Government in order to encourage farmers to take up permanent farming in the Southeastern Islands. Since such operations will be executed on good lands sitting on top of water lenses, the potential for a quick recovery of the investment is good. The initial investment of \$7,500 can be recovered in just three years with the onion production of the first acre.

5. A sprayer and small tools will be provided to the farmer in the first year as part of a loan in kind.

6. Mango seedlings are provided in kind, as part of the initial loan, for the first three acres. Seedlings for the two remaining acres will be bought by the farmer.

7. Onion inputs will be provided in kind, as part of the initial loan, for the following operations:

Acre 1: first and second years (\$460 and \$390)

Acre 2: first year (\$460)

Acre 3: first year (\$460)

Onion inputs for the remaining years of the first three acres as well as for Acres 4 and 5 will be financed by the farmer.

8. Labour operations for both onion and mango crops will be entirely financed by the farmer. All labour is considered as hired labour. Payment for the owner's own labour and management skills are included in the farm's stream of net benefit.

9. All mango inputs are financed by the farmer.

10. The current land lease fee of Bh\$20/acre for Crown lands will be charged to each acre, as it is put under production, until Year 6. In Year 7, after he has been cultivating the farm for five years, the farmer will be given a title of ownership to the land.

11. The stream of net benefit before financing for the whole farm represents the return to all resources engaged in production, without any consideration of financing. Since this is a new farm, established on previously unutilized land, all benefits are incremental, since there is no "without project" situation. The Financial Internal Rate of Return (FIRR) to this stream of benefits is 43%. Although such figure could be considered high in many agricultural development projects, it can become quite acceptable in this project, if the following factors are taken into account: (i) the figure is high because the initial investment is relatively small, there is just one negative cash flow and benefits after Year 10 become substantial; (ii) the farm will achieve full development only in Year 13, with benefits from Year 2 to Year 7 being quite small; (iii) farmers will be attracted to the investment only if the long-term prospect is good and the overall rate of return is inviting. The Net Present Worth of this benefit stream, at 12% discount rate, is \$73,000.

12. A loan for a total amount of \$4,000 will be given in kind, to each farmer, in four different installments, from Year 1 to Year 4. Interest payments begin in Year 2 on the outstanding debt at a rate of % a year. Repayment of the principal starts in Year 6 and will be done with five payments of \$800.

13. The stream of net benefit after financing represents the amount of money the farmer is going to receive by participating in the project. Discounted, it provides the financial rate of return to the farmer's own resources, if he has invested any of his own capital in the project. The special circumstance of this project, in which land clearing and preparation, at a total cost of \$7,500, is provided to the farmer as a Government grant, makes the calculation of an internal rate of return after financing a

ludicrous exercise, since the first and only negative cash flow is diminutive. If the farmer had to finance land clearing and preparation, the FIRR after financing would be 47.5%, slightly above the FIRR before financing. The Net Present Worth of the project, considering the grant, at 12% discount rate, is \$80,600.

MARKETING SUBPROJECT: BUDGET OF THE MARKETING SYSTEM (\$'000)

WEEKEND PROJECT	Y E A R S																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17-20
BASIC VALUE OF PROD. 2/	2,260.0	5,252.0	5,274.0	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3	7,057.3
QUAILING + PACKING 3/		1,195.0	1,195.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0	1,540.0
BROKERAGE FEES (165) 4/		707.0	791.1	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6	1,050.6
TOTAL INFLOWS	2,260.0	7,194.0	7,220.1	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9	9,655.9
INVESTMENT		2,406.0															
PRODUCE EXCHANGE		999.4															
EXIST. PACK. MACHINES		1,029.1															
NEW PACK. MACHINES		4,406.4															
TOTAL INVESTMENT 5/		700.0															
INCRCH. WORK. CAP. 6/																	
OPER. EXPENDITURES																	
PRODUCE PURCHASE 7/	2,650.0	4,330.0	4,330.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0	5,704.0
INTER-DS. TRAMP.	242.6	814.0	836.0	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3	1,173.3
SALARIES	1,105.8	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0	793.0
MALINT. + PARTS	36.0	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5
IMPORTS + FUEL 8/	192.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5	129.5
UTILITIES	51.5	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
AUX. SERVICES	60.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
SUBTOTAL	4,508.5	6,365.1	6,367.1	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4	8,170.4
MISCELL. (55)	228.5	318.3	319.4	400.5	400.5	400.5	400.5	400.5	400.5	400.5	400.5	400.5	400.5	400.5	400.5	400.5	400.5
TOTAL OPER. EXP.	4,708.1	6,683.4	6,706.5	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9
TOTAL OUTFLOW	4,706.1	10,433.7	6,683.4	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9	8,570.9
NET BENEFIT BEFORE FINANCING																	
TOTAL 9/	(2,546.1)	(5,632.6)	511.4	513.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0	1,077.0
NET BENEFIT AFTER FINANCING																	
LOAN RECEIPTS 10/		5,200.0															
INTEREST 12%																	
PRINCIPAL																	
NET FINANCING		5,200.0	(633.6)	(633.6)	(633.6)	(633.6)	(1,961.8)	(1,634.9)	(971.5)	(900.2)	(644.0)	(710.1)	(854.7)	(591.4)			
TOTAL 11/		(392.6)	(122.2)	(120.8)	443.4	443.4	273.4	(84.6)	42.1	(2,047.8)	(1.2)	232.2	295.6	422.3	485.6	1,077.0	

MARKETING SUBPROJECT: BUDGET OF THE MARKETING
SYSTEM

N O T E S

1. Situation Without Project - In this column, the figures for 'Basic Value of Produce at PE' and 'Produce Purchase' represent a four-year average, from 1986-89. This was done to minimize some strong variations in these two items observed in the last two years. All other cost figures are updated information on costs incurred by the system.
2. Basic Value of Produce at the Produce Exchange - In the situation 'without project', this represents the actual volume of sales of the Exchange (average of four years, 1986-89). In the situation 'with project', this represents the cost of purchasing the produce from the farmer, plus inter-island transportation (by boat), and plus auxiliary services (transportation of produce from Packing House to boat and from boat to the Exchange).
3. Grading and Packing - The Packing Houses will charge \$4 per box of produce graded and boxed.
4. Brokerage Fees - The Produce Exchange will charge a brokerage fee of 15% over the product 'price' (basic value of produce at PE). Both the brokerage fees and the grading and packing fees correspond to produce industry patterns. For this analysis, the commission was estimated up from the price paid to farmers; in practice, it is deducted from price of sale to retailers.
5. Total Investment - Investments in Years 6 and 11 represent replacement of vehicles. Investment in Year 10 translates the replacement of cold storage chambers at the PE and Packing Houses.
6. Incremental Working Capital - The figure of \$780,000 represents two months of operations in the 'with project' situation, according to Table 4.3.
7. Produce Purchase - It is assumed that in Year 1 the volume of produce purchased would remain basically the same as in the situation without project. The figure is the result of multiplying 4,000 tons by \$723, the basic value of one ton of produce.
8. Inputs and Fuel - The figure falls from Year 1 to Year 2 because, starting in Year 2, the cost of the boxes provided by the system will be included in the grading and packing fees charged to farmers (the system will charge \$4/box, and a box costs approximately \$1).
9. Net Benefit Before Financing - The stream of net benefit before financing represents the return to all resources engaged in the operation of the marketing system, -without any consideration of

financing. The Financial Internal Rate of Return (FIRR) is calculated for the 'with project' situation and is equal to 13%. The Net Present Value (12%) is equal to \$373,600. The calculation of the FIRR and NPV for the incremental net benefit would have to take into account the situation 'without project', which represents an annual loss of about \$2.5 million. Such amount would have to be added to the stream of benefits 'with project', making both the rate of return and the net present value extremely high (in fact, they would be equal to 103.3% and \$19,406,400, respectively). The exercise, therefore, would be ludicrous if it did not provide a strong argument in favour of the financial and economic worth of the project.

10. Financing - A loan for a total value of \$5,280,000 will be provided in order to cover investment costs (\$4,496,400) and incremental operating costs of \$780,000. The latter will cover operating expenditures for two months. The loan will be provided for a period of 15 years, with a 5-year grace period. The annual interest rate is 12%.

11. Net Benefit After Financing - The stream of net benefit after financing represents the return to the resources engaged by the Marketing System (Produce Exchange) in the subproject, or the amount of money the system is going to receive per year for participating in the project. Again, for the same reasons mentioned above, the exercise is conducted only for the 'with project' situation, without taking into account an incremental flow of benefits. The FIRR is 19% and the NPV(12%) is equal to \$386,600.

**CROPS: INCREMENTAL NET BENEFIT
\$ / ACRE**

MANGO		ONION		PERSIAN LIME		GRAPE FRUIT		ORANGE	
YEARS	INF 1/	YEARS	INF	YEARS	INF	YEARS	INF	YEARS	INF
1	(1,817)	1	(4,476)	1	(3,065)	1	(3,033)	1	(3,033)
2	(519)	2	1,796	2	(888)	2	(740)	2	(740)
3	(591)	3	1,796	3	(775)	3	(775)	3	(775)
4	(120)	4	1,855	4	1,292	4	2,707	4	786
5	1,566	5	1,471	5	2,587	5	6,717	5	2,727
6	2,758	6		6	4,143	6	9,367	6	4,056
7	3,924	7		7	4,897	7	12,047	7	5,380
8	3,924	8		8	5,585	8	13,207	8	5,640
9	3,924	9		9	5,585	9	13,207	9	5,640
10	3,924	10		10	5,585	10	13,207	10	5,640
IRR 2/ = 37.30%		IRR = 20.60%		IRR = 37.65%		IRR = 63.99%		IRR = 37.97%	
NPV (\$) 3/		NPV (\$)		NPV (\$)		NPV (\$)		NPV (\$)	
DR 4/ 8% = 8,974		DR 8% = 1,281		DR 8% = 13,351		DR 8% = 38,118		DR 8% = 13,556	
DR 10% = 7,638		DR 10% = 1,039		DR 10% = 11,402		DR 10% = 33,431		DR 10% = 11,579	
DR 12% = 6,486		DR 12% = 815		DR 12% = 9,716		DR 12% = 29,373		DR 12% = 9,871	
DR 14% = 5,490		DR 14% = 604		DR 14% = 8,254		DR 14% = 25,848		DR 14% = 8,390	

1/ INF Incremental Net Benefit

2/ IRR Internal Rate of Return

3/ NPV Net Present Value

4/ DR Discount Rate

**CROPS: INCREMENTAL NET BENEFIT
\$ / ACRE**

TOMATO		CABBAGE		SWEET PEPPER		CUCUMER		WATER MELON		IRISH POTATO	
YEARS	INF	YEARS	INF	YEARS	INF	YEARS	INF	YEARS	INF	YEARS	INF
1	(7,292)	1	(5,601)	1	(6,453)	1	(3,650)	1	(3,991)	1	(5,857)
2	1,090	2	975	2	1,679	2	1,692	2	1,426	2	600
3	1,090	3	975	3	1,679	3	1,692	3	1,426	3	600
4	1,090	4	975	4	1,679	4	1,692	4	1,426	4	600
5	1,090	5	975	5	1,679	5	1,692	5	1,426	5	600
						IRR = 30.25%	IRR = 15.99%				
						NPV (\$)	NPV (\$)				
						DR 8% = 1,954	DR 8% = 732.09				
						DR 10% = 1,713	DR 10% = 529.23				
						DR 12% = 1,489	DR 12% = 340.26				
						DR 14% = 1,280	DR 14% = 163.95				

**CROPS: INCREMENTAL NET BENEFIT
\$ / ACRE**

CORN		PIGEON PEA		CASSAVA		SWEET POTATO		BANANO		
YEARS	INF	YEARS	INF	YEARS	INF	YEARS	INF	YEARS	INF	
1	(3,635)	1	(3,518)	1	(4,245)	1	(4,427)	1	(5,964)	
2	77	2	717	2	618	2	445	2	3,289	
3	77	3	717	3	618	3	445	3	3,289	
4	77	4	717	4	618	4	445	4	3,289	
5	77	5	717	5	618	5	445	5	3,289	
						IRR = 41.32%				
						NPV (\$)				
						DR 8% = 4,930				
						DR 10% = 4,462				
						DR 12% = 4,026				
						DR 14% = 3,619				

INCREMENTAL CASH FLOW (\$000)

HEED SIZES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
50 DOE UNIT																					
YEAR 1 = 19	(261)	85	(8)	87	(6)	87	(8)	(8)	87	(6)	97	(6)	87	(7)	(6)	87	(6)	87	(7)	(6)	87
YEAR 2 = 22	(303)	95	(9)	100	(9)	100	(7)	(7)	100	(7)	109	(8)	100	(7)	100	(7)	100	(7)	100	(7)	100
YEAR 3 = 24	(330)	107	(10)	109	(10)	109	(8)	(8)	109	(8)	109	(8)	109	(8)	109	(8)	109	(8)	109	(8)	109
YEAR 4 = 14	(193)	62	(5)	64	(5)	64	(6)	(5)	64	(5)	64	(5)	64	(5)	64	(5)	64	(5)	64	(5)	64
YEAR 5 = 9	(124)	41	(4)	41	(4)	41	(4)	(4)	41	(4)	41	(3)	41	(3)	41	(3)	41	(3)	41	(3)	41
SUB TOTAL = 88	(218)	(240)	(8)	(8)	22	223	144	223	145	224	166	225	147	225	147	225	147	225	147	225	147
100 DOE UNIT																					
YEAR 1 = 9	(206)	63	32	122	32	110	32	122	32	119	32	110	32	119	32	119	32	119	32	119	32
YEAR 2 = 15	(343)	105	53	53	203	54	199	53	203	54	203	54	203	54	203	54	203	54	203	54	203
YEAR 3 = 12	(274)	84	(274)	84	42	163	43	159	42	155	43	159	43	159	43	159	43	159	43	159	43
YEAR 4 = 9	(206)	(206)	(206)	(206)	63	32	122	32	119	32	122	32	119	32	119	32	119	32	119	32	119
YEAR 5 = 6	(137)	42	21	42	(137)	42	21	42	22	80	21	82	22	80	22	80	22	80	22	80	22
SUB TOTAL = 41	(268)	(137)	(137)	53	203	410	417	448	418	448	421	446	419	444	419	444	419	444	419	444	419
150 DOE UNIT																					
YEAR 2 = 3	(93)	(93)	21	12	57	12	54	12	57	12	54	12	54	12	54	12	54	12	54	12	54
YEAR 3 = 1	(31)	(31)	(31)	7	4	19	4	18	4	19	4	18	4	18	4	18	4	18	4	18	4
YEAR 4 = 1	(31)	(31)	(31)	7	4	19	4	19	4	19	4	19	4	19	4	19	4	19	4	19	4
YEAR 5 = 1	(31)	(31)	(31)	7	4	19	4	19	4	19	4	19	4	19	4	19	4	19	4	19	4
SUB TOTAL = 6	(93)	(10)	(10)	(12)	37	42	81	53	83	53	81	53	80	52	80	52	80	52	80	52	80
200 DOE UNIT																					
YEAR 2 = 1	(34)	3	3	6	27	8	27	8	27	8	27	8	27	8	27	8	27	8	27	8	27
YEAR 3 = 1	(34)	(34)	(34)	3	6	27	8	27	8	27	8	27	8	27	8	27	8	27	8	27	8
YEAR 4 = 2	(46)	(46)	(46)	6	12	54	16	54	16	54	16	54	16	54	16	54	16	54	16	54	16
SUB TOTAL = 4	(34)	(31)	(31)	(59)	39	47	89	51	89	51	89	51	89	51	89	51	89	51	89	51	89
TOTAL: 148 FARMS																					
INCREMENTAL	(467)	(625)	(410)	(28)	301	722	731	775	735	776	737	775	735	772	735	772	735	772	735	772	735
NET BENEFIT	(467)	(625)	(410)	(28)	301	722	731	775	735	776	737	775	735	772	735	772	735	772	735	772	735

HERD SIZE = 150-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	24,595	6,453		(31,048)
2		11,459	18,470	7,011
3		11,636	15,845	4,009
4		13,118	31,690	18,572
5		11,636	15,845	4,209
6		13,124	31,345	18,221
7		11,636	15,845	4,009
8		13,118	31,690	18,572
9		11,636	15,845	4,009
10		13,118	31,290	18,172

NPV = DR \$ IRR = 27.34%

8% = 33,846
 10% = 28,245
 12% = 23,326
 14% = 18,990

HERD SIZE = 200-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	27,217	8,783		(34,000)
2		12,435	15,520	3,085
3		12,823	18,820	5,797
4		15,073	42,260	27,187
5		13,089	21,330	8,241
6		15,073	41,860	26,787
7		13,089	20,930	7,841
8		15,073	42,260	27,187
9		13,089	21,330	8,241
10		15,073	41,860	26,787

NPV = DR \$ IRR = 33.21%

8% = 58,354
 10% = 49,865
 12% = 42,423
 14% = 35,872

SHEEP AND GOATS: INCREMENTAL NET BENEFIT

HERD SIZE = 50-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	10,311	3,443		(13,754)
2		6,311	10,775	4,464
3		5,811	5,390	(421)
4		6,325	10,880	4,555
5		5,811	5,490	(321)
6		6,325	10,880	4,555
7		5,811	5,390	(421)
8		6,325	10,880	4,555
9		5,811	5,490	(321)
10		6,325	10,880	4,555

NPV = DR \$ IRR = 9.75%
 8% = 996 MIRR 1/ = RISK RATE = 10%
 10% = (131) SAFE RATE = 8%
 12% = (1,121) 9.82%
 14% = (1,995)

1/ MIRR = Modified Internal Rate of Return

HERD SIZE = 100-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	18,856	4,211		(22,867)
2		7,543	14,550	7,007
3		7,277	10,780	3,503
4		8,305	21,860	13,555
5		7,277	10,880	3,603
6		8,305	21,560	13,255
7		7,277	10,780	3,503
8		8,305	21,860	13,555
9		7,277	10,880	3,603
10		8,305	21,560	13,255

NPV = DR \$ IRR = 30.27%
 8% = 27,748
 10% = 23,509
 12% = 19,782
 14% = 16,494

**RESULTS OF THE ECONOMIC ANALYSIS (IRR AND NPV) CARRIED OUT
FOR SELECTED CROPS AND LIVESTOCK MODELS**

CROP DEVELOPMENT					
DESCRIPTION	IRR ^{1/} (%)	NPV ^{2/} (Bh\$)			
		DR 8%	DR 10%	DR 12%	DR 14%
Mango	48.6	10,839	9,389	8,137	7,052
Onion	40.2	2,529	2,284	2,056	1,844
Persian Lime	45.5	13,604	11,765	10,175	8,794
Grapefruit	>50.0	35,294	31,081	27,433	24,261
Orange	47.5	18,472	16,585	14,951	13,533
Cucumber	46.3	2,549	2,326	2,118	1,923
Watermelon	38.8	1,989	1,791	1,607	1,435
Banana	>50.0	5,992	5,558	5,154	4,777
LIVESTOCK DEVELOPMENT					
Sheep/Goats					
50-Doe-Unit	20.7	6,374	5,015	3,819	2,762
100-Doe-Unit	35.3	28,843	24,859	21,355	18,261
150-Doe-Unit	33.3	37,547	32,151	27,410	23,228
200-Doe-Unit	37.1	57,548	49,713	42,842	36,791

- ^{1/} Internal Rate of Return
^{2/} Net Present Value

CROPS: ECONOMIC ANALYSIS

<u>PERSIAN LIME</u>	
<u>YEARS</u>	<u>INB</u>
1	(2,161)
2	(569)
3	(483)
4	918
5	2,584
6	3,947
7	4,591
8	5,233
9	5,233
10	5,233

<u>GRAPE FRUIT</u>	
<u>YEARS</u>	<u>INB</u>
1	(2,136)
2	(456)
3	(483)
4	2,690
5	6,127
6	8,430
7	10,741
8	11,774
9	11,774
10	11,774

<u>ORANGE</u>	
<u>YEARS</u>	<u>INB</u>
1	(2,137)
2	(456)
3	(483)
4	994
5	2,677
6	3,878
7	5,046
8	5,293
9	5,293
10	5,293

IRR= 45.5%

IRR= 74.0%

IRR= 47.5%

NPV (\$)

NPV (\$)

NPV (\$)

DR 8%= 13,604

DR 8%= 35,294

DR 8%=18,472

10%= 11,765

10%= 31,081

10%=16,585

12%= 10,175

12%= 27,433

12%=14,951

14%= 8,794

14%= 24,261

14%=13,533

CROPS: ECONOMIC ANALYSIS

<u>CUCUMBER</u>		<u>WATERMELON</u>		<u>BANANA</u>	
<u>YEARS</u>	<u>INB</u>	<u>YEARS</u>	<u>INB</u>	<u>YEARS</u>	<u>INB</u>
1	(2,654)	1	(2,621)	1	(4,113)
2	1,571	2	1,392	2	3,051
3	1,571	3	1,392	3	3,051
4	1,571	4	1,392	4	3,051
5	1,571	5	1,392	5	3,051

IRR= 46.3%

NPV (\$)

DR 8%= 2,549

10%= 2,326

12%= 2,118

14%= 1,923

IRR= 38.8%

NPV (\$)

DR 8%= 1,989

10%= 1,791

12% 1,607

14%= 1,435

IRR= 63.9%

NPV (\$)

DR 8%= 5,992

10%= 5,558

12%= 5,154

14%= 4,777

ECONOMIC ANALYSIS
SHEEP AND GOATS: INCREMENTAL NET BENEFIT

HERD SIZE = 50-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	8,764	2,537		(11,301)
2		4,542	9,159	4,617
3		4,117	4,582	465
4		4,554	9,248	4,694
5		4,117	4,666	549
6		4,554	9,248	4,694
7		4,117	4,582	465
8		4,554	9,248	4,694
9		4,117	4,666	549
10		4,554	9,248	4,694

NPV=

DR \$

IRR= 20.7%

8%= 6,374

10%= 5,015

12%= 3,819

14%= 2,762

HERD SIZE =100-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	15,858	3,198		(19,056)
2		5,632	12,368	6,736
3		5,405	9,163	3,758
4		6,279	18,581	12,302
5		5,405	9,248	3,845
6		6,279	18,326	12,047
7		5,405	9,163	3,758
8		6,279	18,581	12,302
9		5,405	9,248	3,843
10		6,279	18,326	12,047

NPV=

DR \$

IRR = 35.3%

8%= 28,843

10%= 24,859

12%= 21,355

14%= 18,261

ECONOMIC ANALYSIS

HERD SIZE = 150-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	20,901	4,836		(25,737)
2		8,441	15,700	7,259
3		8,591	13,298	4,707
4		9,850	26,937	17,087
5		8,591	13,468	4,877
6		9,850	26,643	16,793
7		8,591	13,298	4,707
8		9,850	26,937	17,087
9		8,591	13,468	4,877
10		9,850	26,597	16,747

NPV=

DR \$
 8%= 37,547
 10%= 32,151
 12%= 27,410
 14%= 23,228

IRR= 33.3%

HERD SIZE = 200-DOE UNIT

YEARS	CAPITAL COST	OPERATION COST	REVENUE	INCREMENTAL NET BENEFIT
1	23,134	5,116		(28,250)
2		10,161	13,192	3,031
3		9,600	15,827	6,227
4		11,512	35,921	24,409
5		9,825	18,131	8,306
6		11,512	35,581	24,069
7		9,825	17,791	7,966
8		11,512	35,921	24,409
9		9,825	18,131	8,306
10		11,512	35,581	24,069

NPV=

DR
 8%= 57,548
 10%= 49,713
 12%= 42,842
 14%= 36,791

IRR= 37.1%

Chapter VIII. OUTSTANDING ISSUES

8.01 The Agricultural Services Development Project may be considered as the first major intervention made by the public sector to improve the state of agriculture in The Bahamas. This means that the project will take place in an environment - be it physical, institutional, economic or social - unused to receiving this kind of intervention and that, therefore, will have to be adapted and prepared so that the various technical, operational and administrative proposals made by the project may be successfully introduced.

8.02 It is clear, then, that the Ministry of Agriculture will have to address a number of issues regarding either the more immediate impediments to the execution of the project or, on a longer-term basis, some structural factors adversely affecting the development of agriculture in the country. Some of these issues can be tackled immediately; others will require more time to be resolved.

8.03 The more immediate issues to be addressed have to do with administrative and operational matters regarding the execution of the project and are summarized below.

Administrative Issues

8.04 Following the recommendations presented in the institutional analysis, the internal structure of MATI will need to be adapted for project execution. A Project Co-ordination Unit needs to be established and staffed with the necessary personnel to carry out the implementation of the various project components.

8.05 In the crop and livestock development areas, there is a need for training and reassigning existing technical personnel, as well as for hiring new staff to carry out the work of the project. Such actions, if taken at an early stage, will facilitate and expedite the execution of the project.

8.06 It is necessary to find sites for the new buildings proposed by the project, making sure that legal matters are taken care of and that infrastructure and services will be in place.

8.07 Legal matters for the establishment of slaughter slabs in four participating islands must be resolved.

8.08 The new operations proposed by the project for the marketing system will require detailed planning and a substantial amount of internal reorganization.

Operational Issues

8.09 The redeployment of existing personnel and the deployment of new staff in the participating islands will raise a number of operational issues that must be foreseen and resolved in areas such as housing, transportation, working facilities, salary levels, incentives, etc.

8.10 Operational issues related to the renovation of marketing facilities and the establishment of new ones (bidding procedures, construction contracts, importation of equipment, etc.) must be foreseen and planned well in advance because of the multifarious tasks to be accomplished and the amount of resources involved.

8.11 The installation of cooling facilities on the mail boats will be a complex operation, and its details will need to be anticipated and scheduled.

8.12 Farmers must be surveyed and organized in all islands, so that they may be informed about the project and feel encouraged to participate in it.

Longer-Term Issues

8.13 Besides these more immediate matters, a number of longer-term issues related to the prospects of agricultural development in The Bahamas must be addressed. They represent constraints which must be either removed or mitigated so that the development proposals may be successfully implemented. Such issues are summarized below.

8.14 Land Tenure - The land tenure systems of The Bahamas are described and discussed in different sections of this report. The importance of the matter and the need for the systems to be updated were amply recognized by the Ministry of Agriculture and discussed during the preparatory work of this project. Assistance to the Ministry in this area could be provided by, and should come from, institutions with extensive experience in this subject matter. The various aspects of the matter - legal, historical, social, anthropological, economic and agricultural - will have to be taken into account so that a rational, equitable, modern and coherent new system may be established.

8.15 Agricultural Credit - This issue is closely related to land tenure, since land is used as collateral for loans. But other aspects of agricultural credit, such as loan distribution and collection, concessionary facilities and others, are equally relevant and must be duly addressed so that agricultural credit in The Bahamas may become a much more important factor in the country's strategy for agricultural development.

8.16 Natural Resources Management - Given the relative scarcity of natural resources - except for the many beautiful beaches and an almost ideal climate - and the peculiar geographical configuration of the country, The Bahamas needs a comprehensive plan for natural resources management. Utilization of land and water for agricultural purposes will depend on how other competing uses for those two natural resources are established on a priority basis. Above all, the environment must be protected in a country that depends so much on tourism. There is an urgent need for inter-institutional co-ordination and co-operation. Recommendations in this regard are provided in Annex 5 of this report.

8.17 Irrigation and Water Use - As part of the natural resources management plan, The Bahamas needs a Master Plan for Land and Water Use. The advancement of agriculture will depend heavily on irrigation. Therefore, irrigation methods and systems will have to be adapted to the characteristics and water availability of each island. Furthermore, they will have to be in accordance with the overall plan for natural resources development. Detailed reference to irrigation methods is presented in Annex 3 of this report.

8.18 Inter-Island Transportation - Most of the transportation of agricultural produce in The Bahamas is made by the so-called mail boats. Under the project, the mail boats will be upgraded in terms of storage space and cold-storage facilities with a view to dramatically reducing the spoilage of agricultural produce during transportation. The whole issue of inter-island transportation is therefore crucial and will have to be addressed by the Government so that it does not become a bottleneck for agricultural development. Annex 4 of this report discusses the issue and makes recommendations regarding possible solutions to the present problems.

8.19 Promotion of Investment in Large-Scale Agriculture - This report shows very clearly that there are ample possibilities for large-scale export-oriented agriculture in the Northern Islands. For such investment to take place, it is necessary to (a) create an environment which is conducive to corporate farming, and (b) promote this kind of agriculture by showing the comparative advantages which The Bahamas enjoys in relation to neighbouring countries. The two large-scale citrus plantations which are presently operating with success on Abaco Island serve as concrete evidence of the possibilities for commercial agriculture in the North.

8.20 The issues discussed above are related to various external variables which can affect the execution of the project. The execution of an integrated project like the present one, with all its complexities, will always be affected by external factors which are outside the control of the executing agency and which will depend on policy decisions which are generally made at a higher policy-making level. This calls for a continuous dialogue and co-operation among government and other participating institutions.

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