AN ECONOMIC ANALYSIS OF THE WAUNA-YARAKITA OIL PALM PROJECT USING THE LITTLE AND MIRRLEES APPROACH TO PROJECT APPRAISAL

by

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A dissertation submitted in partial fulfilment
of the requirements for the Degree of Master
of Agricultural Development Economics in the
Australian National University

Canberra, September 1978

D E C L A R A T I O N

Except where otherwise indicated, this dissertation is my own work.

Patricia Best

ACKNOWLEDGEMENTS

I wish to thank the Government of the Cooperative Republic of Guyana, particularly Cdes Yhap, Sinclair and Edwards of the Training Division of the Public Service Ministry and the Chief Agricultural Officer (Ag) Cde Browman for their efficiency, cooperation and the provision of data.

I would also like to thank Dr R T Shand, my supervisor and Head of the Development Studies Centre of the Australian National University, not only for his guidance and pertinent suggestions expected of any supervisor but also for his keen interest and words of encouragement at every stage of preparation.

Worthy of mention, also, is the Project Appraisal Unit of the Australian Ministry of Foreign Affairs, particularly Messrs Peter Hodge and George Whitlam who were kind enough not only to avail the use of the departments library to me but also their machines and investment analysis computer programmes and other relevant information; and the Department of Overseas Trade, Ministry of Trade, Australia for trade information used in this study.

Last, but not least, acknowledgements go out to Dr Dan Etherington, Mesdames Bridget Boucher, Jennie Colman, Biddy Cochrane and Miss Angela Kouvelis without whose help the final presentation of the thesis would not have been possible.

Patricia Best

ABSTRACT

This study investigates the relative merits of the two most frequently used methods of agricultural project appraisal - the Conventional Efficiency Analysis as described by Gittinger and the Little and Mirrlees methods - in relation to the development of an oil palm project in Guyana and in the context of Guyana's relatively open economy. An evaluation of the two alternative techniques are given in light of results.

Using the existing literature on project evaluation techniques, available methods are reviewed in an effort to justify the choice of the two methods. The Conventional Efficiency Analysis and the Little and Mirrlees methods are discussed in detail, the latter particularly, because of its relative complexity.

The nature and history of oil palm production in Guyana is also discussed to indicate the possible contribution of the oil palm to the development of Guyana. The crop's world production, trade and its position in the world fats and oils economy are also considered in an appendix.

In the investigation of the social profitability of the Wauna - Yarakita oil palm project using both methods the criterion used is the internal rate of return supplemented by the net present value and benefit - cost ratio in some cases. The rates of discount utilised in the calculation of the net present values are 8 and 10 percent. The study mainly utilised data contained in the report on Oil Palm Development in Guyana, South America 1976-1980 by Ndaeyo and Isang.

The main conclusion of the study is that, in the context of Guyana, there was no difference in the decisions taken, as the rates of return obtained in both cases were quite high. The use of the Little and Mirrlees for marginal projects could, however, make the difference between acceptance and rejection. It could also be deduced that the contribution of the Little and Mirrlees method may only be substantial in a situation where border prices are thought to differ substantially from domestic price levels. Where such a situation does

not occur, one need not go all the way to Little and Mirrlees but rather modify the Conventional Efficiency Analysis procedures (e.g. SER, SWR) and yet obtain similar results.

The project when the extraction of timber was included yielded an investment which although profitable had no real rate of return. Finally, the effects on the rates of return of cost over-run, increased oil palm yields, different levels of consumption in the unorganized sector and a higher shadow wage rate were also discussed.

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BASIC DATA OF GUYANA

Area	Population	Density
83,000 square miles	0.784 million (mid 1976) Rate of Growth: 1.6% (1972-1975)	9 persons/square mile

Social Indicators

Life Expectancy at Birth	M: 62.02	F: 66.72 (1969-1971)
Primary School Enrolment		75.13 (1975)
Secondary School Enrolment		58.82 (1975)

Highest Level of Education Obtained by Population[1] (1970)

	Total	None	Primary	Secondary	University	Other + N.S.
M	185,115	10,454	134,393	32,062	2,163	3,043
F	187,983	20,588	136,894	25,635	641	4,225
TOTAL	370,098	31,042	271,287	57,697	2,804	7,268
(%)		(8.39)	(73.3)	(15.6)	(0.7)	(2.0)

Calories Intake per day per capita (Cal)	2080 (1970)
Protein Intake per day per capita (Gram)	47.4 (1970)
Persons per physician	274 (1970)

Working Population by Industrial Group

Groups	1960	1970
Agriculture	59,790	46,201
Mining and Related	6,063	7,856
Manufacturing	26,308	23,860
Construction and Related	12,856	7,162
Electricity, etc.	922	1,123
Commerce	18,298	17,199
Transport	7,700	7,772
Services	29,102	44,772
Not Stated	163	3,388
Total	161,202	159,333
Unemployment Rate	2%	2%

[1] In the absence of an Adult Literacy Ratio this indicator is used.

Basic Data of Guyana (Continued)

Gross National Product		1967	1968	1969	1970	1971	1972
GNP at current market prices	(Mn.G$)	397.0	424.0	457.2	492.9	528.1	577.1
GNP at 1970 constant prices	(Mn.G$)	367.6	404.5	442.1	492.9	533.4	612.3
Growth Rate	(%)		10.0	9.3	11.5	8.2	14.8
Per Capita GNP	(U.S.$)	276.4	297.0	316.7	343.7	362.4	370.3
GDP (at 1970 f.c.)by Industrial Origin (%)							
Agriculture		18.6	16.9	17.9	17.1	18.4	17.8
Sugar-cane		....	(51.5)	....	(53.5)	(59.5)	(61.2)
Paddy rice		....	(18.5)	....	(16.5)	(12.3)	(10.0)
Fishing	)		1.2		1.1	1.1	1.1
Forestry	)	3.9	1.4	3.5	1.1	1.0	1.1
Mining and Quarrying	)	16.8	19.6	19.4	20.4	18.3	17.2
Manufacturing		13.1	12.1	11.9	12.2	12.4	12.3
Sugar Processing		....	(25.3)	....	(26.4)	(31.2)	(31.1)
Rice Processing		....	(8.6)	....	(6.7)	(5.2)	(3.3)
Transport and Communication		6.9	6.3	6.2	5.9	6.0	6.3
Construction		5.8	7.4	7.9	7.9	7.8	8.2
Commerce		12.0	12.7	11.8	11.4	11.0	11.2
Ownership of dwellings	)						
Financial and Other Services	)	9.7	9.4	8.9	9.6	9.9	9.7
Government		13.3	12.8	12.5	13.2	14.1	15.1
GNP by Expenditure (%)							
Public Consumption		16.8	16.5	17.3	17.9	19.2	20.3
Private Consumption		68.0	67.1	65.3	65.7	63.6	62.9
Gross Capital Formation		26.4	22.8	21.4	22.8	19.47	18.77
Net Exports of Goods & Services		....	-3.8	-3.0	-4.2	-1.3	-2.5
Savings Ratio (at current market prices)							
Domestic Savings as % GNP		10.7	10.8	10.2	10.6	12.0	11.0
Domestic Savings as % of Gross Capital Formation		42.9	47.6	47.6	41.2	54.7	58.4

Basic Data of Guyana (Continued)

Consumer Price Indices	1967	1968	1969	1970	1971	1972
Consumer Price Index (Georgetown and N.Amsterdam)	92.6	95.4	96.7	100.0	101.0	106.1
Annual Increase (%)	....	3.0	1.4	3.4	1.0	5.0
Money and Credit						
Money Supply (Mn.G$)	53.0	56.9	59.7	59.0	66.9	82.1
Annual Change (%)		7.0	4.9	-1.2	13.4	22.7
Commercial Banks						
Time and Savings Deposits	22.3	81.8	92.0	103.0	121.9	146.2
Government Finance (Mn.G$)						
Current Revenue	99.0	104.4	112.8	134.3	128.4	152.4
Current Expenditure	112.9	130.9	144.4	169.7	188.3	203.5
Current Surplus (+)/ Deficit (-)	-13.9	-26.5	-31.6	-35.4	-59.9	-51.1
Capital Account Surplus (+)/Deficit(-)	-1.9	5.8	4.1	1.3	3.7	0.3
Over all Surplus (+)/ Deficit (-)	-15.8	-20.7	-27.5	-34.1	-56.2	-50.8
Financing						
Domestic Borrowings, net	4.7	6.3	13.4	17.0	41.0	32.8
Foreign Borrowing, grants	17.0	18.1	17.5	18.5	26.1	16.6
Use of Cash Balances	2.1	2.2	0.9	-0.2	-7.2	-1.2
Balance of Payments (Mn.$US)						
Exports (f.o.b.)	....	113.0	123.8	129.0	145.9	143.9
Imports (f.o.b.)	....	-95.8	-105.5	-119.9	-120.4	-128.9
Trade Balance	....	17.2	18.3	9.1	25.5	15.0
Services (net)	....	-33.3	-32.1	-29.7	-32.2	-29.2
Transfers (net)						
Private Unrequited Transfer (net)		-1.8	-1.1	-0.5	-0.2	0.2
Govt. " " "		4.0	2.2	2.2	0	1.0
Current Balance		-13.9	-12.7	-18.9	-6.9	-13.0
Capital Flows						
Long Term Capital		19.8	17.4	15.8	15.3	15.3
Short Term Capital		7.1	-3.0	-0.2	-3.2	0.1
Net Errors and Ommissions		-10.0	-3.7	3.1	-4.8	8.0
Overall Balance		3.0	-2.0	-0.2	0.4	10.4

Basic Data of Guyana (Continued)

Leading Exports (%)	1967	1968	1969	1970	1971	1972
Sugar	....	30.6	37.4	28.4	27.0	33.6
Bauxite	....	27.0	25.9	24.5	28.2	33.0
Alumina	....	15.3	16.1	13.7	12.8	9.3
Rice	....	12.1	8.1	6.8	7.1	8.3
Terms of Trade						
Commodity	98.04	106.74	97.81	98.01	....	....
Income	112.61	116.72	101.00	103.00	....	....
Exchange Rate (G$ per US$)						
Average at end of period	2.0000	2.0000	2.0000	2.0000	2.0000	2.2194
International Reserves						
Total (end of yr. Mn.US$)	18.85	23.55	20.55	20.40	26.16	36.75
Ratio to Merchandise exports...		4.8	6.0	6.3	5.6	3.9

CHAPTER 1

INTRODUCTION

1.0 Background

Over the last two decades there has been considerable growth in the importance and number of development projects in developing countries financed with external assistance. This has led financing bodies to ponder and study the methods of evaluating projects, particularly from the standpoint of the society as a whole. In other words, donors and lenders have been concerned with the need to relate human and financial resources invested in their activities to actual benefits obtained, and to measure the extent to which they have achieved assigned objectives, with a view to giving some idea of how development assistance can be made most effective. This concern is also shared by governments of responsible recipient countries. These factors have led to the development of appraisal and evaluation techniques for projects.

Many methods have emerged. Apart from the conventional efficiency analysis expanded by Gittinger (1972) the following methods have been employed:

1. The Domestic Resource Cost method (Bruno 1967)
2. The Effective Rate of Protection method (Balassa and Schydlowsky 1968)
3. The UNIDO method (UNIDO 1972)
4. The 'Effects' method (Chervel 1974)
5. The Little and Mirrlees method (Little and Mirrlees 1968, 1974)
6. The Squire and Van Der Tak method (Squire and Van Der Tak 1975)

Since project selection is one of many policy weapons, criteria for project selection can only be properly defined within the broader framework of economic policy and planning. Provisionally, it can be assumed that the ultimate objective and intention of the government's economic activities in developing countries is to provide a higher standard of living. Therefore, in the 1950s growth was the focal point of economic development and capital was thought to be the most important limit to faster economic growth. Using the Gross Domestic Product as a measure of growth and the value-added definition of GDP, a link was established between national income theory and project analysis theory yielding the conventional efficiency analysis, the precursor of present day economic analysis.

At the most basic level, the project analysis allows for remuneration of

labour and other inputs at market or shadow prices, which are intended to approximate true opportunity costs. Everything left over is then compared with the capital stream necessary for the project. The project which maximizes return to capital is given the highest rank. Returns for the project are determined by market prices adjusted for any distortions. An outline of this approach has been documented by Gittinger (1972).

However, major policy objectives have changed from a focus on growth to foreign exchange in the 1960s and to the inclusion of improvement in income distribution and employment opportunities in the 1970s. So too has the general framework for appraising projects. Two recent advances in the theory of economic analysis of projects now allow a more precise and comprehensive approach to project evaluation. First, the method by which costs and benefits expressed in foreign exchange and those expressed in domestic currency are rendered commensurable has been refined and clarified; this has led to a better understanding of the concept of the 'shadow exchange rate' and the'standard conversion factor'[1] customarily used in project appraisal. It represents a technical edvance within the existing framework of project evaluation. Second, and more importantly, the framework itself has been extended to allow for the explicit consideration of equity and the rate of growth objectives in project selection.

According to Linn and Squires (1976), it has long been argued that the exchange rate of many developing countries is overvalued, and that to correct this, net foreign exchange benefits should be assigned a premium. In explaining the precise meaning of 'overvalued' some economists point to a continued 'long-term disequilibrium' in the balance of payments; others argue that a foreign exchange shortage is constraining growth; still others point to distortions between domestic and international prices resulting from tariffs and quantitative restrictions. Whatever the correct rationalization the shadow exchange rate (SER) has traditionally been used to inflate foreign exchange benefits in domestic currency. More recently the standard conversion factor (SCF) has been used to deflate domestic currency benefits to make them commensurate with foreign exchange benefits. Alternatively conversion factors may be used to net out all transfer payments between the public and private sectors arising from the economy's tariff system. In principle, each domestic item will have its own conversion factor depending on the transfer payments peculiar to that item.

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1. The 'standard conversion factor' is the ratio of the official exchange rate to the shadow exchange rate. See also Table 2.1.

However, the shadow exchange rate does not correct a fundamental disequilibium in the balance of payments (the appropriate policy for this purpose is an adjustment to the official exchange rate, which may in turn necessitate a revision of the SER and the SCF). Nor does the SER result from a foreign exchange constraint on growth. This is handled in project analysis by assigning a premium to investment (savings). What it does is to adjust approximately for a variety of distortions arising mainly out of the country's tariff policy (Linn and Squires 1976)

Conventional efficiency analysis is still relevant, in that it examines costs and benefits on the assumption that project-induced savings and consumption are considered equally valuable, as are consumption benefits accruing to different income groups. These assumptions concerning the relative value of different types of benefits define the efficiency analysis of projects. The method is, however, not sufficient.

The efficiency analysis of projects assumes that the country's actual growth rate is optimal, in the sense that an additional unit of project-generated consumption for the rich is as valuable as an additional unit for the poor. In most countries, however, actual circumstances diverge substantially from the above assumptions, as may be seen by the continued concern of most governments to accelerate growth, and to reduce inequalities in the distribution of income. 'Economic' analysis of projects, therefore, must go beyond efficiency analysis by trying to incorporate values more in line with those generally held by policy makers.

This involves the application of weights to each of the benefit categories, in order to reflect explicitly the value judgements regarding relative worth of net benefits accruing to the public sector, to private savings and to private consumption of different income groups. It has been found most useful to assign a government weight of unity, while attributing weights higher, lower or equal to unity to the other categories depending on the particular set of value judgements.

In applying social analysis to projects some practical problems arise. In particular, the estimation of the distribution of net efficiency benefits between beneficiary categories, and the derivation of weights attributed to each category may be difficult. One may, however, employ sensitivity tests in the social evaluation of projects to check on the effects of variations in distribution of net benefits around predicted distribution.

Employment, an economic objective of increasing importance, is also catered for in the most recent framework extensions. However, the possible conflicts between output and employment objectives should be

borne in mind in project evaluation[1].

New methods are therefore being evolved. But there are yet other requirements which need to be fulfilled before any one criterion of project analysis is selected. Project selection criteria and methodology should not only be soundly based in economic theory, but should make relevant simplifications about reality; and should be simple enough and practical to use, yet flexible enough to deal with complex problems. Whether any one criterion meets all these requirements is, indeed, a matter of judgement.

There has been much discussion on the relative merits of methods, and this is to be taken up in Chapter 2, but it has mainly centred around the comparative merits of two in particular:

1. the Conventional Efficiency Analysis; and
2. the Little and Mirrlees method.

The conventional efficiency analysis defined by Gittinger (1972) was universally used in the 1960s but then questions as to the appropriateness of this under circumstances of domestic distortions in factor market prices and low levels of aggregate savings and investment, and the aid implications led to the formulation of the Little and Mirrlees method.[2]

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1. See Stewart and Streeten (1971) for an enlargement of this point.

2. This approach was initiated by Professor Little of Nuffield College, Oxford during and after his tenure as Vice President of the Organization of Economic Co-operation and Development (OECD) in 1967. This Little and Mirrlees approach was published in Volume II of the OECD's Manual for Industrial Project Analysis in Developing Countries in 1968, Volume I being the Methodology and Case-studies.

   This second volume of the OECD Manual for Industrial Project Analysis: Social Cost-Benefit Analysis offered guidelines for the appraisal and evaluation of investment projects in the manufacturing sector. Consequently, the first research applicaiton of the method concentrated on industrial projects. However, a wider scope of application evolved and 25 additional case-studies in agriculture, roads, irrigation, housing, tourism as well as estimation of the shadow prices of labour and of private investment have also been completed. The findings from this research led to the publication of a subsequent volume of the Manual - Project Appraisal and Planning for Developing Countries - in 1974 - by the same authors.

Some agencies have already adopted the method e.g. Britain's Overseas Development Administration[1], the United Nations Industrial Development Organization and West Germany's Kreditanstalt fUr Wiederaufbau. Some have not, since it is claimed that it is suited primarily to a research context given the amount and types of data needed. Definition of circumstances to which its use is preferable is a matter of considerable importance.

The approach essentially addresses itself to social cost-benefit analysis in an international context. Shadow pricing techniques and, specifically, world prices are used. There is much controversy about this and some objections to their use are discussed in Chapter 2 (Sections 2.7.4 and 2.7.5)

It appears that much of the impetus for the Little and Mirrlees method may have been derived from Little's work in India[2]. It is now considered, however, that many other countries stand to gain from his major contribution to the theory and practice of cost-benefit analysis.

The present study is an attempt to apply and evaluate the Little and Mirrlees method as an appropriate technique for Guyana. The study is concerned with a perennial crop, oil palm, which is relatively new to Guyana. There are no commercial plantings but there have been two experimental large scale plantings, comprising 180 acres established by the Demerara Sugar Company in 1972 and 372 acres planted in 1973 and jointly cultivated by the state and smallholders. The performance of the above plantings and the findings of visiting experts have indicated that the oil palm is a crop of great potential for the country and is capable of substantially decreasing Guyana's present and anticipated deficit in vegetable oils. A number of studies have been done on the feasibility of producing palm oil commercially in Guyana, the most recent being included in a report on Oil Palm Development in Guyana by two Nigerian experts (Ndaeyo and Isang 1975). There have also been some investigations into the feasibility of siting the project in a number of areas. Among these:

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1. See Symposium on Project Appraisal in Lesser Developed Countries

2. Professor Little had experience in India as a member of the Massachusetts Institute of Technology's Centre for International Studies Project (1958-1959). In subsequent publications, he has repeatedly made comments of the kind that
   "all important prices in India diverge socially from prices which would ensure overall economic efficiency" (Little 1961,pp15) or
   "the rupee is greatly overvalued" (Little 1960, pp27) or
   "the practicability of using shadow prices (for labour) is, or rather should be, a burning question for India"
   He subsequently uses the rupee as his accounting currency.

1. the Demerara River
2. the Essequibo River
3. the Ebini, Berbice River
4. the Matthews Ridge - Port Kaituma Complex

The Wauna Yarakita area, which falls within the fourth category, was considered as the site for an oil palm project on the suggestion of the Nigerian team. The project would comprise 25,000 acres of oil palms. The area was considered favourable because of its lighter soils, moderate rainfall, relatively low transportation and marketing requirements and a need to develop the hinterland areas.

1.1 Objectives and Scope of the Present Study

This thesis investigates the relative appropriateness of the two most frequently used methods of project evaluation - the Conventional Efficiency analysis and the Little and Mirrlees method - in relation to the development of an oil palm project in Guyana, and in the context of Guyana's relatively open economy. In other words, the two techniques will be applied to the Wauna-Yarakita oil palm project as defined in Section 3.8 and an evaluation of the appropriateness of these two alternative techniques will be given not only in light of the results but also bearing in mind the extra time and resources required for the efficient use of the Little and Mirrlees method.

The project to be appraised was previously suggested by Ndaeyo and Isang (1975) as two projects comprising an estate sector with its own mill and a farmers' sector again with its own mill. An economic analysis was undertaken for the 10,000 acre estate project. A financial analysis was attempted for the cooperative sector of the project, but this was only confined to the first batch of settlers in the determination of the financial returns to the farmer. This study examines the economic feasibility of the project and attempts to overcome the weakness in the previous analysis, which neglected the consideration of the economic efficiency of the entire project. The analysis employs the two most frequently used methods for the analysis of agricultural projects, namely the Conventional Efficiency Analysis and the Little and Mirrlees method.

As employment and income distributional problems are relatively unimportant in Guyana, the use of social cost-benefit analysis techniques which would explicitly incorporate these aspects was not considered necessary.

1.2 Plan of Study

This study is organized into three parts with 6 chapters in all. Chapter 2 briefly reviews the available methods of project evaluation and discusses the Conventional Efficiency Analysis and Little and Mirrlees approach in detail. Because of its relative complexity the discussion of the Little and Mirrlees approach will receive much attention in this chapter.

Chapter 3 contemplates the possible contribution of oil palm to the development of Guyana and also discusses the project to be appraised. An appendix to this chapter will review the nature of palm oil production, its world production and trade and its position in the world fats and oils economy.

Part 2 comprises chapters 4 and 5. Chapter 4 presents the analysis of social profitability using the Little and Mirrlees method. In the early part of this chapter the method of shadow pricing, the identification of traded and non-traded goods, the standard conversion factor, the shadow wage rate and other important issues will be discussed. Chapter 5 embodies the results of the appraisal using the Conventional Efficiency analysis and a comparison of the various measures of profitability using both methods.

Part 3, comprising chapter 6, presents conclusions and lessons learnt from the application of the Little and Mirrlees method and an evaluation of the two techniques.

1.3 Data

This study mainly utilises data contained in the report on Oil Palm Development in Guyana, South America, 1976-1980 by Ndaeyo and Isang (1975).

CHAPTER 2

THE LITTLE AND MIRRLEES AND CONVENTIONAL EFFICIENCY ANALYSIS APPROACHES TO PROJECT APPRAISAL

2.0 Introduction

The purpose of this chapter is to discuss in some detail the Conventional Efficiency Analysis and the Little and Mirrlees methods of project appraisal, particularly since these methods are to be later applied and compared. However, rather than restrict discussion to these two methods, other methods available are briefly reviewed using the existing literature on project evaluation methods. The ensuing discussion will serve to explain the choice of the above two methods for use in this study.

2.1 The U.N.I.D.O. Approach

This approach, like the Manual (Little and Mirrlees 1968) was developed for the evaluation of industrial projects. The level at which evaluation occurs varies with the method used. This method assumes that evaluation is undertaken within government, by the Office of the Central Project Evaluator which is not only constantly in touch with various departments of the Central Government, but is regularly fed with information on the state of the economy and the policies of the government. It can make recommendations regarding the desirability of a project and other matters but it may be too much to suppose that the government will alter its policy altogether on the basis of such recommendations.

In this approach, the national objective is assumed to be *aggregate consumption benefits*. The rate of growth of National Income objective is considered to be subsumed within that of aggregate consumption benefits. While the national objective used indirectly caters for the effects of income distribution through prices (prices being a function of income distribution), prices may be distorted and corrections for this are allowed for by attachment of appropriate weights. Employment, as a separate objective, does not explicitly receive any value but is implicitly catered for through the weights attached to other objectives, especially that of income distribution.

The basic feature involved in calculating the aggregate consumption benefits of a project is to measure the consumer's willingness to pay for the 'net output' of the project. Costs involved are measured by the

maximum alternative benefit foregone as a result of using resources and services.

Thus a given project can be divided into three categories:

1) Direct Present Benefits
   (a) consumer goods
   (b) producer goods
   (c) foreign exchange

2) Direct Present Costs
   (a) producer goods
   (b) foreign exchange

3) Indirect factor benefits and costs
   e.g. unskilled labour

The numéraire is present aggregate consumption benefits. Another distinguishing feature of this method is that the shadow prices used e.g., of foreign exchange, unskilled labour and investment are to be those provided by the Central Government. This is in direct contrast to other methods (Little and Mirrlees) which provide their own formulae for these parameters.

In any given year one evaluates the algebraic sum of the direct and indirect benefits and costs yielding the annual net benefits of the project. The net benefits are then discounted using the social rate of discount supplied by the government.

Apart from the difference mentioned above, the method differs from that of Little and Mirrlees in terms of

1) the numéraire - the Little and Mirrlees numéraire is $\frac{1}{s}$[1] times of that of U.N.I.D.O. More specifically, U.N.I.D.O. procedures use present consumption as numéraire and place a premium on savings while Little and Mirrlees use current savings as numéraire and penalize consumption; and

2) it uses the SER (a single one) instead of the SCF or multiple conversion factors used by Little and Mirrlees

2.2 The Domestic Resource Cost (DRC) and the Effective Rate of Protection (EPR)

The concept of DRC relates to a measure of real opportunity costs in terms of total domestic resources of producing (or saving) a net

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[1] See section 4.1.6 for a definition of $\frac{1}{s}$.

marginal unit of foreign exchange. By comparing it with some measure of the economy's 'real' accounting exchange rate it can be used as an investment criterion, just as the ROR of a project is compared with some measure of the real rate of interest. This method has been in use since the 1950 s by government planners, e.g., in Israel, as a method of project evaluation under conditions in which the official exchange rate and prices of tradables are distorted.

Essentially annual costs are divided into foreign exchange and labour, whether by input-output or cruder methods. A rate of interest has to be assumed in order to give annual direct and indirect capital costs and labour costs per unit of foreign exchange saving are calculated. This yields an own exchange rate for the project, i.e. local currency cost per dollar, say, saved. This is then compared with the estimated shadow rate.

The numéraire, domestic costs per unit of foreign exchange output, can easily be converted to the Little and Mirrlees numéraire by using an appropriate conversion factor. Computationally, this turns out to be that of labour, the shadow wage rate; hence the method is often considered to be a short-cut of the Little and Mirrlees method.

The DRC method can also be applied using input-output analysis as a systematic expost measure of effective protection of certain goods (Bruno 1963; Krueger 1966).

The concept of effective tariff or EPR owed its impetus to Balassa (1965) and Corden (1966) and Johnson (1965,1969) to devise improved measures of the impact of commercial policy on trade and of the implicit protection of value-added in the presence of traded inputs.

The original formulation concentrated on the measurement of protection by means of the observable effective tariff. Denoting tradable input coefficients by m_{ij} (in value terms) and the tariff rate on commodity i by t_i, we have for the effective tariff g_j on commodity j :

$$g_j = \frac{t_j - \Sigma m_{ij} t_i}{1 - \sum_i m_{ij}}$$

This has been suggested as a selection criterion: those industries or projects with the lower rate of effective protection being preferred.

Although there are subtle differences, this method resembles Bruno's in many ways and in theory if the appropriate corrections are made, the

two approaches will yield the same results. Nonetheless, there are two similarities which are pertinent to this discussion. Firstly, they aim at dealing only with trade and factor market distortions. Secondly, they may both be seen as short-cuts to the Little and Mirrlees method (Little and Mirrlees, 1974, pp.365).

2.3 The 'Effects' Method

What gives this method its specific character is that it is based on precedures followed by planners and that it adheres to a French school of thought that the level of market prices is unimportant in project selection. The stage of project selection is reached at the moment when decentralised planning boards have handed in their reports proposing various development projects and activities; the central planning team then makes its first attempt to work these elements into line with constraints in the economy.

The method involves the following procedures.

1) Analysing the project in detail.
2) Analysing the country's economy in detail.
3) Introducing the project into the economy by putting the two analyses together.
4) Studying the alternative situation (economy without the project).
5) Determining, by comparison of the two situations, the effects of the project on the economy.
6) The working out of a criterion for the selection of projects by comparison of costs and benefits.

Not only are the effects on the economy of a whole series of problems e.g. increase in prices of a specific good, devaluation, standard of living of various household categories taken into account during project selection; but also whether the project is unique or linked with other projects. In the latter case a consolidated account is established for the set of projects. The criterion in (6) may be the internal rate of return along with net present value.

2.4 The Squire and Van Der Tak Method

This approach represents the most recent effort by the World Bank to take account of its practices which evolved over time and reconcile them with the recent advances in the theoretical literature. Hence it summarizes

the basic ideas found in UNIDO Guidelines (Section 2.1) and those of Little and Mirrlees (1974). Not only has a more systematic treatment been given to the application of shadow prices but the rates of return are calculated to take explicit account of the impact of distribution of income between investment and consumption and between rich and poor.

Generally, it could be said that governments make decisions based on some conception of welfare. A welfare function, defined by the objectives of the government can therefore be assumed to exist. Often, however, objectives may be inadequately defined and therefore lead to inconsistent decision making. When they are adequately defined, they tend to revolve around one fundamental objective relating to the distribution of income over time and at a point in time. In this approach, the intertemporal and interpersonal aspects of aggregate consumption form the basis of the welfare function.

As with any other method of project appraisal, the first stage in application procedures is the identification of project generated costs and benefits by reviewing the situtation with and without the project. Benefits and costs are then valued using shadow prices. In determining the shadow prices of commodities utilised or produced by the project, it is necessary to classify goods as either traded or non-traded. Traded goods refer either to inputs of the project which are directly imported or those which lead to additional inputs since any domestic production of the input may be faced with capacity constraints; or output from the project which is directly exported or, although sold locally, leads to additional exports. Traded inputs are measured at the cost insurance freight (c.i.f.) import price. This price is also used for output which substitutes for imports. Traded output is measured at the free on board (f.o.b.) the direct foreign exchange of earnings of the export. All border prices used above are unadjusted for import or export taxes.

The above rule applies only when there is perfect elasticity of supply of imports or demand for exports, that is, when the project does not induce export or import price changes. However, if import prices rise, or if export prices fall on account of the project the 'true' import or export price is better approximated by the marginal import cost or export revenue.

Non-traded category of goods embodies commodities such as electricity or transport or those whose domestic supply price, at a given level of local demand, is below the c.i.f. price of imports but above the f.o.b. price

of exports. Commodities which are isolated from foreign markets through government policy also fall within this category. The shadow price in these cases may be the demand price, the supply price or somewhere in between. To qualify this, a shadow price based on the demand price is recommended for inputs reducing supply while one based on the supply price is recommended for inputs supplied by new production. If the input affects other uses and necessitates new output, the weighted average of the demand and supply prices is suggested. Weights are determined by the elasticity of demand and supply. On the output side, shadow price determination is similarly influenced by output demand or supply price, depending on whether the output increases supply, reduces output of other producers or both. If at the margin supply is perfectly elastic or demand perfectly inelastic, the supply price is the shadow price to use for both inputs and outputs.

As can be deduced from the discussion above, traded goods are measured at border prices. Defining the cost of non-traded goods used in the project as the sum of the marginal social cost of increased production and the marginal social benefit of reduced consumption induced by increased demand of the project for the non-traded inputs leads to the breaking down of non-traded goods further into traded goods and basic domestic inputs. The value of traded and non-traded goods can therefore be made commensurable at border prices by applying specific conversion factors defined as the ratio of the cost of non-traded goods and its domestic price, to non-traded goods. However, it is difficult in practice to estimate specific conversion factors for all non traded goods; so that a shortcut utilising an average conversion factor for a group of non-traded items is used. Traditionally the World Bank and other agencies have disregarded the use of a number of specific conversion factors and uses one conversion factor - the official exchange rate divided by the shadow exchange rate - if the numéraire is measured in border prices. The numéraire in this approach is 'freely available public sector income of constant purchasing power measured in units of local currency'. One may therefore deduce that where the numéraire is measured in local currency the inverse of the ratio above would be the factor used to make border prices commensurable with the value of non-traded goods measured in local currency.

The shadow wage rate and the interpretation of what it represents will differ with the evaluator's value judgements and given policy constraints. It cannot be overemphasised that all shadow prices should have the same underlying assumptions and therefore the shadow wage rate should reflect the government's valuation of consumption versus savings and the valuation of consumption accruing to different income groups if these are important government objectives.

In the simplest case the shadow wage rate is meant to measure the opportunity cost of labour: that is the marginal output of labour foregone elsewhere because of the project. The shadow wage rate could be zero where unemployment is expected to continue for the life of the project; however one should remember, not only are there seasonal changes in unemployment, and that increased rural-urban migration may result from the creation of an additional job in the urban sector, so resulting in a SWR which is a multiple of one worker's marginal production; but also that there may be a number of wage rates possible for different skills, times and locations.

With respect to rents, profits and other capital incomes the appropriate shadow price is the marginal social cost determined as for any other non-traded item in instances of excess capacity. When it becomes evident that capacity constraints exist, scarcity values, rents earned on inputs (i.e. shadow rents) or the additional investment required should be included in costs. Again the effect of additional use of these items on savings and income distribution should be adequately reflected, as in the shadow wage rate, in the shadow prices.

The UNIDO feature (Section 2.1) of measuring benefits in terms of the consumer's willingness to pay for the net output of the project is still evident in this method where the difference in consumer surplus induced by project benefits needs to be valued, again allowing for income distribution effects.

The determination of the social value of incremental benefits produced by the project, that is to allow for income distribution effects is determined by applying the net weight $(\beta - \omega)$ to the efficiency benefits. β shows the cost and ω, the welfare benefit of an increase in consumption as measured by the numéraire. In calculating β, information on the marginal consumption pattern is required. More specifically the ratio of the value of this consumption at border prices to its value at domestic prices is required. Both traded and non-traded goods may be valued in a basket of commodities reasonably representative of the particular income class in question. If traded goods form a large proportion of goods, import-export tax or subsidies will be the major determinant of the ratio. On the other hand, if there are a large number of non-traded goods, more complicated methods will have to be applied.

Ideally

$$\beta = \frac{M + X}{M(1 + t_m) + X(1 - t_x)}$$

Consumption Conversion factor	=	Value of Imports and exports at border prices	÷	Value of imports plus exports at domestic prices

The purpose of ω is to indicate the value of a marginal increase in consumption of a particular group in the private sector measured at domestic prices, relative to the numéraire (i.e., relative to the value of free exchange in the public sector) so that

$$\omega = W_c / W_g \quad \text{or}$$

Value of private sector consumption at consumption level c, relative to the numéraire	Marginal Social value of private sector consumption at level c	÷	Marginal Social value of foreign exchange in the public sector

As a short cut to the estimation of ω, the formula d/v is used where

$$V = W_g / W_{\bar{c}} \quad \text{where}$$

$W_{\bar{c}}$ is the marginal social value of private sector consumption at the average level of consumption, and $d = W_c / W_{\bar{c}}$.

One can therefore derive streams of costs and benefits using the shadow prices suggested above to reflect their value to the economy given the government's basic objectives. The next step is the identification of investment criteria. The discount rate used is the accounting rate of interest which reflects the rate of fall of the numéraire, public income expressed in the domestic currency equivalent of foreign exchange. Investment criteria include the net present value, the internal rate of return, cost minimization and first-year return. The 'cut-off rate' for the internal rate of return is the accounting rate of interest.

Just as the net present value and the internal rate of return are two different ways of illustrating the same information, there are other tests similar to the internal rate of return derived for factors of production other than capital. Net benefits may be related to foreign exchange or

to labour. In these cases the 'cut-off rates' are the shadow exchange rate and the shadow wage rate.

2.5 The Conventional Efficiency Analysis

For convenience of exposition, the application procedures of this method could be divided, like other methods of project appraisal ,into four main sections:

a) The identification of costs and benefits
b) Selection of proper values
c) Comparison of costs and benefits
d) Other issues in applying discounted measures of project worth.

The first step involves the identification of incremental costs and benefits generated by the project, after a careful review of the 'with' and 'without' project situations.

Capital, labour, land and taxes comprise costs. All with the exception of taxes a transfer payment are deducted from the benefit stream. Taxes are paid to the government and therefore represent social income since the government uses it to the benefit of the society as a whole. Economic analysis aims at determining the benefit of the project to the society as a whole, therefore, taxes should be considered a benefit and not a cost to be deducted from the income stream as done in a financial analysis. Actual costs vary with the design of the project and can only be considered adequately catered for after the design of the project has been approved technically.

Benefits may be direct, secondary or intangible ones. Direct benefits are those resulting directly from the project and may take the form of increased value of output, greater physical production, quality improvement and changes in the location, time and sales to mention a few. Secondary and intangible benefits represent benefits accruing outside the project. The former relates to project-induced or multiplier effects while the latter covers such items as *income distribution*, national defence or just a better way of life. There may be some difficulty in measuring benefits in these categories (Gittinger 1972). In fact, it has been suggested that economic analysis may be an inappropriate tool for dealing with intangible effects. Salvage items also represent benefits and are accounted for in the final project year.

With items of cost identified and quantified, the next step is to value such items. Although market prices may be used, if it is thought that

they reflect the 'true'social value of the good or service, more often than not, a shadow price may be necessary because market prices are distorted. Specific areas in which Gittinger (1972) suggests the use of shadow prices are traded commodities, labour, capital and foreign exchange.

World prices are suggested for traded commodities, that is those which are exportable or importable; however, for items such as vegetables, cassava and meat, domestic prices are suggested since the question of world prices hardly applies. Labour is shadow priced at its marginal value product. In labour surplus economics this may be zero although by recent opinion, it may be close to, but not actually zero. Computationally, it has been suggested that a zero marginal value product may be used in cases where it is close to zero. Multiple shadow wage rates may also exist owing to the seasonal nature of employment in some agricultural industries. In such cases, it is suggested that the shadow wage is determined on an annual basis by multiplying the shadow wage rate when labour is scarce by the number of days when it is assumed that such labour is fully employed,

The use of a shadow exchange rate and a shadow interest rate instead of the official exchange rate and the actual borrowing rate on loans is also advocated.

In comparing costs and benefits, it is the criteria used to compare these items that makes the conventional efficiency analysis fundamental to the other methods used. An interest rate is used to discount benefits accruing in different time periods since money flows at future dates are thought to be worth less than those today. The total of such benefits, the Net Present Worth or Net Present Value, is normally used as one criterion in project selection. If the net present value of a project is negative - that is, if the discounted value of the benefits is less than the discounted value of the costs the project should be rejected. However, in practice, projects with a positive net present value should not necessarily be accepted for two reasons. First, the shadow prices of some inputs e.g. land, or site value or mineral resources, are virtually impossible to estimate outside the project appraisal process itself. This may lead to an underestimation of the opportunity costs of such inputs. Secondly, there are many projects that by their nature are mutually exclusive: if one is chosen the other cannot be undertaken. This applies, for example, to different designs or sizes or timings of what is essentially the same project. This factor hinges around the fact that this criterion does not allow ranking.

The Benefit-Cost Ratio is also used to compare benefits and costs.[1] The

$$\text{Benefit - Cost Ratio} = \frac{\text{Present Worth of Benefits}}{\text{Present Worth of Costs}}$$

This criterion is used most commonly in water resource projects but seldom in private investment analysis. Any project with a benefit-cost ratio of one or more is suitable for selection. This does allow for some ranking of projects.

The discounted criterion most often used is the Internal Rate of Return referred to as the ROR in this study. The ROR is that discounting rate of iterest which just makes the net present worth of the cash flows of the project equal to zero and represents the earning power of money used in the project over the project's life. The formal selection criterion is to accept all projects having an internal rate of return equal to or above a 'cut-off rate' which is normally set slightly above the opportunity cost of capital. Projects can also be ranked in order of the magnitude of the ROR. The higher the ROR, the higher its rank. This criterion is however defective as a measure of relative merits of mutually exlusive projects and in cases where multiple rates of return or non-existant rates of return exist. The problems of multiple or non-existant rates of return arise when net cash outflows occur subsequent to the initial capital outlay. There exists a rate of return in the case of the former each time the stream of cash flows changes from positive to negative for successive years. A case of the non-existant rate of return occurred in this study and will be explained in Section 4.4.1.

Uncertainty is inherent in any project analysis. As a starting point one tries to utilise the best estimates of variables in the calculation of criteria used. However, since actual values may deviate from the best estimates, sensitivity analysis may be used to investigate the sensitivity of the project to changes in certain variables. These variables may include prices, cost-overrun, delays in implementation and yields.

With this brief review of other project appraisal methods we can better appreciate the Little and Mirrlees approach, with its divergences from the Conventional Efficiency Analysis.

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1. Incidentally, economists are quite inconsistent in their use of 'benefit-cost ratio'. About half the time, they use 'cost - benefit ratio.'

2.6 The Little and Mirrlees Approach - Origin and Theory

Governments must assess the costs and benefits of various projects from the point of view of the economy as a whole. It is the difficulty of reconciling this view with that of the firm in its normal profitability analysis which prompted I.M.D. Little and J.A. Mirrlees (1968) to publish their Manual. The Manual's main message could be that a valid assessment of an industrial project's worth to an economy often requires the use of values which differ from the values used in the normal kind of business appraisal. Market wage rates which are assumed to be overstated in industry are corrected by use of a 'shadow wage rate'. This is an estimate of the social cost of labour and allows for both the differential productivity of labour in agriculture and industry and the effect of extra employment on total saving. The shadow wage rate lies somewhere between the actual market rate and an agricultural subsistence rate. The domestic shadow wage of labour cannot be used to determine labour's value in a project since it reflects only the domestic scarcity of labour in the economy. Once the shadow wage rate has been estimated, it should be converted into the 'world price'. In practice this would almost always be done by using either a 'specific conversion factor' or a 'standard conversion factor'.

The lower level of aggregate saving and investment in the economy is compensated for by the use of the 'accounting rate of interest' (ARI). The ARI is an estimation of the opportunity cost of capital. One notes here that Little and Mirrlees do not use the consumption rate of interest, which could also be considered similar to the social discount rate. Savings are assumed to be so difficult to generate, that projects are assumed to produce not only possibilities of future consumption but also possibilities of future savings. They state further, and this is reasonable, that future savings would not necessarily carry the same discount rate as future consumption. Here, rather than discount consumption and savings using two discount rates, Little and Mirrlees revalue future consumption in terms of savings, so giving a unified benefit stream, or rather, a cash flow stripped of its consumption elements so that it represents only savings. A single ARI is then used to discount this cash flow. The choice of the

ARI is very important, as too low an ARI can lead to excessive investment, a balance of payment deficit, underuse of resources and a tendency towards inflation. Little and Mirrlees suggest the trial of three rates between 10-15 per cent to sort out the "good" and the "obviously bad" projects.

The divergence of the prices of goods from their true social values is dealt with by what could well be considered a Little and Mirrlees innovation. This consists of valuing traded goods at prices which they command at world market or border prices, c.i.f. for imported goods and f.o.b. for exported goods and valuing non-traded goods by decomposing them into traded goods and labour embodied in them.

Thus for a product which uses only unskilled labour as a primary factor of production we have

$$SPV = \sum_{t=o}^{T} \frac{V_t - (SWR)_t \quad L_t}{[1+(ARI)_1][1+(ARI)_2].....[1+(ARI)_t]}$$

where SPV = social present value (criterion)
V = value added at accounting prices
SWR = Shadow wage rate
ARI = Accounting rate of interest
T = life of the project
L = the unskilled labour used by the project, and
t = the time subscript

For the sake of computations of costs and benefits using the Little-Mirrlees approach a project could be divided into three broad categories.

1. Traded goods and services
   (a) Goods which are actually exported or imported (or their close substitutes actually exported or imported)
   (b) Goods that could be exported or imported had the country followed policies that would have resulted in optimum industrial development.

2. Non-traded goods and services
   This includes power, internal transport, construction, land and cement amongst others.

3. Unskilled labour.

2.7 Rationale and Relevance

2.7.1 The Choice of Numéraire

The numéraire, uncommitted social income, is itself measured in terms of convertible foreign exchange. The reasons proferred by Little and Mirrlees for the use of the above numéraire are two in number.

1. Foreign aid and loans account for a large part of new fixed public investment in many less developed countries. Therefore the use of convertible foreign exchange as the numéraire allows the accounting rate of interest to be directly comparable with interest on loans payable in foreign currency or lending abroad.
2. Border prices expressed in foreign currency play an important role in the system of accounting prices in their two publications.

The use of foreign exchange as a numéraire represents a change from those normally used. Associated with its use have been a number of changes from the usual way of thinking and also some misconceptions. Setting of the shadow price of foreign exchange equal to unity has wrongfully led to a misconception that foreign exchange is the only scarcity. In contrast another misconception is that since the shadow price of foreign exchange is absent in their method it seems that Little and Mirrlees do not take the scarcity of foreign exchange into account. The shadow price of foreign exchange is important only as a relative price; the relative price between foreign exchange and domestic resources (indicative of relative scarcities) is not abolished by normalizing all prices with respect to foreign exchange.

Another change is the consideration of foreign exchange at the disposal of the government as the unit of account. If aggregate consumption is felt to be too high, increases in income which are allocated for consumption are valued at less than their nominal value. This is distinct from the practice of using consumption as the unit of account e.g. using the U.N.I.D.O approach (see U.N.I.D.O. 1972) where increases in national income accruing to the government are valued at more than their nominal value.

2.7.2 Determination of Value Added at Accounting Prices

Little and Mirrlees value traded outputs and inputs at border prices. When determining the accounting prices of non-traded inputs they suggest many methods but do show a preference for one - the valuation of a good at

the marginal social cost of producing it, broken down into traded goods which are treated as mentioned above and labour valued at the shadow wage.

There are two ways of rationalizing their method of valuing commodities. The first, which is later discussed in section 2.7.3. under the heading of the Total Planning Optimizing Approach appeals to an optimum and it is believed that the economy is moving towards such an optimum. If this is so then the prices which would prevail in the optimum situation are the appropriate accounting prices and can therefore be used as a clear standard reference for planners. However, constraints, be they external or self imposed, do exist and therefore prevent the adoption of such optimum policies. The second way is to allow for these constraints and then show that the Little-Mirrlees' rules in their simple form are indeed valid. Such an approach is discussed in 2.2.4 under the heading of the Partial Planning 'Improvement' Approach.

2.7.3 Total Planning Optimizing Approach

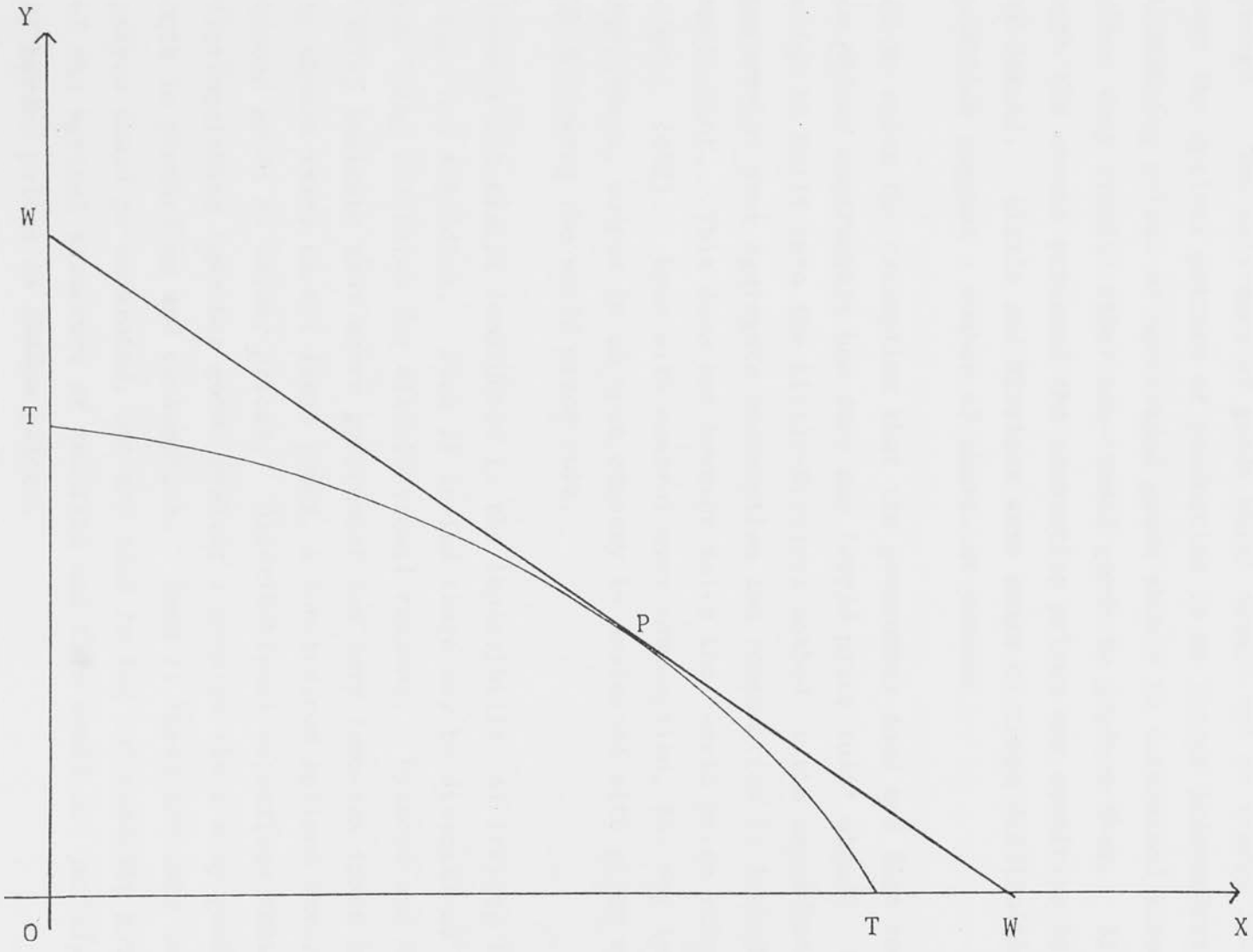
To begin with, let us refer to International Trade theory with its 'usual' convexity and continuity assumptions. Let us also assume that there are no transport costs. Our aim is to maximize social welfare which depends on the consumption of various goods and on the way in which they are distributed. Plannners are also omnipotent being subject only to those constraints imposed by technology and trade possibilities. The planning rule in the above circumstances would be to equate social marginal cost of production of each good with its world price. We can use figure 2.1 to demonstrate this. Here, for a simple two good case, TT is the transformation curve, and WW represents world prices. The optimal production point is P and the optimal consumption point will depend on the welfare function. When applying this rule in practical project selection, factor prices at P may have to be guessed. On the other hand accounting prices for traded goods are simply their world prices whatever the domestic production possibilities and whatever the pattern of demand. The above still holds true in the case of more goods whether intermediate or final. This is demonstrated by Hansen (1967).

The rules become difficult if the simple assumptions above are dropped.

1. If the economy is not a price taker in world trade then world prices are not given independent of domestic production and consumption. Optimal production, consumption and the accounting prices of goods and factors must, therefore, be determined simultaneously. Little and Mirrlees deal with this by taking the marginal export revenue or the marginal

FIGURE 2.1

TOTAL OPTIMISING APPROACH



import cost as their measure of value. This may be the approximate solution but strictly speaking it is the marginal value at the optimal point which is more pertinent. Their approximation can therefore be considered non-optimal and hence is likely to mislead the economy.

2. Should the community face transport costs, problems would arise in theory. If there are costs, there are likely to be some goods which should not be traded at all - those whose social value lies between c.i.f. and f.o.b. prices. The existence of goods which should not be traded indicates that the optimal pattern of production is no longer independent of demand. Accounting prices of non-traded goods should be determined simultaneously since they require other non-traded goods to produce them. If costs vary with the amount produced the accounting prices are sensitive to the pattern of demand. Little and Mirrlees were aware of these difficulties and in practice suggest a number of short-cut methods.

3. If we relax the assumption that the government does not face constraints in policy instruments how does our 'world price rule' stand? One constraint which is built into the Little-Mirrlees method is the imperfect control of government over aggregate consumption and consumption is linked to employment. This does not however solve the 'world price rule' problem (Joshi 1972). Even with control over consumption, for any level of employment, output in an open economy is maximized with given world prices by following the world price rule.

4. Another constraint considered is the impossibility of levying lump-sum taxes and subsidies. Even if levied there may be distortions if they are being collected for distributional reasons. Diamond and Mirrlees (1971) indicate that where government can levy lump-sum taxes but is free to choose taxes on all final goods, a constrained optimum involves valuing traded goods at border prices. Distributional objectives achieved by distinguishing consumer goods present a problem since many goods are used both in production and consumption. Even if these consumer and producer prices could be separated, one may need to tax intermediate goods as part of the optimal structure of taxation and this would not justify the use of border prices as shadow prices.

5. What are the shadow pricing rules of the public sector, given that the government cannot optimally tax the private sector? This appears to be an area which has only recently gained attention in theoretical literature.[1] However, one may assume that if the world prices of traded goods are given, then these prices would be their appropriate shadow price, as far as non-traded goods go, their shadow prices would be sensitive to the trade conditions prevailing between the private and public sectors.

2.7.4 The Partial Planning 'Improvement' Approach

This is the justification for the Little-Mirrlees accounting prices assuming that the government plans the whole economy using the appropriate shadow prices (or that it offsets domestic distortions by the appropriate taxes and subsidies). In other words a project is being evaluated taking everything including existing government policies, whether rational or irrational, as given.

To justify the use of border prices one needs to identify 'fully traded' goods. A 'fully traded' good may be defined as one whose increase in domestic supply or increase in demand affect only the foreign balance. This requires that, for an exportable, demand is perfectly elastic or for an importable supply of it is perfectly elastic. The 'fully traded' category does not necessarily imply free trade. Rather, there need only be a constant tariff or tax. Very close substitutes of 'fully traded' goods which do not enter foreign trade could be considered 'fully traded'. Given the above condition - no effect on prices of domestic consumption and production of the good - a project could either substitute imports or increase exports. With foreign exchange as numéraire, gross benefit is equal to project output times its border price. Thus if inputs and outputs are 'fully traded', a project worth doing is one where the net benefits measured at border prices is positive. This could be illustrated diagramatically using figure 2.2. DD is the domestic demand curve. OP is the c.i.f. price. OP' is the tariff-inclusive external price. Before the project the quantity demanded is OM, AM is the quantity imported and the domestic supply is OA. A project is now set up to produce output AB.

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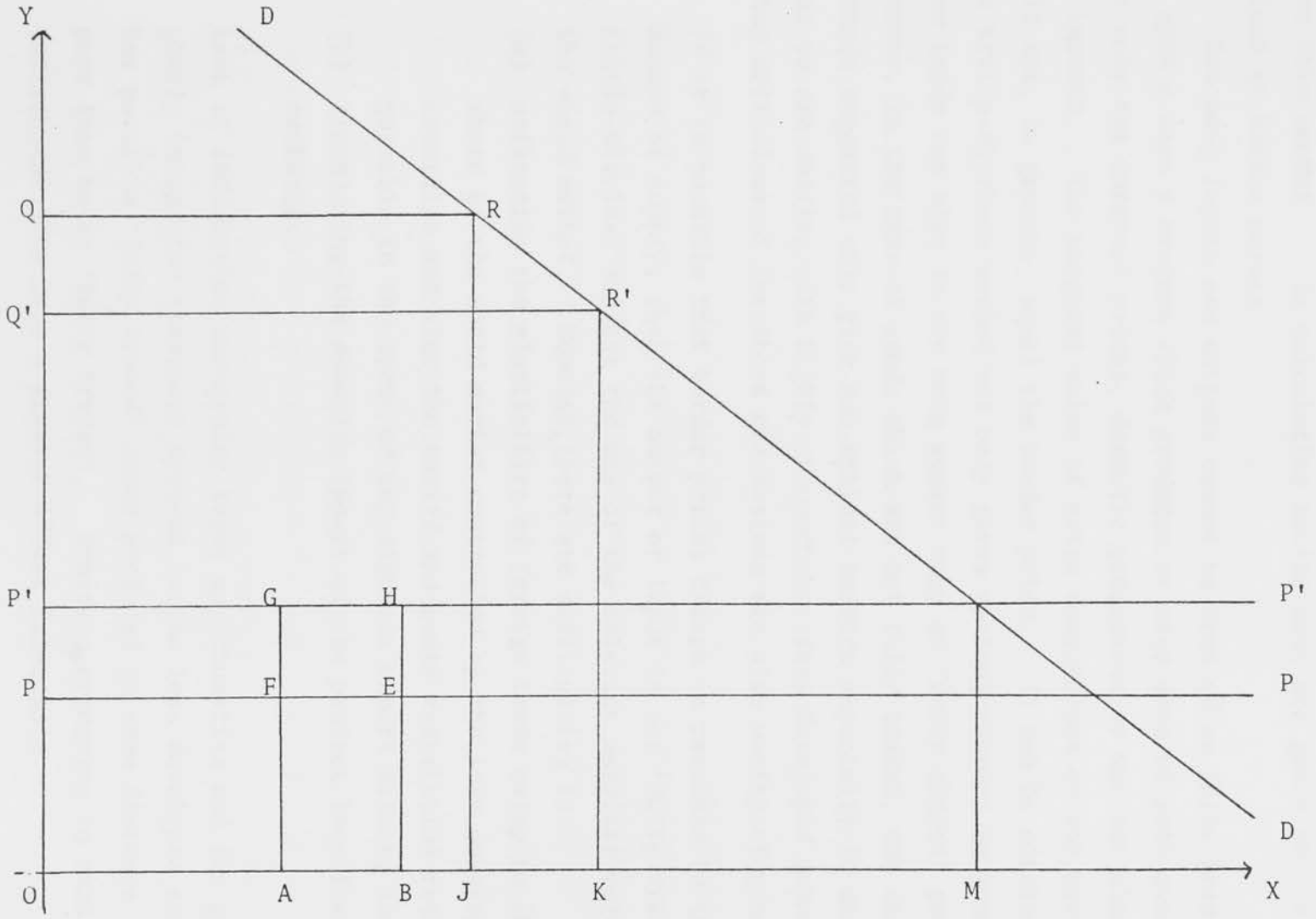
[1] A short survey can be found in Dasgupta (1971).

FIGURE 2.2

PARTIAL PLANNING 'IMPROVEMENT' APPROACH



Assuming a perfectly elastic foreign supply and no effect internally, imports could fall by AB and the value of imports by ABEF. Now the social benefit is the cost of the cheapest feasible cost by which the economy can obtain the same quantity. Here the cheapest alternative is to import and thus the gross benefit is ABEF and the project should be accepted as long as the social cost of producing the output is less than this amount.[1] In calculating social cost all goods should be valued at border prices.

Now many inputs and outputs cannot be treated as fully traded. In such a case a project which produces or uses more of such goods affects not only the internal prices, domestic production or use but also exports or imports. The marginal value of extra consumption or the marginal cost will not, in general, equal the border price. It can be concluded that the Little-Mirrlees method not only gives optimal answers in conditions of free trade but also in the much weaker case of 'fully traded' goods. However, in the case of goods which are not fully traded, the various methods suggested only give sub-optimal answers especially if one recognizes that we are dealing with highly distorted less developed economies. Other criticisms of the above conclusions are also worthy of note.

1. If it is possible that border prices change in response to the project demand or supply, then the output or input is not 'fully traded'. Little-Mirrlees suggest the use of the relevant marginal values in the world market. However, there are difficulties in:
   (a) estimating the elasticities of foreign trade owing to the small share of the world market controlled by the less developed countries and also the tariff and quota restriction retaliations possible in the event of any vigorous export effort; and
   (b) translating the domestic impact of the project into foreign exchange.

2. Lack of information concerning trade opportunities and the generally poorly integrated transport systems in the less developed countries bar possible 'fully traded' goods produced at some distance from the port from being 'fully traded'. Projects producing in such an environment thus have a greater effect internally.

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[1] Government loses tariff amounting to EFGH.

3. Government policy may not allow goods to be 'fully traded'. The valuing of output of a project where the product in question is subject to an input quota, already fully taken up, is a good example. In this case the border price may not necessarily be the appropriate shadow price to use.

4. Existing underutilization of capacity in the home industry may or may not be another reason why goods may not be 'fully traded'. If, for example, the project demand for some input leads to fuller utilization of capacity in the input producing industry, this extra demand may not increase exports nor reduce imports. If production in the industry is constrained purely by demand, the social cost of supplying the input is the marginal cost of producing it, which is below the c.i.f. or f.o.b. price. One knows that underutilization of capacity cannot be considered as due only to demand factors. Others include bad labour relations, inefficient management or a general shortage of inputs. In the first two instances, an increase in demand will not remove such under-utilization. In the case of shortage of inputs, further utilization will only starve other industries of such inputs. The true shadow price of such inputs will then be their marginal value products in alternative use. If however inadequate demand is responsible for the underutilization, we may then assume that a rational government could correct it by macroeconomic means outside project selection, if such shortages are amenable to correction by macroeconomic policies.

5. There is also the case where the large difference between the c.i.f. and f.o.b. prices is the main reason why some goods do not enter foreign trade. Here one has no border price to which one can refer. Little and Mirrlees get around this by saying that project demand would be met by domestic expansion in the production of the required project inputs and thus have its effect on foreign trade through the domestic industry's requirement of traded goods directly or indirectly. They suggest valuing these goods by their marginal costs of production broken down into traded goods and labour valued at the shadow wage. Joshi (1972) points out that extra demand may indeed be met by the deprivation of other users instead of expanded supply.

There is also the difficulty of using the marginal social value as a measure of benefit. This is its conversion into its foreign exchange equivalent. The unrealistic assumption that Little and Mirrlees

sometimes make to solve this problem is that government can adjust the production of the non-traded good so as to satisfy the equality of marginal value and marginal cost. This, they assumed would allow the valuing of non-traded goods to give correct results.

2.7.5 Comments on the use of Little-Mirrlees Accounting Prices

The issues in the preceding section have been discussed in the Manual.[1] However not much importance has been attached to them. Whatever the case, foreign exchange is still the numéraire and in an attempt at getting an accurate estimate of foreign exchange Little and Mirrlees introduce the conversion factor. The latter is the average of the proportions by which the domestic prices of traded goods exceed their world prices. This is being deceptively simple. A great deal depends on weights, standpoint and foreign exchange with or without taxes and trade restrictions, whether given or with some changing. If trade restrictions are changing some allowance should be made for the change in price relationships that would occur naturally, due to a change in exchange rate. There definitely appears to be the need for more attention to the standard conversion factor.

Although Little and Mirrlees cater elaborately for the valuation of a good which is not 'fully traded', they nevertheless expect that project analysts should, as far as possible bend over backwards to treat commodities as 'fully traded'. A possible justification is that border prices are the accounting prices for goods which should be 'fully traded'. This assumes an optimal situation with respect to exchange rate policy which is really not the true picture in the less developed countries. This leads us into the assumed relationship of the project evaluation unit and the government machine. If optimal conditions do not reign in the country under study it is implicit in the Little-Mirrlees approach that the Project Evaluation Office is capable of influencing the government to correct their international and internal fiscal policies. This, of course, reflects the position of the OECD itself. But, is this possible in many of the less developed countries for which the Manual was written? As it happens the Project Evaluation Office would not presume or rather, dare to presume

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1 The elasticities in foreign trade is mentioned in Chapter VIII and Quotas on pps.109,113 and 128. Excess capacity on pps.108,113 and the possibility of project demand for a non-traded input reducing competing domestic use rather than increasing production on pp.153.

in many cases, that it could influence the government concerned to change its policies. The results accruing from the Little-Mirrlees approach could deem many a project unworthy of being implemented which could be the 'wrong' decision since real conditions are not optimal. The decision would satisfy sub-optimal conditions. Because of this the UNIDO method[1] referred to in Chapter I is sometimes preferred owing to its closer approximation to real world and thus optimality conditions.

Another point of interest is that using the Little-Mirrlees rule for accounting prices, goods may be less than 'fully traded' for reasons other than the irrationality of the government. Apart from the poorly integrated market system, the poor flow of information, the inefficient transport systems, government may face administrative constraints in ensuring the 'right' price structure through taxes and subsidies. This again questions the validity of using border prices.

Another objection to the use of border prices as shadow prices refers to government objectives and the sort of policy or policies it is willing to operate. An underlying assumption of the Little-Mirrlees approach and the reason for setting shadow prices of goods and services is that government is under no international constraint to limit the degree of international integration. There are a fairly large number of cases imaginable in which government is not able or willing to complete external economic integration e.g. it has no policy instrument available to wipe out pockets of excess supply, or pressure groups insist on the retention of import quotas, or nationalistic policies require the domestic production of certain goods.

2.7.6 The Shadow Wage Rate (SWR) and the Accounting Rate of Interest (ARI)

These are corrections for the market wage rates and interest rates. In shadow pricing labour the first step is to estimate its marginal product in alternative use. In labour-surplus less developed economies, the direct and indirect source of extra labour to industry is agriculture. So the marginal product of labour in agriculture has to be estimated. To value this marginal product at accounting prices, one has to take a bundle of products which can represent the marginal physical product and then use the Little-Mirrlees method for pricing traded and non-traded goods to deal with the components of the bundle. This step is far from easy; the non-traded will present difficulties and may have to be repriced by using the

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[1] For expansion on this point see Dasgupta (1972) which is really an expansion of another article by Dasgupta (1970).

standard conversion factor. This step is important however as it is through the SWR that Little and Mirrlees allow for the scarcity of foreign exchange: a low SWR encourages the use of domestic resources and vice versa for a higher SWR.

If we assume that the maximum industrial wage rate (w) is above the marginal product of labour in agriculture (m) there is a genuine distortion. But the authors of the manual not only acknowledge this distortion in the calculation of their shadow wage rate, but also allow for a deficiency in saving and investment which is assumed to exist in the less developed economies. So that the SWR is more than rather than equal to m as one is first likely to assume. A similar belief is shared by Marglin (1967), Sen (1960) and U.N.I.D.O (1972) but Little and Mirrlees, in addition, attempt to bring intertemporal considerations into project evaluation. Let us now examine the optimizing framework underlying their analysis.[1]

Savings and investment are seriously considered deficient by Little and Mirrlees. Their arguments for this are:

1. Collectively individuals prefer more to be saved but this preference is not generally reflected by the market even if it is perfect;
2. individuals prefer present to future consumption;
3. the existing structure of the economy and the risk discounts of private individuals generally involve a lower than optimum rate of saving.

Although savings can be increased through taxation, Little and Mirrlees believe that it can also be increased by restricting industrial employment (i.e. by preventing an increase in the living standards of a particular group, i.e. the low productivity workers). It however will become impossible in the future to restrict employment as a means of subsidizing future generations. The following diagrammatic treatment is a simple development of that adopted by Sen (1960) above. The model underlying the Manual is somewhat more complicated but bears sufficient similarity to the model about to be discussed.

Let us assume the choice of employment in the industrial or organized sector of an economy where:

1. one good is produced (or what comes to the same thing several 'fully traded' goods with fixed world prices);

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[1] See Sen (1960)

2. where the marginal product of labour in agriculture remains unchanged as labour is drawn out of agriculture over the entire relevant range;

3. where the terms of trade between industry and agriculture are fixed (say by international trade);

4. where total investment in the economy comprises the 'surplus' in industry in addition to resources taxed away from the agricultural sector;

5. where the maximum tax revenue obtainable by taxing agriculture does not vary with the movement of labour in industry;

6. where production relations in the industrial sector are characterized by constant returns to scales and diminishing returns to labour.

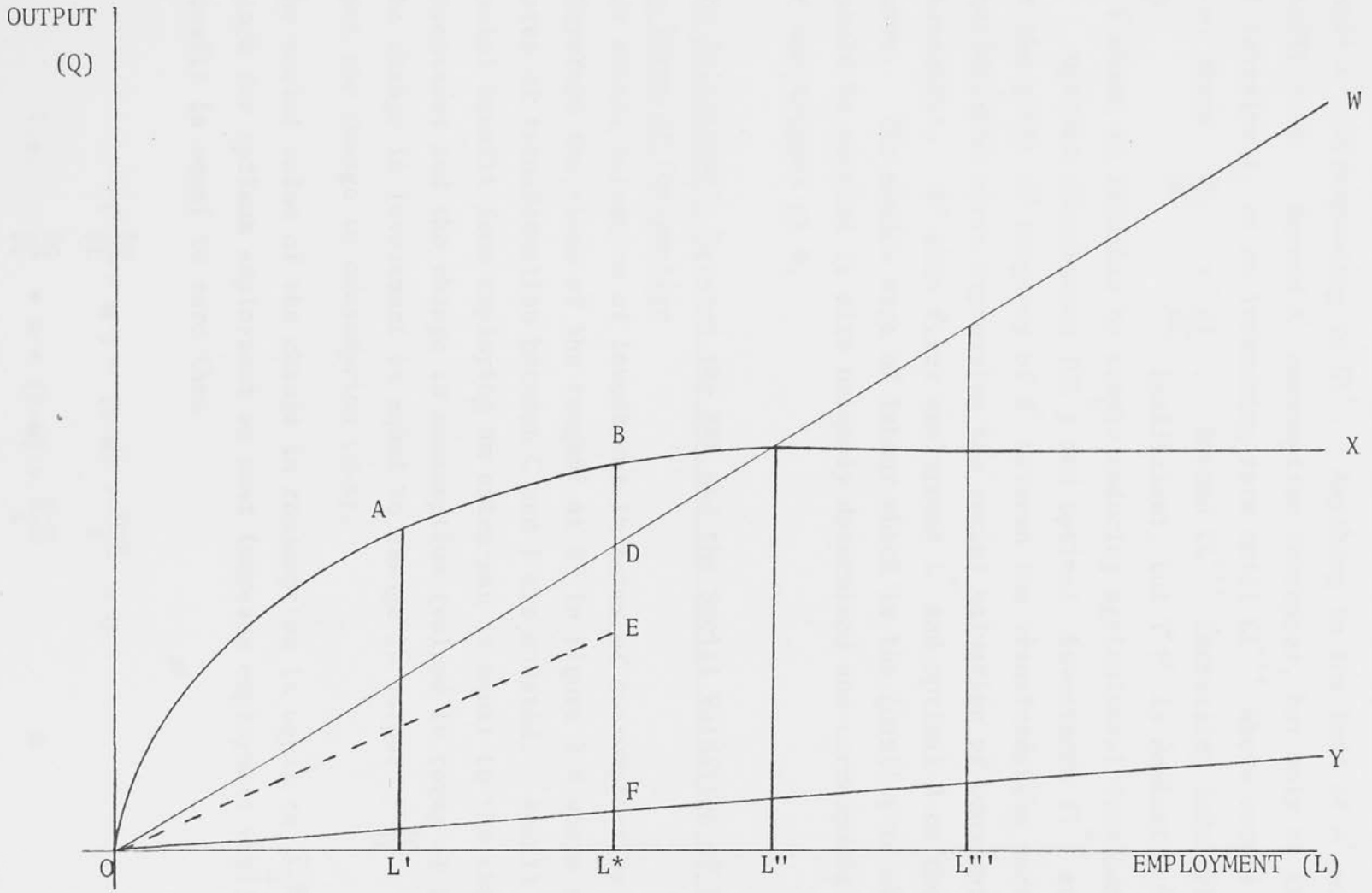
In figure 2.3, OX is the total product curve. On the vertical axis there is output (Q) measured in terms of foreign exchange. On the horizontal axis there is employment in the industrial sector (L). The institutional wage (w) is the slope of OW. If consumption out of wages is c, it is assumed that w=c, (m) is the marginal product of labour in agriculture and is the slope of OY. Therefore, for any level of employment the total industrial wage bill and thus consumption corresponds to a point on OW and output to a point on OX.

The contribution of total investment is equal to industrial output less industrial workers' consumption. An extra man moving from agriculture to industry not only increases total consumption by c-m but changes investment by $\frac{\partial Q}{\partial L} - c$.

As we can see, up to point L' that is, where $\frac{\partial Q}{\partial L} > c$ both consumption and investment can be increased by additional employment. At L', $\frac{\partial Q}{\partial L} = c$ that is total investment is maximized. At L'' the entire output is exhausted by the wage bill and beyond L'' output can still be increased but an increase in consumption must be subsidized by tax revenue raised from the agricultural sector. At L''', $\frac{\partial Q}{\partial L} = m$ so that output is maximized. Between L'' and L''' investment decreases at an increasing rate. Beyond L''' additional employment would be an inefficient way of increasing total consumption since investment would decrease by more than consumption rose. If an increase in consumption is desirable beyond L''' it is more efficiently accomplished by reducing

FIGURE 2.3

SHADOW WAGE RATE



agricultural taxation. Optimal employment L^* must lie between L' and L''' depending on the relative social valuation of consumption and investment. How the model is closed can best be seen by converting figure 2.3 into Figure 2.4, a transformation curve between total consumption and total investment. Here OM is the total consumption in agriculture when industrial employment is zero. Total investment (financed by agricultural taxation) is ON. As industrial employment rises from zero total investment and consumption rise until L' corresponding to CL'. Anything to the left of A' would be inefficient. Beyond A' consumption increases, but only at the expense of investment, at an increasing rate until CL''' where output is maximized i.e. where $\frac{dC}{dL} = \frac{dI}{dL}$. Beyond CL''' increasing industrial employment is inefficient; but $T'P'$ is dominated by the 45^o line $T'Z$ which is feasible by simply reducing agricultural taxation.

Optimal consumption (CL^*) and optimal investment (I^*) are determined at the point of tangency of B' between the transformation curve $PT'Z$ and an indifference curve expressing the social valuation of consumption and investment. B' also fixes employment L^* and optimal B on the total product curve. The shadow wage of labour which is the quantity to which ∂Q should be equated is also uniquely determined and corresponds to the slope of the tangent at B.

2.7.7 The Relationship between the SWR and the Social Valuation of Investment in Terms of Consumption

Let social valuation of investment in terms of consumption be S. S is therefore the slope of the tangent at B' in Figure 2.4 where the marginal rates of transformation between C and I are equated. Recall that the net social benefit from employing an extra man is equal to the change in investment and the change in consumption (valued in terms of investment). The change in investment is equal to change in output $\left(\frac{\partial Q}{\partial L} - m\right)$ less the change in consumption (c-m).

The social value of the change in consumption is equal to $\frac{c-m}{s}$
Since for optimum employment we must increase employment until net social benefit is equal to zero then

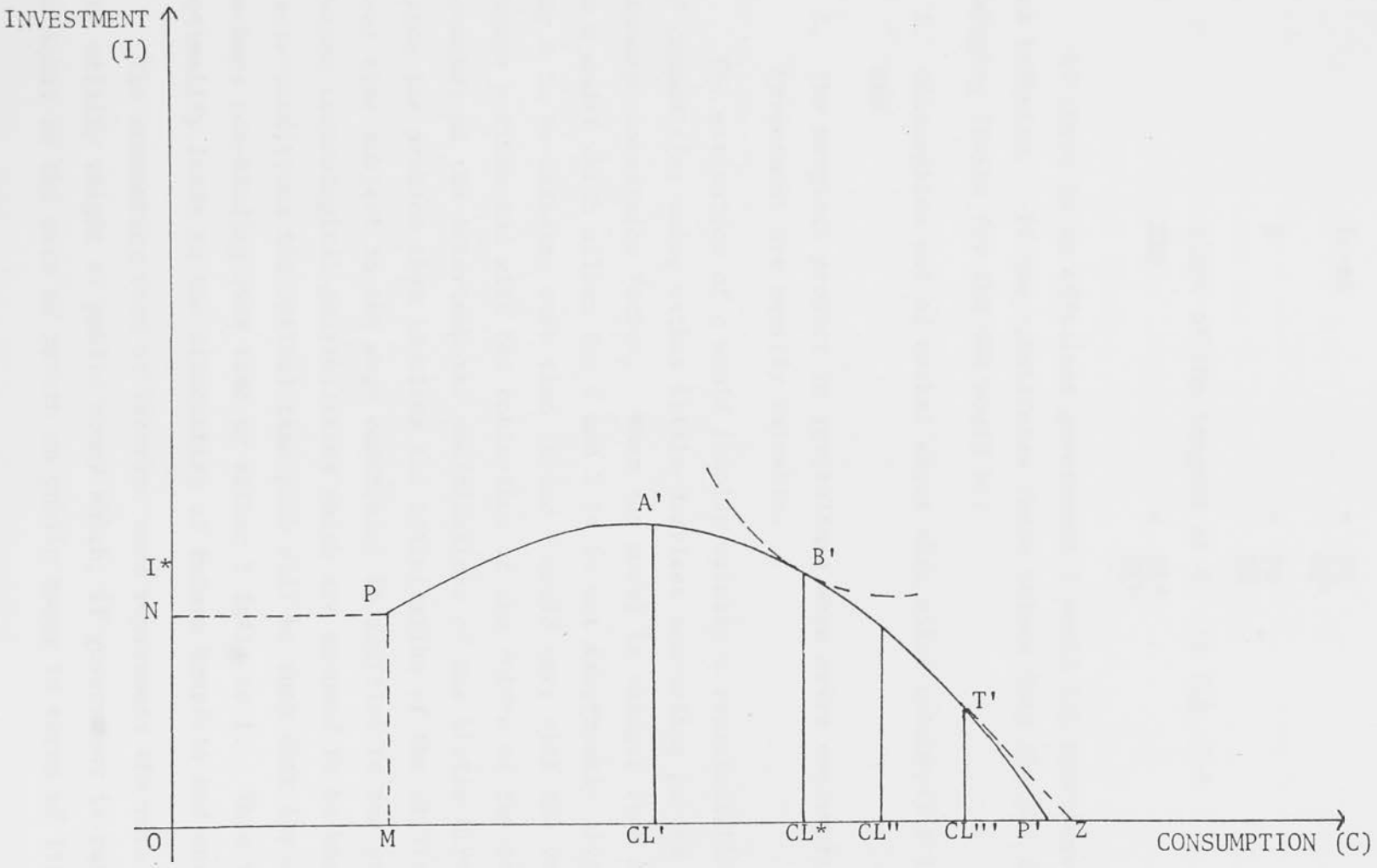
$$\left(\frac{\partial Q}{\partial L} - m\right) - (c-m) + \frac{c-m}{s} = 0$$

$$\text{i.e.} \quad \frac{\partial Q}{\partial L} = m + (c-m) - \frac{c-m}{s}$$

$$= m + (c-m)\left(1-\frac{1}{s}\right) = SWR$$

FIGURE 2.4

SHADOW WAGE RATE



If the above is multiplied by S we get the value of the SWR with consumption as the numéraire (Marglin 1967). In other words the SWR or the social cost of labour in employing an extra man is equal to the loss of agricultural output plus the increase in consumption which is considered to be a benefit. So that in figure 2.3

$$\text{Optimal employment} = L^*$$

$$m = \frac{FL}{OL^*}$$

$$(c-m) = \frac{FD}{OL^*}$$

$$S = \frac{FD}{ED} =$$

slope of the tangent at B' in fig. 2.4

$$SWR = \frac{EL^*}{OL^*}$$

If there is an efficient government S would lie somewhere between one and infinity. If one substitutes these values into the SWR formula the emerging limits for the SWR would be:

1. consumption out of market wages when extra consumption is valueless; and
2. the marginal product in agriculture when extra consumption and investment are equally valuable.

The estimation of c would involve valuing a representative bundle of commodities using either Little-Mirrlees accounting prices or the standard conversion factor. When the model is changed from a static one to a model which allows for C and I to be not exogenously given and allows for S to be changing over time (since S could vary with the value of S in future periods and with the conception of the future of the economy) one broaches on the intertemporal modifications of the Little-Mirrlees method, since the problem then involves the optimization of the utility function over time subject to the wage constraint in addition to the present and future technological possibilities which are assumed to be known. Under these conditions the optimal time path will be such that the wage constraint becomes non-binding over time or rather S falls to 1. This type of optimality leads to the discounting of future benefits and costs.

The accounting rate of interest used represents the rate of fall of the utility weight of public money which, if government is rational, would be equal to the rate of return on public money in terms of itself at every

moment. There is a relationship between the accounting rate of interest and the consumption rate of interest. The latter is the rate of fall in the utility weight of consumption. If we denote the utility weight of government money by U_I and the utility weight of consumption by U_C, we have $s = \frac{U_I}{U_C}$. Differentiating logarithmically with respect to time we have $\frac{\dot{s}}{s} = \frac{\dot{U}_I}{U_I} - \frac{\dot{U}_C}{U_C}$ or rather the rate of fall of s = ARI - CRI.

Which rate of discount is used depends on whether the numéraire is consumption as is the case with UNIDO Guidelines where the CRI is used; or whether the numéraire is government savings in terms of foreign exchange in which case the ARI is used. If CRI is used the impact of the project on savings is multiplied by s in cost-benefit analysis. In the second case however, the impact of the project on consumption is revalued in terms of government saving with the above in mind using the SWR. Changes in capitalist or private consumption have to be deflated explicitly since private profits are not only not as valuable as public money but they also lead to extra present or future consumption. Indeed Little and Mirrlees consider extra capitalist consumption as a pure cost on grounds of income distribution.

It is clear, therefore, that the ARI, CRI and SWR are all related and the values chosen for them must be consistent with each other. In principle, they are determined optimally by solving for the optimal time path in the economy. In practice Little and Mirrlees identify T, when the economy will reach a position where public money is no more valuable than consumption. After identifying a 'marginal product' using information about its labour-capital ratio, the value of s in the current period (s_o) is calculated. The formula is given on page 167 of the Manual. Once s_o is found the SWR can be calculated. The ARI is then estimated by trial and error, the criterion being that it should not pass more or less projects than the investment budget will permit.

On a note of warning, there are some areas in which errors could be made:

1. Initial guesses may be wrong;
2. s_o and hence the SWR could be sensitive to the r and m chosen;
3. if the ARI is guessed incorrectly then one has necessarily to revise both ARI and SWR.

It is little wonder that Joshi (1972) suggests that the procedures for the determination of r and m are 'unnecessarily complicated'.

2.7.8 Comments

1. Little and Mirrlees make the assumption that the supply price of labour to industry must equal the marginal product of labour in agriculture. This does not, however, allow for the various costs involved in moving to urban life and the need to acquire skills etc. The supply price of labour may be higher than the agricultural income sacrificed.

2. It has been argued that rural-urban migration acts as an equilibrating mechanism linking earnings in agriculture to the expected value of industrial earnings which, in turn, equals the industrial earnings times the probability of finding a job. If this is believed, then the value of agricultural product sacrificed is equal to the organized industrial wage which could then logically be the shadow wage of labour.

3. Changes in terms of trade between industry and agriculture may affect the value of the SWR significantly if they are not fixed by international trade.

2.8 Case Studies

A list of case studies using the Little-Mirrlees approach can be found in Appendix 2. Reference will be made to these for various aspects of my appraisal from time to time. This list includes not only studies which have been financed by the grant to Nuffield College from the Leverhulme Trust but also those which were done through purely intellectual interest.

2.9 Summary

The Conventional Efficiency Analysis and the Little and Mirrlees methods of project analysis were chosen to appraise the oil palm project in Guyana not only because these are the two most frequently used methods in the appraisal of Agricultural projects but because they represent turning points in the theory and practice of project analysis. To expand on this, the Conventional Efficiency Analysis is fundamental to the traditional analytical procedures used by the World Bank and other agencies and is the precursor of modern economic analysis. The Little and Mirrlees method was a turning point in that it allowed for the more precise accounting of the social value of commodities involved in the project and gave the rudiments for the incorporation of the income distribution, rate of growth and employment objectives in project analysis.

The UNIDO method was developed for industrial projects and expanded the Conventional Efficiency Analysis to incorporate the income distribution and employment objectives. It utilizes shadow prices recommended by the government and as Lal (1974) believes, given the same assumptions about the environment, the method should yield similar investment priorities to those of Little and Mirrlees. It was later upgraded to give a more systematic treatment of shadow prices and explicit consideration of impact of distribution of income between investment and consumption and between rich and poor. This upgrading yielded the Squires and Van Der Tak method.

The Domestic Resource Cost and the Effective Rate of Protection method were not thought suitable since they aimed only at dealing with trade and factor market distortions and could be seen as short cuts of the Little and Mirrlees method. The 'effects' method is based on the identification of costs and benefits for the various agents in the economy by taking account of the backward and forward linkages in each investment decision. It is more suited for use by planners and not a project evaluation office not only because of the quantity of data and resources required but it attempt to evaluate projects within the framework of explicitly set multiple objectives which, indeed, cannot possibly be embraced in a single economic function. Although it provides information necessary to take into account the income distribution effects by identifying agents receiving the income, the appraisal of income distribution and its relation to the value-added objective is left open. It also uses market prices and does not cater for distortions in factor markets.

Finally, since the income distribution and employment objectives are relatively unimportant in the context of Guyana, the Little and Mirrlees method was preferred to the Van Der Tak and Squire method, that is, to a method which explicitly allows for the incorporation of these objectives in its procedures.

TABLE 2.1

SUMMARY OF THE SALIENT FEATURES OF SEVEN METHODS OF PROJECT APPRAISAL

Parameter	UNIDO	DRC	EPR	'Effects'	Squire and Van Der Tak	Conventional Efficiency Analysis	Little & Mirrlees
Valuation of Traded Commodities	Foreign Exchange equivalent to consumer's willingness to pay	World Prices	World Prices	World Prices	World Prices	World Prices	World Prices
Valuation of Non-traded Commodities	Domestic Prices	Break down into 1) Labour (see below for valuation) 2) Traded commodities valued at world prices	Break down into 1) Labour (see below for valuation) 2) Traded commodities valued at world prices	Domestic Prices	1) Break down into Traded commodities and labour and valued at world prices or 2) Apply SCF = $\frac{OER}{SER} = \frac{1}{SER}$	Domestic Prices	1) Break down into Traded commodities and labour and valued at world prices; or 2) Apply SCF average tariff level = $\frac{1}{SER}$
Numeraire	Present aggregate consumption benefits valued at domestic prices	Domestic Costs per unit of foreign exchange	Observable effective tariff (Section 2.2) or equivalently Effective exchange rate = ratio of domestic (protected) value added to International free trade value added	a) Total value added created ie income by category of agents b) gain in foreign exchange	Freely available public income of constant purchasing power measured in units of local currency	Present consumption benfits expressed in domestic currency	Uncommitted social income measured in terms of convertible foreign exchange
Shadow Price of Labour	Net loss of production services to the rest of the economy	Domestic value added at real opportunity cost. In pratice the market price is often used in the absence of more information .	Domestic value added at real opportunity cost.	No shadow price - market prices are used	Labours foregone marginal production at accounting prices + Net social cost of increased consumption + Social cost of reduced leisure	Opportunity cost of labour in terms of product foregone	Additional resources devoted to consumption-* the social value of increase in worker's own consumption in addition to social value of any surplus consumption accruing to others as a result of movement to a new occupation.
Rate of Discount	CRI = social rate of discount	Accounting rate of exchange	Accounting rate of exchange	CRI ≠ social rate of discount	ARI	CRI = or ≠ to social rate of discount	ARI
Income Distribution	Implicit consideration	No consideration	No consideration	Information in relation to the objective is collected but there is no explicit consideration	Explicit consideration	No consideration	Implicit consideration

* - = minus

CHAPTER 3

PALM OIL IN THE DEVELOPMENT OF GUYANA

3.0 Introduction

The main purpose of this chapter is to highlight important features of the palm oil industry both globally and in Guyana. However, before dealing directly with this subject a brief outline of the world fats and oils economy is given (Appendix 3). Other important issues on technical as well as economic aspects are also discussed and a description and history of the palm oil project analysed in this study is also included.

3.1 Vegetable Oils Situation in Guyana

The Caribbean Community of which Guyana is an important member has a chronic problem of vegetable oil deficit. Even though CARICOM now imports as much as 26 million lbs. of vegetable oils per annum, in addition to local production, the Community still has an annual deficit of the order of 12 per cent of present imports, meaning that the region still requires an additional supply of about 3 million lbs. to meet its demand.

Domestic production of vegetable oils in Guyana has been fairly steady, averaging 868,000 gallons per annum for the period 1965-1972. Consumption, estimated at 1,567,000 gallons per annum, could only be maintained at that level by augmenting domestic production with a sizeable importation of 699,000 gallons per year during this period (Table 3.1). Even at this level, the total demand has never been met. For example, in 1972, the Ministry of Agriculture estimated the demand for vegetable oils in the country at 2.4 million gallons (21.702 million lb) whereas local production and imports for that year totalled 1.387 million gallons (12.54 million lbs.) (Table 3.2), showing a deficit of 1.013 million gallons (9.16 million lbs) or 42 per cent of the quantity demanded. The demand for 1976 and 1981 was estimated at 2.54 million gallons (23.23 million lbs) and 3.01 million gallons (27.5 million lbs) respectively. This demand was to be met in full through increased domestic production and continued importation. There is, therefore, a ready market for vegetable oils, both locally and within CARICOM.

TABLE 3.1

DOMESTIC PRODUCTION, IMPORTS AND CONSUMPTION OF VEGETABLE OILS IN GUYANA, 1965-72 (000 Gals)

Year	Local Production	Imports	Total Available	Exports	Net Available for Local Consumption
1965	653	353	1,006	0.03	1,006
1966	837	41	878	0.01	878
1967	896	163	1,059	0.04	1,059
1968	897	3,525	4,422	5.00	4,417
1969	699	428	1,127	0.00	1,127
1970	895	204	1,099	0.00	1,099
1971	899	609	1,508	0.03	1,508
1972	1,171	266	1,437	50.00	1,387
TOTAL	6,947	5,589	12,536	55.11	12,481
Av.	868	699	1,567	5.88	1,560
As % of Total Available	55.42	44.58	100	0.44	99.56

TABLE 3.2

GUYANA: VEGETABLE OILS PRODUCTION TARGETS AND DEMAND (1972, 1976 & 1981)

Year and Vegetable oil crop	Acres	Yield (lbs)	Production (000 lbs)	Imports (000 lbs)	Estimated Domestic Demand (000 lbs)
1972 Actual					
Coconut oil	33,300	450	15,000	1,630	16,630
Soybean oil	10	200	2	170	172
Palm oil	200	0	0	0	0
Other vegetable oils	0	0	0	4,900	4,900
TOTAL	33,510	447	15,002	6,700	21,702
1976 Programme					
Coconut oil	33,300	495	16,480	1,350	17,830
Soybean oil	300	250	75	0	75
Palm oil	500	240	120	0	120
Other vegetable oils	0	0	0	5,205	5,205
TOTAL	34,100	489	16,675	6,555	23,230
1981 Programme					
Coconut oil	33,500	500	16,750	4,350	21,100
Soybean oil	1,000	300	300	0	300
Palm oil	1,000	375	375	0	375
Other vegetable oils	0	0	0	5,725	5,725
TOTAL	35,500	491	17,425	10,075	27,500

Faced with the reality of an increasing internal demand for vegetable oils, a ready CARICOM market for surplus, and having itself made a conscious effort to restrict importation of some agricultural commodities, the government of the Cooperative Republic of Guyana has decided to explore the possibilities of large scale production of vegetable oils within the country. Coconut is now the major domestic source of vegetable oil in Guyana. Guyana's annual production of copra and coconut oil over the last decade has however stagnated at around 6,000 tons of copra and about 844,000 gallons of edible oil respectively (Table 3.3). Domestic demand for fresh coconut water and meat is expanding so fast that it has given rise to a profitable green coconut market, as well as increasing praedial larceny, with the subsequent reduction in the quantity of copra and coconut oil produced. There are also production problems facing the coconut industry. For example, disease, due to lack of necessary drainage works in areas favouring the economic production of this crop, has precluded any further substantial contribution from this crop in the short term. However, on completion of the extensive and costly sea defence, drainage and irrigation projects presently in progress and with the upgrading of cultural practices on existing plantations, coconut could make a worthwhile contribution to the removal of the vegetable oil deficit.

To augment local coconut oil production three other crops, namely soybeans, peanuts and oil palm, were considered by the government. Soybeans and peanuts have the advantage over coconut and oil palm that they are annual crops which can be planted, harvested and processed within a matter of months. On the other hand, both are comparatively low in oil content; one has to plant fifteen times the acreage of oil palm and four times that of coconut to derive equivalent quantities of vegetable oil. Further more, both are highly mechanized crops, requiring little labour and both are risky crops.

Oil palm is the most appealing of the four crops. Apart from a higher oil yield per acre than any other oil crop, it is less demanding agronomically and in disease control measures than the other three. Its cultivation is labour intensive and therefore creates employment opportunities for a large number of people. It provides Guyana with an opportunity not only of bridging the deficiency gap in the shortest possible time but also of becoming a possible exporter of vegetable oils.

TABLE 3.3

DOMESTIC PRODUCTION OF COCONUT PRODUCTS IN GUYANA

1963 to 1970

Details	Copra (Tons)	Edible Oil (Gallons)	Raw Oil (Gallons)	Total Oil (Gallons)
1963	5,899	690,990	45,750	736,740
1964	5,804	877,895	44,420	922,315
1965	4,636	652,650	39,150	691,800
1966	5,777	830,075	49,700	879,725
1967	4,882	88,075	29,600	917,675
1968	7,013	892,900	60,650	953,550
1969	7,436	69,345	97,531	796,876
1970	5,074	791,000	61,275	852,275
A. Average production per year	5,815	790,366	53,510	843,876
B. Average per ton copra		135.92	9.2	45.12
C. Yield of copra in tons per acre (46,957 acres in all)	0.12			
D. Yield of Oil per acre:				
1. By volume (gallons)		16.31	1.10	17.41
2. By weight (lbs.)		149.24	10.07	159.31

3.2 Guyana's Development Plans

The programmes and policies of any country are guided by its national objectives. In the Cooperative Republic of Guyana, it was one of the declared and firm objectives of the government to feed, clothe and completely house the seven hundred and fourteen thousand people of Guyana by 1976. This objective had been the foundation upon which the country's 1972-76 Development Plan was conceived and implemented. Goals of this plan included the reduction of unemployment, an increased rate of growth of the Gross National Product and Gross Domestic Product, increase in per capita income and the development of self-confidence and self-reliance in the people of Guyana.

Although a lot of progress, particularly in the agricultural sector, was made during the 1972-76 Development Plan period, the rapid changes in the socio-economic and political situation in the world in recent years prompted a revision of the Plan during the latter half of the Plan period (1974-76), and the practical experience gained from the implementation of the 1972-76 Plan was a valuable tool in the drafting of the 1977-81 national agricultural programmes. The 1977-81 Development Plan had more or less the same goals as the previous plan; namely

(a) to increase foreign exchange earnings by a rapid increase in the exports of sugar and rice;

(b) to increase the level of domestic self sufficiency in food items and feed grains now imported, but which can be produced locally. These items include milk, root crops, vegetable oils, peas and beans, peanuts and fruits, corn, soybean and vegetables;

(c) to establish sufficient cooperative production systems in crop, livestock, processing and marketing, as a means of improving the efficiency and level of farm income earnings and distribution;

(d) to accelerate the economic development of the six administrative regions of the country, through planned locations of major impact agricultural projects;

(e) to create 10,000 new agricultural jobs through expansion of primary agriculture, agro-industry and related fields, including textile manufacturing and oilseed and fruit processing;

(f) to grow 6,000 acres of cotton annually and

(g) to pursue a positive policy of diversification and import substitution in agricultural production.

From the above, it is quite clear that the weight of developmental responsibility rests heavily and squarely on the agricultural sector and will continue to do so for some time to come.

3.3 Early Interest in Oil Palm Development

Guyana has long realised its deficiency in producing vegetable oils: to meet demand the country has had to depend upon large importations of vegetable oils. The country has realised for some time that oil palm was capable of making some positive contribution towards bridging the deficiency gap, for palms were introduced into Guyana about 60 years ago and planted in the Essequibo, Demerara and Berbice regions. It appears, however that no further development followed these introductions until the 1960 s when small plots of oil palm were established at the Central Agricultural Station, Mon Repos (1960) and some years later at Ebini, Berbice River (1967-68) and Wauna (1969).

The promising performance of these plantings revived Guyana's interest in the crop. First, on Guyana's request, Mr R.L. Grut (1970) brief feasibility study of oil palm cultivation prospects in Guyana. He identified four areas where oil plam cultivation was possible. These were:

(a) the Demerara River area
(b) the Essequibo River area
(c) Ebini area and
(d) Port Kaituma - Matthews Ridge Complex

This was followed by the establishment of two pilot (small scale) oil palm plantings comprising 180 acres planted in 1973 and 1974 by the Demerara Sugar Company at St Jan, West Bank, Demerara and 372 acres planted by the Ministry of Agriculture, Settlers and Farm Corps at Wauna, North West District.

In 1974, two separate teams, one working on food crops generally and the other one on the Wauna Land Settlement Scheme, appraised the country's oil palm programmes. The parties involved were Messrs R.R. Nathan

Associates Incorporated Washington, sponsored by the United States Agency for International Development, who worked on "Guyana's Food Crop Systems", and Messrs F.A. Teriba,. B. Phillips et al, students of the Economic Development Institute of the International Bank for Reconstruction and Development Project Appraisal Training Programme. The latter group appraised the Farm Corps' and Settlers' projects at Wauna.

The performance of the trial plantings at Mon Repos, Ebini and Wauna, the pilot plantations at St Jan and the Wauna Settlement Scheme, coupled with the reports of the aforementioned persons have very much contributed to the intensification of the government's interest in and hope for oil palm as an important vegetable oil source. A subsequent assessment of the performance of the above mentioned plantings in 1975 prompted two Nigerian experts, Inuaeyen Ndaeyo and E.U. Isang to suggest and appraise the establishment of a 10,000 acre estate and a 15,000 acre smallholder planting in their report (Ndaeyo and Isang 1975).

3.4 Geographical Background

Guyana, covering 83,000 square miles (53 million acres) is in the tropics and is situated on the north eastern coast of the South American continent between latitudes 1^{o} and 9^{o} north of the Equator and longitudes 57^{o} and 61^{o} West Meridian. It is washed by the Atlantic ocean on its northern boundary and flanked by Surinam on the East, Brazil on the south and south-west and Venezuela on the west. Its total land mass is dissected by streams and rivers, the most important ones being the Essequibo, Demerera, Berbice and Corentyne Rivers.

Guyana is characterised by high rainfall and equable temperatures. It rains mainly during two wet seasons, April to August and November to January better known as the May-June and November-December rains. Rainfall averages 91 inches annually for the country as a whole and ranges up to 120 inches along the coast. The other months constitute the dry seasons which also vary from mild along the coast to severe in the hinterland. The mean annual temperature ranges from 75^{o} to 85^{o}F.

The country is divided into four natural vegetation belts, namely, the Coastal Belts, the Sand and Clay Belt, the Hinterland District and

the Interior Savannah or Rupununi. Politically, it is divided into six administrative regions, namely

(a) the North West District
(b) Pomeroon and Essequibo Coast Districts
(c) East Coast Demerara - West Coast Berbice District
(d) Corentyne District
(e) Mazaruni - Potaro District
(f) Rupununi District

In the 1970 census Guyana had a population of 0.714 million people with an estimated labour force of 210,000 and unemployment at that time was 2 per cent. The population growth rate was 2.5 per cent per annum. The country's population is concentrated around Georgetown, the capital, and other coastal towns. Consequently, although the road system is well developed on the coast, the same cannot be said for the hinterland, where transportation is mostly by water and by internal flights using the numerous airstrips developed throughout the country.

3.5 The Agricultural Sector

The economy of Guyana is dominated by two giants, namely:-
(a) Agriculture including forestry, livestock and fishing and
(b) Mining including quarrying.

In the eleven year period (1965 to 1975) the agricultural and mining sectors contributed an average of 27.5 and 17.1, totalling 44.6 per cent for both sectors of Gross Domestic Product. With agriculture contributing 50 per cent and mining 39%, both contributed 89% of export earnings over the 1967 to 1975 period. On the other hand, in terms of employment 29 per cent of the working population is engaged in agriculture.

The agricultural sector is dominated by two commodities, sugar and rice, the production of which far exceeds domestic requirements and yields a large surplus for export. Together, the two crops contribute 71 per cent of the sector's total production and 86 per cent of the sector's export earnings. Otherwise agricultural production is so low that importation of agricultural commodities over the years is inevitable. The country's agricultural economy, therefore, has a narrow base which the government has decided to widen through its policies of increasing agricultural production, of diversification and import substitution, and through the banning of importation of some agricultural commodities.

3.6 Agricultural Institutions

1. Ministry of Agriculture

The responsibility for agricultural development in Guyana is vested in the country's Ministry of Agriculture, with a senior Cabinet Minister as the political head and a Permanent Secretary as the administrative head. The Ministry has three main Divisions - Agriculture, Lands and Hydraulics - each headed by qualified professional personnel. The Lands Division is responsible for land development and preparation for cultivation, while the Hydraulics Division provides irrigation and drainage facilities in the developed areas to enable the Agricultural Division to go ahead with the utilisation of land for agricultural purposes.

The functions of the Agricultural Division include responsibility for veterinary services, livestock breeding and production; agricultural extension and education; food science and technology; soils and crop science; fisheries; as well as resource development and planning.

As in other developing countries of the world the Ministry has experienced a shortage of professional and supervisory agricultural staff. Despite this, the Ministry will provide the staff required for the two new projects to be appraised.

2. Related Corporations

There are some eight national corporations with agricultural functions, some of which come under the control of the Minister of Agriculture. These comprise

(a) Guyana Marketing Corporation (GMC)
(b) Guyana School of Agriculture Corporation (GSAC)
(c) Guyana Agricultural Products Corporation (GAPC)
(d) Guyana Forest Industries Corporation (GFIC)
(e) Guyana Timbers Limited (GTL)
(f) Guyana Timber Export Board (GTEB)
(g) Guyana Marine Foods Limited (GMF)
(h) Guyana Rice Board (GRB)

Of these, the last two have no direct bearing on the project.

a) Guyana Marketing Corporation

The GMC is charged with the responsibility of providing an assured market and paying economic prices for farm produce and organising distribution of supplies to consumers throughout the country. It also acts as a purchasing agent, as well as a clearing house for certain crops.

b) The Guyana School of Agriculture

Established in 1963 and made a corporation in 1964, this school trains junior workers for the Ministry of Agriculture and private enterprises; trains teachers of vocational agriculture and farmers who wish to improve their farming skill. It also prepares students for advanced training in agriculture. The school will help produce the additional junior technical staff required for the oil palm project.

c) The Guyana Agricultural Products Corporation

This was the most recent of the Agricultural Corporations to be established. Its function is to plan and execute government programmes for large scale production and processing of both crop and livestock products on a commercial and economic basis. This is the corporation which is to execute the project.

d,e,f) The Forestry Corporations

These work towards the same goal of promoting development, protection and exploitation of the country's forest resources. The main function of the GFIC, established in 1973, is to promote the economic growth and development of forest industries as well as to undertake the manufacture of forest products in Guyana. The GTEB is the sole exporter of Guyana's timbers while Guyana Timbers Limited engages both in the export trade and the manufacture of components of pre-fabricated houses. The GTEB will be responsible for the export of timber produced by the project.

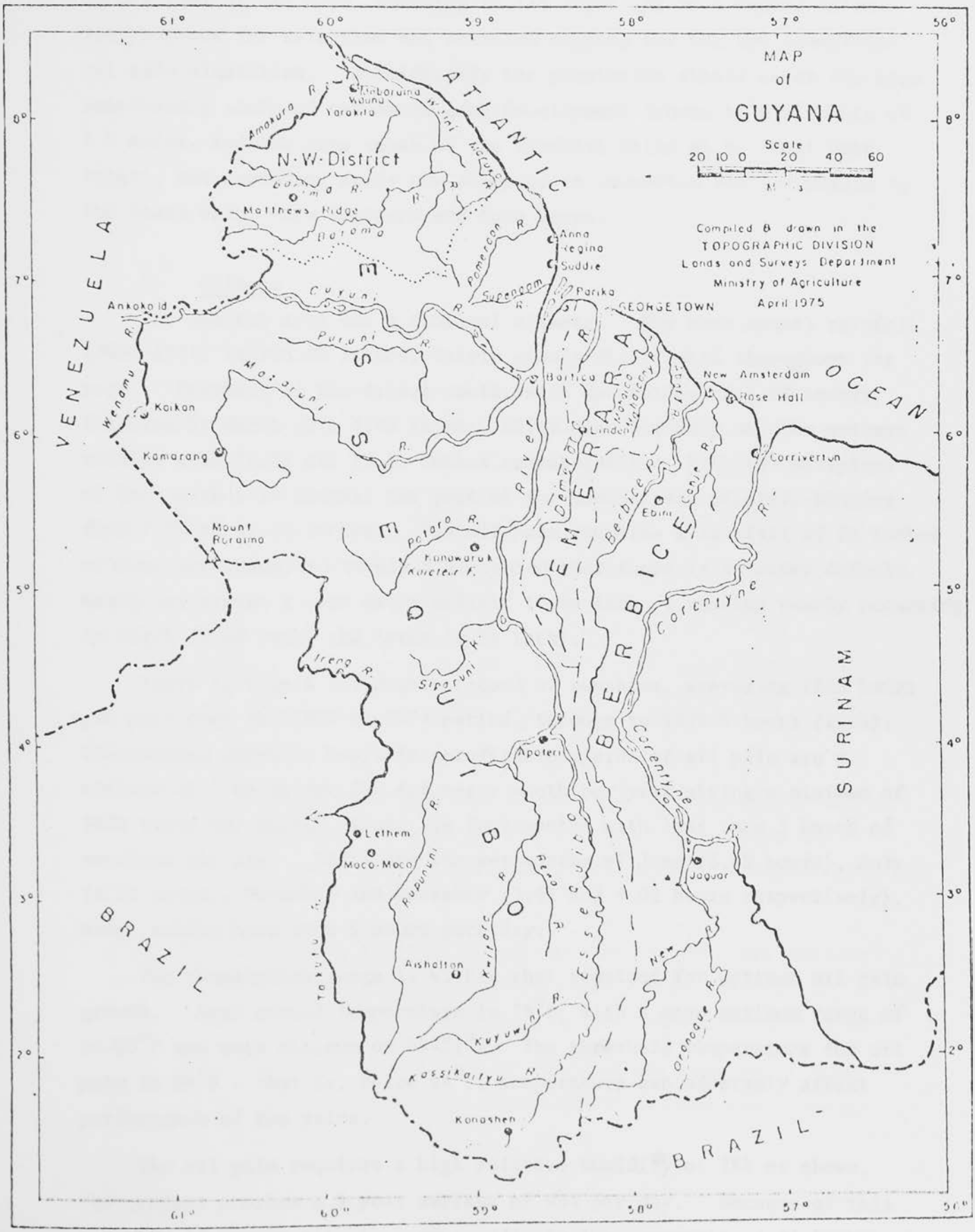
3.7 Project Area

1. Location

The project area is located within the Wauna (South) - Yarakita (North) region of the North West District of Guyana. (see Map 3.1).

MAP 31

MAP OF THE COOPERATIVE REPUBLIC OF GUYANA
SHOWING THE NEW OIL PALM PROJECT AREAS
IN THE NORTH WEST DISTRICT OF THE COUNTRY



The site is sixteen miles from Mabaruma, along the Mabaruma - Hosororo - Wauna road and adjacent to the Wauna Land Development Scheme. The entire Wauna - Yarakita region is 53,465 acres (or 83.8 square miles) of which 28 per cent of the area, covering 15,115 acres (or 26.6 square miles), are proposed for selection and detailed mapping for the new commercial oil palm plantation. Specifically the plantation should cover the area immediately south of the Wauna Land Development Scheme to a distance of 2.5 miles, and the area south of the Yarakita Hills up to 'Haul Over Point', but excluding areas now occupied or earmarked for occupation by the State Farm, Farm Settlers and Farm Corps.

2. Climate

The project area has a tropical climate. The mean annual rainfall (1966-1974) is 108.83 inches, fairly evenly distributed throughout the year. February is the driest month, with an average of 2.98 inches, followed by March with 4.40 inches, while June and July are the wettest months, with 14.17 and 13.85 inches respectively. With the exception of May, with 5.19 inches, the rest of the months have rainfall ranging from 7.92 to 11.69 inches. The oil palm requires a rainfall of 78 inches or more per annum, so evenly distributed that there is no water deficit. Wauna has almost a zero water deficit (0.94 inch) reading yearly occurring in March (0.40 inch) and April (0.54 inch).

There is also a favourable record of sunshine, averaging 1850 hours per year over the 1970 to 1974 period, through to 2020.5 hours (1974). The optimum sunshine hours for profitable yields of oil palm are a minimum of 5 hours per day for every month per year giving a minimum of 1830 hours per year. Wauna has four months with less than 5 hours of sunshine per day. These are the wet months of June (3.65 hours), July (4.34 hours), November and December (3.41 and 4.02 hours respectively). Other months have over 5 hours each day.

The temperature range is within that required for optimum oil palm growth. Mean annual temperature is 78^{o}F, with a mean maximum range of 84-90^{o}F and mean minimum of 67-71^{o}F. The threshold temperature for oil palm is 64^{o}F - that is, below 64^{o}F, temperature can adversely affect performance of the palms.

The oil palm requires a high relative humidity of 75% or above. The project area has a 5 year average of 95% per day. Because of this the rate of evaporation is correspondingly low, averaging 4.84 inches

per month. On the whole the project site has a climate that is good for oil palm growth.

3. Vegetation

The natural vegetation of the project site is tropical forest which is richly endowed with valuable species of timber including Bulletwood, Mora, Red and White Cedar, Kunta, Kabukali, Yarulla, Truli and Corkwood. These are assets and revenue earners for the project as well as the nation. In addition to the plantings of oil palm mentioned earlier, farmers in the Yarakita area cultivate assorted root crops, coconuts and coffee.

4. Topography

The project area immediately south of the Wauna Land Settlement Scheme and up to 2.5 miles away has rolling highlands with moderately steep to steep slopes, while the area south of the Yarakita hills and extending to 'Haul Over Point' consists of rolling highlands with a dominance of moderately steep slopes. Between these two sections, the land form is rolling to hilly and steep to very steep especially near gullies.

5. Soils

The soil of the Wauna-Yarakita region falls into three main groups namely:-

a) 15,115 acres or 28 per cent of the area are moderately suited to crop production and comprise the Wauna Sandy Loam and Kasarama loamy sand and are classified under the Land Capability Class II;

b) another 32,220 acres or 60 per cent of the area are moderately to poorly suited for crop production. They include the Yarakita loamy sand, Hosororo gravelly clay and Lama Muck; and finally

c) 6,310 acres or 12 per cent of the area are made up of Hosororo clay, mixed colluvial and alluvial and are considered unsuitable for crop production.

The project area falls in the first group where the soil series are well to moderately well drained, very strongly acid and low in natural fertility. Wauna sandy loam is a deep, dark greyish-brown sandy loam over yellowish red sandy clay; while Kasarama loamy sand is a dark greyish brown loamy sand over yellowish red sandy clay loam. Both soil series are very suitable for oil palm cultivation and root crop intercrops, but in all cases optimum yield can only be achieved under good soil and crop management, especially since the thin surface horizon of the unstable sandy soils is very susceptible to erosion under clean cultivation.

6. Rivers

The project area is drained by three large rivers, their tributaries, a number of small creeks and gully systems, some of which have no names. The rivers are the Koriabo on the eastern boundary, the Amakura on the west and Yarakita and Aruau on the southern boundary.

7. Land Tenure System

All land in the country is vested in the government of Guyana which then sells or leases it out to whoever wants it. For agricultural purposes, land is leased to farmers in the interior at the concessional rate of 25 cents per acre for the first 5 years, 50 cents for the second 5 years and G$1 for the third 5 years. Legislation introduced in 1972 required all land allocations to attract an annual flat rent of $2 per acre, but as yet this has not been enforced.

8. Labour Force

The total population of Wauna is estimated at about 300 persons, mainly settlers. That of surrounding areas is estimated at about 7,700 persons mainly Amerindians who are also farmers but engage in shifting cultivation. It is possible for certain farmers and their adult children in the locality to give up their present jobs and join the proposed commercial oil palm estate as labourers. It is also possible that local labour may not be able to meet the labour requirements of the plantation, in which case outside labour will be required. In the same way that members of the Farm Corps and settlers have come from all over the country to settle in Wauna, it will be quite easy to recruit up to 4000 persons from the unemployed to work in the oil palm plantation provided remunerative wages, fringe benefits and basic social amenities are provided.

9. Accessibility and Communication

The area is linked with Mabaruma, the administrative centre, and Kumaka, the commercial and shipping centre of the area, by an all-season 16 mile motorable road through Hosororo and Wauna. Mabaruma itself, is served by a daily air transport service from Georgetown and Matthews' Ridge, headquarters of the North West District of which Wauna and Yarakita are members. Kumaka has a weekly shipping service from Georgetown.

In addition, a 14-mile road, used mostly during the dry season, has been constructed between Wauna and Yarakita. Its 65-mile extension from Yarakita to Port Kaituma, through Hobadiah and Sebai, has been traced and construction work is in progress from the Kaituma end. This road when completed will link Mabaruma with Baramita (170 miles away) through Kaituma, Arakaka and Matthews' Ridge. It will also link the plantation with the Farm Settlement part of the project, also specialising in oil palm cultivation.

A radio-telephone link exists between the headquarters in Georgetown and various other divisions and the Wauna Land Development Scheme. This service could be strengthened, brought up to date and shared with the Oil Palm Project. Perhaps a separate one could be installed for the project.

10. Agricultural Service

There is an agricultural Extension Office at Hosororo headed by an Agricultural Officer. This office renders extension services to farmers around Mabaruma, Hosororo, Wauna and Yarakita. This service will have to be expanded to meet the requirements of the intended project.

11. Marketing of Agricultural Produce

Once a week on Tuesday, a boat arrives from Georgetown at Kumaka bringing goods to the interior and leaves on Thursday with farm produce purchased from farmers in the locality by the Guyana Marketing Corporation.

3.8 General Description of the Project

The project comprises two sections namely:-

(1) A 10,000 acre Commercial Oil Palm Estate and

(2) A 15,000 acre Farmers' Oil Palm Planting Scheme.

The components of the proposed commercial project are as follows:

(a) selection and extraction of useful timber between 1976 and 1980 from the project area covering over 15,000 acres of the forest stretching from Wauna Land Settlement to Yarekita;

(b) the selection, demarcation and blocking out of some 10,000 acres suitable for oil palm planting from (1) above, the 10,000 acres excluding unusable areas of rivers, valleys, hills and gullies, steep slopes and unplantable areas, factories and other utilities;

(c) the building of office and residential quarters for management. staff and labourers starting from 1976 and completing by 1980;

(d) the installation of an integrated processing mill with a throughput of 20 tons of fresh fruit bunches per hour and capable of extracting palm oil from fresh fruit bunches as well as palm kernel oil, kernel cake from palm kernels;

(e) the establishment of fruit collection systems to cater for non-estate palm fruits produced by the Wauna Settlers, Farm Corps and other oil palm farmers within a 15-mile radius of the processing mill;

(f) project management;

(g) a staff training programme at selected centres and through inservice courses and orientation visits.

Owing to the satisfactory performance of Wauna farmers' oil palm crop referred to earlier and the expressed wish of numerous farmers to participate in a scheme of this kind, the Nigerian Mission suggested a Farmers' Oil Palm Planting Scheme which comprised the following components:

(a) the planting of some 15,000 acres of oil palm at a minimum rate of 20 acres per farmer between 1977 and 1981;

(b) the growing of root crops in the Scheme area, both as intercrops with the palms through the project years 2 to 7 and as sole crops thereafter;

(c) the installation of a cooperative integrated oil palm processing mill (the estate type) for the sole purpose of purchasing and processing the farmers' palm fruits;

(d) the provision of the necessary organisation, management and facilities for administering this scheme.

3.8.1 Project Organization and Management

1. Executing Agencies

The development of the proposed project will be executed by:

a) The GAPC which will be responsible for the establishment and running of the 10,000 acre estate sector and timber extraction. Since the farmers' scheme is a new one, it has been suggested that it should be executed, like the rice programme, by one agency, in this case, the GAPC. This system will ensure easy movement of personnel, materials, equipment and services between the estate and the scheme.

b) The Guyanese Ministry of Agriculture, the duties of which are two-fold; first to assist and guide the oil palm planting programme of the farmers involved in the project and secondly, to make its research services and facilities available to both farmers and the estate, particularly, in respect to soil and leaf analyses and crop protection.

2. Management

The successful execution of this project depends upon the recruitment of the right type of staff for each aspect of oil palm work. Most of the administrative, technical and professional staff and other staff will be recruited or seconded from the Ministry of Agriculture and other government agencies and the remainder from the private sector.

3. The Estate and Scheme Centres

Both estate and the farmers' scheme will have headquarters in a central position within the relevant areas. These centres will house staff, vehicles, plants, equipment and the processing mills. It is at these centres that seedlings will be raised. One would therefore expect a skeleton number of buildings to be erected along those for housing estate and scheme personnel.

Other aspects of the projects will be discussed in the ensuing chapters.

CHAPTER 4

SOCIAL PROFITABILITY

4.1 Method of Shadow Pricing

As mentioned earlier, a valid assessment of a project's worth to an economy often requires the use of values which differ from those used in the normal kind of business appraisals carried out by enterprises. Market prices used in the latter may be distorted by taxes and subsidies. In a social profitability analysis the social values of inputs and outputs are arrived at by using 'shadow prices' which reflect the social value of resources used or output produced. Thus taxes are subtracted from market costs or added to the firm's revenue; conversely subsidies are added to market costs or subtracted from the firm's revenue. However, by far the most important modification is the cost of labour to which a shadow wage rate is applied.

The use of world prices is the distinguishing feature of the method used. This provides a measure of the foreign exchange earnings or savings resulting from the sale of output. The shadow price of those goods which actually enter into foreign trade is the established world price; that is for imports, the c.i.f. price in addition to the port-to-user margin which consists mainly of transportation and handling charges, and for exports, the f.o.b. price less transportation and handling charges. If the goods are close substitutes for traded goods, then the ratio of the world price to local price for the latter will provide the world price equivalent. Where products are not sold locally but are to replace imports, the border price of the imported substitute will be used to reflect savings in foreign exchange. If goods are not traded then their price is estimated as if conditions of free trade existed in the economy, since this allows for computation of the value directly comparable with those of traded goods.

The first step is to classify all costs into categories which are suitable for further processing into shadow costs as explained above. The inputs of the project are subdivided as follows:

1. Labour
2. Salaries
3. Materials
4. Transport Charges
5. Services and miscellaneous
6. Equipment and buildings
7. Land
8. Taxes and subsidies

Items 1 and 2 are supplemented by the indirect inputs of labour and salaried staff estimated to be embodied in items 3, 4, 5 and 6. Any profits appear in the latter items as factor incomes. Items 1 to 6 can therefore be seen as consisting of factor income earned in Guyana in addition to foreign exchange costs of imported materials and equipment. Land and taxes do not appear as social costs for reasons given below. Subsidies to the 750 farmers involved are however included in costs.

The eight headings will not be discussed in more detail.

4.1.1. Direct Factor Incomes

These comprise wages of the estate and factory workers and staff salaries, and refer to local personnel. There are only two areas in which expatriates are to be involved.

1. Personnel involved in mill establishment
2. Technical assistance in the form of 24 expert months spread over six years. Here, instead of attaching an expert for two continuous years the experts will be expected to pay regular short visits of about 4 months per year to Guyana over a period of 6 years (1976-1981).

Since item 1 cannot be precisely determined from the source of data used it is considered indirectly accounted for in the analysis in the determination of the border price of the mill. Item 2 was not included in costs since its value depends on bilateral agreements and hence was not quoted in the source of data used.

4.1.2 Traded and Non-Traded Goods

Guyana has been an extremely open economy with a share of imports in the G.D.P. averaging 62 per cent in the 1970s.

This means that most commodities in Guyana are likely to be fully traded. More recently however public policy seems to be veering towards reducing the 'dependence' of the Guyanese economy on external forces including foreign trade which is perhaps a consequence of balance of payments difficulties following the 1973 oil price increase and the slowing down of the growth impetus from the maturation of the bauxite industry. The government has sought to manage the payments crisis by increasingly stringent import controls. This situation is, however, very likely to change since Guyana, with its 784 thousand people, will inevitably have to rely on foreign trade, if only because of limited domestic markets. Most modern industries require markets larger than can be provided by the Guyanese market if they are to operate at efficient scales of production. Therefore unless high cost production is to be perpetuated the only option will be either to import the products of such industries or, if they are set up domestically, to export the output which cannot be sold at home.

For the most part, therefore, it would be assumed that the Guyanese economy is extremely open and treat most of the inputs used by the project as either exported or imported. The methods used for breaking down these items into their constituent parts are explained in detail in appendix 4.1. The following is a brief summary.

The cost of imported materials is broken down into c.i.f. cost, port-to-user margin and taxes. Fertilizers are treated separately as they constitute an important part and separate data were obtained for them. For non-traded goods such as locally made tools and polybags, the 'standard conversion factor' was applied, so deriving their equivalent foreign exchange value.

Some of the splits were indeed very approximate. The most obvious ones are non-traded goods such as building and construction, transport and electricity and fuel for which the input-output table of the economy has to be used. Unfortunately there is no up-to-date input-output table for the Guyanese economy. The Inter-Industry Table for 1959 compiled by A Kundu (1963) was of some help since it revealed a significant proportion of foreign exchange costs. The splits were considered only approximate since changes in relative prices of traded goods and tariff schedules must have occurred since 1959.

4.1.3 Standard Conversion Factor (SCF)

Before embarking on the discussion of land and taxes and subsidies, it is a convenient point to examine the 'standard conversion factor'. This is used not only in computing the border prices of a small number of non-traded items but also in the calculation of the shadow wage rate. The SCF is an average tariff level and is intended to measure the extent to which the domestic price level differs from what its level would be under conditions of free trade with a balance of payments equilibrium. Quotas are practically non-existent in Guyana. Import duties averaged about 25 per cent and export duties, 5 per cent in the 1970-72 period.

Import duties reduce the volume of imports; a balance of payments equilibrium is obtained by a rise in the domestic price level. On the other hand, export duties reduce the value of exports, with equilibrium resulting from a fall in domestic prices. In each case, the extent of change in domestic prices depends on the relevant elasticities of demand for inputs and of supply of exports.

In Guyana, export duties are derived mainly from precious stones, mainly gold and diamonds, bauxite, sugar, greenheart timber (*Ocotea rodiaei*), aquarium fish, shrimps and molasses. Import duties are mainly on consumer goods. It seems unlikely that a cut in impact duties would produce a disproportionate increase in imports but even less likely that a cut in export duties would result in very much higher exports (owing to the inelasticity of supply).

It would therefore seem that, on balance, the price raising effect of import duties is stronger than the price lowering effect of export duties. It could be, therefore, guessed that on average domestic prices are 20 per cent higher than world export prices. These preliminary conclusions are endorsed when the conversion factors of a number of traded goods are plotted on a graph. The cluster[1] of points resulting appeared to indicate 0.8 to be the SCF to be used in converting miscellaneous output and consumption from domestic to world prices.

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[1] Method suggested by Little and Mirrlees (1974, p. 218).

4.1.4 Land

The purchase of land represents a cost to the enterprise. Its social cost, however, is given by its productivity in the best alternative use. Nearly four-fifths of the total land area of Guyana is covered by virgin tropical rain forests, the principal exceptions being the cultivated areas on the coast and the savannahs in the north-east and in the south-west. The area in question is no exception. This would therefore suggest a zero opportunity cost.

All land with the exception of land on the coast, mainly sugar estates and some of the land used for rice cultivation, is owned by the state. Land is presently leased to farmers in the interior at the rate of 25 cents per acre per annum for the first 5 years, 50 cents for the second 5 years and $G1 for the third 5 years.

Land is therefore not included in social costs.

4.1.5 Taxes and Subsidies

The payments of duties and taxes by the project and by those firms directly or indirectly contributing inputs to the project do not represent a social cost. For example, if the cost of gasoline or diesel used was taken gross of tax, some government revenue would be wrongly counted as a cost to society. Taxes are therefore subtracted where they occur. Subsidies are likewise added to costs.

The following subsidies have been recommended for the 750 farmers involved in the project.

TABLE 4.1

SUBSIDIES RECOMMENDED FOR FARMERS

Item	Subsidy per acre $G
Land Development	125
Cassava	50
Oil Palms	250
Peanuts	150
Sweet Potato	40

All costs can now be expressed as wages, salaries or foreign exchange. The next step is to convert factor incomes to their foreign exchange equivalent.

4.1.6. The Shadow Wage Rate (SWR)

The shadow wage rate attempts to measure the cost to the economy, in foreign exchange, of using labour in any particular way as opposed to its alternative use. The alternative is assumed to be subsistence agriculture.

It is assumed that in developing countries consumption is considered, socially, less valuable than investment to an extent greater than that reflected by the rate of savings. Since the choice of projects will affect both the interpersonal and intertemporal distribution of consumption through the distribution of project benefits in the form of wages, the social cost of labour is measured by the increase in consumption which results (i.e. fall in investment) with some offset from this to reflect the value of the benefit for some now consuming more. The formula is

$$SWR = c' - \frac{1}{s}(c - m)$$

where c' = additional resources devoted to consumption

c = consumption of the wage earners on the estate and at the mill

m = marginal productivity of the wage earner

s = the value of uncommitted government income measured in terms of consumption committed (in terms of the numeraire) and, therefore,

$\frac{1}{s}$ = the value of one unit of current socially weighted consumption in terms of savings

The methods used to calculate the variables above are found in Little and Mirrlees (1974). As was mentioned in Chapter 3, labour for the project will have to be drawn from the unemployed in the various regions of Guyana since there is not sufficient labour in the Wauna-Yarakita area. The marginal productivity of such labour is assumed to be zero since it has been explicitly stated by Little

and Mirrlees (1974, p. 279) that "The marginal productivity of unemployed labour is surely not greater than zero - except that people are seldom entirely unemployed. Although arguments can be advanced for saying it is negative, we recommend assuming it to be zero, unless, of course, there is hard evidence in support of a better estimate".

In fact, the marginal productivity of labour in the agricultural sector may actually be very close to zero, since most of Guyana's unemployment occurs in agriculture. The reason for this is that Guyana's agriculture does have a narrow base - mainly export-oriented sugar and rice - with relatively small quantities of anything else being produced. Because of rising wage rates owing to (1) trade union pressure in response to inflation, (2) a demand for wages levels equal to those rising wages in other sectors (e.g. Mining and quarrying and construction), and (3) a falling labour supply, these two industries have become increasingly mechanized with the concomitant unemployment resulting.

The method used for calculating the consumption levels c' and c is found in Little and Mirrlees (1974,pp 280-3).

Calculation of c' and c

1. The first step is to find the wage rate in the oil palm industry.

The market wage rate used was $5.50 and, in an attempt to find the level of real wages 5 years hence, the rate of growth of wages in the sugar industry was used, for not only is this agricultural crop in the organized sector but the industry also has a system of production and control very similar to that anticipated for the oil palm industry. The rate of growth of market wages in this sector between 1969 and 1976 was estimated at 22 per cent per annum and assuming that this trend continues for another 5 years, the market wage would be $11.55. This was then deflated by the consumer price index to give a real wage of $6.79 or $1,758.61 per annum assuming 259 working days each year.

2. The next step was to find the proportion of the wage spent on consumer goods.

Firstly, income tax, compulsory savings in the form of a national development surtax and national insurance contributions

had to be deducted. Rates for these items were located in the Guyana Handbook (1975) and the following deductions were made.

(a) Income Tax	43.53
(b) National Development Surtax	43.53
(c) National Insurance	60.20
	$147.26

Income net of taxes, compulsory savings and insurance was $1,611.35 per annum @ $6.22 per day.

Assuming a rural savings rate of 0.04 and average consumption rate of 0.95, consumption was estimated at $5.91 per day equivalent to $4.72 at border prices after applying the 'Standard Conversion Factor' of 0.8. Therefore

$$c' = \$4.72^{1}$$

3. To obtain c one has now to subtract allowances made for changes in environment, namely additional food, transport, and housing expenses attributed to change in price levels (i.e. urban vs. rural). These were estimated as amounting to $750 per annum or $2.89 per day.

Therefore,

$$c = \$4.72 - 2.89$$
$$= \$1.83$$

Next, there is the value of s to consider. s is the premium on savings, that is, the value of savings per unit of socially weighted consumption. If λ is the utility price of investment (savings) and v' is the marginal utility of (employment generated) consumption, by definition.

$$s = \frac{\lambda}{v'}$$

But $\dot{\lambda}/\lambda$ is the ARI and $-\dot{v}'/v'$ is the CRI (Little and Mirrlees 1974).

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[1] No employment premium has been deducted.

Hence s/s = ARI - CRI, from which it follows that, if the divergence between the ARI and the CRI (which will determine the time path of s) diminishes linearly over time until date T, ARI = CRI and hence $s_n (n = T, \ldots.\infty)$ remains constant and equal to unity. At this time the current value of s may be given by (Manual)

$$s_o = [1 + \tfrac{1}{2} (ARI - CRI)]^T$$

With structural unemployment in Guyana, T could be considered as the date at which this labour is fully absorbed in the relevant organized sector. Accepted investment projects in the industrial sector may also be used to determine s (Little and Mirrlees 1974, p. 247-254).

In Guyana, gross investment is 22 per cent of G.N.P. while savings were only 11 per cent in 1972. The disparity between these two ratios may be explained by the dependence on a high foreign exchange component to investment in the past and, then, mainly in the bauxite industry. The share of public investment in fixed capital formation is 22 per cent.

With a total population of 714 thousand growing at a rate of 1.6 per cent per annum (1970 Census) and a labour force of 210 thousand there is still some unemployment in Guyana; but the country is beginning to feel the effect of a diminishing labour supply which is reflected in rising real wages. This effect has been felt since 1955 and continued through the 1960s when money wages rose by 2.8 per cent per annum. During the early 1970s money wages rose by 22 per cent per annum.

With the scanty information available s was roughly estimated to have a value of 3, using an accepted sea defence investment project. This compares favourably with the estimate of 4 obtained for the Jamaican economy (Lal 1978) which not only shares a similar production base but also a similar development path, labour market problems, balance of payments problems and hence development policies.

To conclude, beginning with a market wage rate of $5.50 per day, c′ was estimated to be $4.72 and c as $1.83. With s estimated as 3 and m assumed to be zero the shadow wage rate could then be estimated:

$$4.72 - \tfrac{1}{3} (1.83 - 0)$$

= $4.11 or 75 per cent of the market wage rate

The cost of labour could then be calculated assuming that:

1) the SWR remained a constant proportion of the market wage rate; and
2) market wage rates continued to rise at 22 per cent per annum for another 5 years and at 10 per cent per annum thereafter.

The rates were changed after the first five years since it is suspected that a greater part of the rise in money wages in recent years could be attributed to trade union action in response to spiralling prices because of the current world recession. The rate of increase between 1955 and 1969 was a lower 10 per cent. The modifications of the basic shadow wage rate above were required using the Little and Mirrlees method, so yielding a different shadow wage for each project year. Even if identical amounts of labour are required for a number of years of the project, the wage bill is expected to increase because of an increasing wage rate.

The Shadow Wage Rate and the Unorganized Sector

There are often difficulties in estimating the shadow wage rate in the unorganized sector not only because it is hard to estimate additional employment but often the notion of 'employment' can become quite vague. Also, while it is still true that extra consumption of an employee represents a reduction in uncommitted income, the wages of additional employees in many cases come out of the profits of the small business men or farmer, so that the resources in question never have a chance of becoming uncommitted government income.

In the case of the 750 farmers involved in the project, considered here as part of the unorganized sector (the organized sector is assumed to comprise sugar, rice and livestock farmers of Guyana) Little and Mirrlees suggest (1974, p. 287-8) that a shadow wage rate is not calculated but that additional consumption benefits are estimated for the farm as a whole. This additional revenue is determined and from this the values of purchased inputs and the marginal productivity of labour (assumed to be zero) are

subtracted. One then subtracts consumption of everyone (workers and farm family) which is assumed to be the average rural consumption, as set at 95 per cent in the absence of precise consumption studies.[1] This figure is thought, here,to be too large, however, as these farmers produce some of their subsistence needs on plots on their farm. Hence a lower level equal to 25 per cent of production is also used in costing farm labour. It should be borne in mind, however, that this may be somewhat on the low side and that the actual value may lie somewhere between these extremes of 25 and 95 per cent levels used here.

4.1.7 Salaries

It is normally assumed that the skilled man, the clerical and administrative worker is paid a salary equal to the value of his production or the service he provides for his employer. This, in turn, is in principle equal to what he could earn in alternative employment. However, there may be some unemployment in some employment categories, e.g. persons possessing secondary education - the kind most likely to go into salaried employment and the kind most likely to be at the bottom of the salary scale. A similar situation appears to exist in Malaysia, Kenya and Trinidad and Tobago. In this event the opportunity cost of these workers would be zero. However, since the exact proportion of the total salary bill affected is unknown, it does not seem unreasonable to modify these salaries by applying a conversion factor of 0.9.

4.2 Projected Revenues and Costs

4.2.0. Introduction

The project has been divided into three sections for the purpose of computing social costs and benefits.

(a) The estate sector comprises the 10,000 acre estate and its own mill capable of processing 20,000 lb (10 tons) per hour of fresh fruit bunches after

1. Demas (1966) has found that the nature and pattern of consumption in the Caribbean territories are somewhat similar, all being influenced, regardless of a lower level of income, by high expectations and increasing travel opportunities to the United States. Of the data available, average rural consumption data of Puerto Rico for 1963 was thought applicable mainly because per capita GNP of Puerto Rico at that time more closely approximated to that of Guyana presently. Daubon and Robinson (1975) used four income ranges - under 1,000, 4,000 - 4,999, 5,000 - 7,499 and 7,500 and over (dollars). Average consumption levels were 1.1112, 0.9528, 0.9181 and 0.6867 respectively. The 0.9528 level was thought most appropriate under the circumstances.

installation of the first phase and 40,000 lb (20 tons) per hour of fresh fruit bunches on completion of the second phase. The planting schedule for the estate is given in Appendix 4.2 while the schedule for the installation of the mill is given in Appendix 4.4(a)

(b) The cooperative mill sector comprises the mill which would be processing farmers' fresh fruit bunches. It is identical to the estate mill and has the same schedule for installation. Fresh fruit bunches will be collected, free of charge, from previously agreed collection points. A nursery is also a part of this government-owned cooperative mill sector and provides seedlings for the farmers involved in the project.

(c) The farmers' sector is planned for 750 farmers. These farmers will not all plant at the same time but in 3 batches comprising 230 who will begin planting in 1977, 230 in 1978 and 290 in 1979 (Appendix 4.3(a)). Each farmer will cultivate a total of 20 acres of oil palms.

The project is assumed to have an economic life of 20 years.

4.2.1 Gross Revenues

(a) Yields

The first consideration here is the yield of fruit. From the fresh fruit bunches, palm oil and palm kernel oil are extracted in proportions which vary with the age of the crop (Table 4.2). Palm kernel oil extraction leaves palm kernel cake, which similarly varies as a proportion with the age of the crop (Table 4.2). Farmers are expected to produce at 75 per cent of estate yields per acre. These figures appear somewhat on the low side when one compares them with those yields found in Malaysia and Papua New Guinea. Different climatic and soil conditions prevail in the different oil palm growing areas but even allowing for these differences the figures are low. The Cape Hoskins (Papua New Guinea) counterpart for Table 4.2 can be found in Appendix 4.4(b). In addition, farmers' production in Cape Hoskins is estimated at 80 and not 75 per cent of estate yields. The distribution above was suggested by Ndaeyo and Isang (1975) using Nigerian planting material. Malaysian planting material was used at Cape Hoskins and may account for some

TABLE 4.2

FRESH FRUIT BUNCH YIELD PER ACRE AND EXTRACTION RATES OF PALM OIL, PALM KERNEL OIL AND PALM KERNEL CAKE

Year after Planting	Year of Harvesting	Yield of f.f.b[1] Per Acre (tons)	Extraction Rates			
			Palm Oil	Palm Kernel	Palm Kernel Oil	Palm Kernel Cake
4	1	0.9	18	3.1	1.55	1.55
5	2	1.4	19	3.2	1.60	1.60
6	3	2.7	20	3.4	1.70	1.70
7	4	3.8	20	4.0	2.00	2.00
8	5	4.7	20	4.5	2.25	2.25
9	6	5.3	20	4.5	2.25	2.25
10-20	7-17	6.7	20	4.5	2.25	2.25

1. f.f.b. fresh fruit bunches.

of the difference. Estimates of yield were made in the absence of the adequate yield data from oil palms already planted in Guyana and therefore tend to have a certain amount of uncertainty attached to them.

Estimates of fresh fruit bunches harvested will affect projections of those costs which vary with fruit yields, namely harvesting, transportation of fresh fruit bunches (either to the mill in the case of the estate, or to the collection point in the case of the farmers), processing costs, and shipping and sales costs (that is the shipping and sales of produce from the location of the factory on the project to the point of utilisation in Georgetown, the capital). Revenue depends on the quantities of palm oil, palm kernel oil and palm kernel cake extracted.

Other sources of revenue in the project are timber (if the estate decides to log the site, before clearing for oil palm), seedlings sold by the cooperative mill sector, and sweet potatoes, cassava and peanuts planted by the smallholders during the immature palm years as intercrops and later as sole crops by the farmers. The number of seedlings required by the estate and farmers are shown in Table 4.3. Anticipated yields for all crops are given in Table 4.4.

TABLE 4.3

PLANTING TARGETS AND OIL PALM SEEDLINGS REQUIRED

PROJECT YEAR	SECTOR				Total Seedlings Required
	Estate		150 Farmers		
	Planting Target	Oil Palm Seedlings Required	Planting Target	Oil Palm Seedlings Required	
1976	-	-	-	-	-
1977	1,000	90,000	1,380	124,200	214,200
1978	1,500	135,000	2,530	227,700	362,700
1979	2,500	225,000	3,810	342,900	567,900
1980	2,500	225,000	3,870	348,300	573,300
1981	2,500	225,000	3,410	306,900	531,900

(b) Prices

The oil palm produces three revenue earning products - palm oil, palm kernel oil and palm kernel cake.

No palm oil is presently sold in Guyana,[1] so, for the purpose of this analysis, the c.i.f. price of soybean oil is used to price the palm oil produced. This would reflect the foreign exchange savings generated by the project. The long term average price of 1960-1976 has been used. This is US $482 per metric ton (2,206 lb) or G$1,248 per long ton.[2]

Palm kernel oil faces a more specialised market as is discussed in Appendix 3. It is hoped that palm kernel oil will substitute for imports of coconut oil. Here again the long term average price is used. A c.i.f. price is US$556 per metric ton (G$1,517 per long ton).

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[1] Palm oil produced by the project is expected to substitute for exports of soybean in the short term.

[2] The c.i.f. Rotterdam price has been used since there has been some difficulty in getting insurance and freight charges of soybean oil between the U.S.A. and Rotterdam and between the U.S.A. and Guyana. It is therefore assumed that insurance and freight charges are similar.

TABLE 4.4

QUANTITIES OF PRODUCTS GENERATED FROM THE PROJECT

PRODUCT	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990-95
ESTATE															
Tons Fresh Fruit Bunches	-	-	-	-	1,000	3,100	7,900	1,250	24,375	35,625	47,125	56,875	65,000	71,250	75,000.0
Tons Palm Oil	-	-	-	-	180	574	1,506	2,960	4,985	7,085	9,475	11,375	13,000	14,250	15,000.0
Tons Palm Kernel Oil	-	-	-	-	15.5*	48.7*	128.1	264.5	470.5	707.5	992.5	1,253.1	1,462.2	1,603.1	1,687.5
Tons Palm Kernel Cake	-	-	-	-	15.5*	48.7*	128.1	264.5	470.5	707.5	992.5	1,253.1	1,462.2	1,603.1	1,687.5
Millions B.ft timber	21.00	31.50	52.50	52.50	52.50	-	-	-	-	-	-	-	-	-	-
COOPERATIVE MILL															
Seedlings	-	124,200	227,700	342,900	348,300	306,900	-	-	-	-	-	-	-	-	-
Tons Palm Oil	-	-	-	-	186.3	656.2	1,712.2	3,410.1	5,706.3	8,089.3	10,691.9	12,909.7	14,733.2	16,119.3	16,890.0
Tons Palm Kernel Oil	-	-	-	-	16.04*	55.9*	217.6	302.8	537.5	809.8	1,129.8	1,425.1	1,657.5	1,813.4	1,900.1
Tons Palm Kernel Cake	-	-	-	-	16.04*	55.9*	217.6	302.8	537.5	809.8	1,129.8	1,425.1	1,657.5	1,813.4	1,900.1
FARMERS															
Tons Fresh Fruit Bunches	-	-	-	-	1,035	3,553.5	8,998.5	17,568.7	29,019.7	40,650.0	53,459.7	64,548.7	73,666.1	800,596.7	84,450.0
'000 lb Sweet Potato	-	3,670.8	8,565.2	14,417.2	14,736.4	12,289.2	11,065.6	5,250.0	5,250.0	5,250.0	5,250.0	5,250.0	5,250.0	5,250.0	5,250.0
'000 lb Cassava	-	52,440.0	15,732.0	27,588.0	34,200.0	31,578.0	31,578.0	11,250.0	11,250.0	11,250.0	11,250.0	11,250.0	11,250.0	11,240.0	11,250.0
'000 lb Peanuts	-	524.4	1,048.8	1,710.0	1,710.0	1,710.0	1,710.0	2,250.0	2,250.0	2,250.0	2,250.0	2,250.0	2,250.0	2,250.0	2,250.0

* Kernel is not processed until 1982 so that yield of 1982 is equal to that of 1980 + 1981 + 1982

Palm kernel cake is considered to be a substitute for copra meal which is used as cattle feed and will be similarly priced at US$94.9 per metric ton giving G$246 per long ton (1960-1974 long term average).

The standard conversion factor 0.8 has been applied to the market prices of fresh fruit bunches, sweet potatoes and cassava. The resulting shadow prices are $120 per ton, 9.6 cents per lb , 4 units per lb and 80 cents per lb respectively.

(c) Revenues

Gross benefits accruing to the project with and without timber extraction are given in Tables 4.5 and 4.6.

Timber exploitation in the project area, as an economic venture, is an optional side line. The great advantage of the timber extraction programme is that, with a lower than usual capital outlay because of river tansportation of logs and chain saw felling, the project can make substantial revenue from the sales of its timber during the first-five years of the project, as the oil palms are being planted. The difference between the two benefit streams, therefore, lies mainly in the income that accrues during the first five years of the project and this is substantial indeed.

Detailed estimates of estate, cooperative mill and farmers' revenue are given in Appendices 4.5, 4.6 and 4.7.

4.2.2. Gross Costs

A summary of costs for the entire project is found in Tables 4.7 to 4.10. These allow for the variation in the following items:

(a) Two levels of farmers' consumption: 95 per cent (Tables 4.7, 4.9 and 4.10) and 25 per cent (Table 4.8) and

(b) two levels of the shadow wage rate: 85 per cent and 75 per cent of the market wage rate are used (Table 4.9);

(c) the timber extraction operation is both excluded (Tables 4.7 to 4.9) and included (Table 4.10).

Table 4.7 and 4.9 show that labour is a very small proportion of total costs. The change of farmers' consumption levels, however, made a substantial difference to the cost streams.

TABLE 4.5

LITTLE AND MIRRLEES - SOCIAL BENEFITS OF PROJECT

EXCLUDING TIMBER OPERATION

(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	-	-	-	-
1977	-	126.9	860.0	986.9
1978	-	204.6	2,299.0	2,539.6
1979	-	374.1	4,243.4	4,617.5
1980	224.6	624.7	4,288.6	5,137.9
1981	716.3	1,175.1	4,251.0	6,142.4
1982	2,218.5	2,647.2	4,787.0	9,652.7
1983	4,160.3	4,789.6	4,800.2	13,750.1
1984	7,050.7	8,069.1	6,254.3	21,374.1
1985	10,080.4	11,523.1	7,650.1	29,262.6
1986	13,574.5	15,335.3	9,187.1	38,096.9
1987	16,405.3	18,623.8	10,517.8	45,546.9
1988	18,801.9	19,309.1	11,611.9	49,722.9
1989	20,610.3	23,313.9	12,443.6	56,367.8
1990	21,694.9	24,428.5	12,906.0	59,029.4
1991	21,694.9	24,428.5	12,906.0	49,029.4
1992	21,694.9	24,428.5	12,906.0	59,029.4
1993	21,694.9	24,428.5	12,906.0	59,029.4
1994	21,694.9	24,428.5	12,906.0	59,029.4
1995	25,257.1	26,327.5	12,906.0	64,490.6

TABLE 4.6

LITTLE AND MIRRLEES - SOCIAL BENEFITS OF PROJECT

INCLUDING TIMBER OPERATION

(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	10,584.0	-	-	10,584.0
1977	15,756.0	126.9	860.0	16,742.9
1978	26,460.0	240.6	2,299.0	28,999.5
1979	26,460.0	374.1	4,243.4	31,077.5
1980	24,684.6	624.7	4,288.6	31,597.9
1981	716.3	1,175.1	4,251.0	6,142.4
1982	2,218.5	2,647.2	4,787.0	9,652.7
1983	4,160.3	4,789.6	4,800.2	13,750.1
1984	7,050.7	8,069.1	6,254.3	21,374.1
1985	10,080.4	11,523.1	7,650.1	29,262.6
1986	13,574.5	15,335.3	9,187.1	38,096.9
1987	16,405.3	18,623.8	10,517.8	45,546.9
1988	18,801.9	19,309.1	11,611.9	49,722.9
1989	20,610.3	23,313.9	12,443.6	56,367.8
1990	21,694.9	24,428.5	12,906.0	59,029.4
1991	21,694.9	24,428.5	12,906.0	59,029.4
1992	21,694.9	24,428.5	12,906.0	59,029.4
1993	21,694.9	24,428.5	12,906.0	59,029.4
1994	21,694.9	24,428.5	12,906.0	59,029.4
1995	25,257.1	26,327.5	12,906.0	64,490.6

TABLE 4.7

LITTLE AND MIRRLEES - SOCIAL COSTS OF PROJECT

EXCLUDING TIMBER OPERATION

(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	848.1	442.9	-	1,291.0
1977	2,250.8	1,334.1	1,574.1	5,159.0
1978	4,106.6	2,406.2	3,802.6	10,315.4
1979	4,760.7	2,198.3	6,399.9	13,358.9
1980	4,354.8	1,157.1	7,288.7	12,800.6
1981	4,269.1	1,381.5	7,398.5	13,049.1
1982	5,093.6	3,098.9	6,777.0	14,969.5
1983	4,031.5	3,081.5	6,463.5	13,576.5
1984	4,060.8	4,288.4	7,032.5	15,381.7
1985	4,255.9	5,268.8	9,186.0	19,210.7
1986	4,464.4	7,468.5	10,667.7	22,600.5
1987	4,656.6	8,941.8	11,950.3	25,548.7
1988	4,812.8	10,132.4	12,984.9	27,930.1
1989	4,945.6	11,066.4	13,806.7	29,818.7
1990	5,047.5	11,576.5	14,252.5	30,876.5
1991	5,103.0	11,576.5	14,252.5	30,932.0
1992	5,158.5	11,576.5	14,252.5	30,987.5
1993	5,214.0	11,576.5	14,252.5	31,043.0
1994	5,269.5	11,576.5	14,252.5	31,098.5
1995	5,325.0	11,576.5	14,252.5	31,154.0

Notes

1. Farmers' consumption = 0.95 production
2. Shadow wage rate = 0.75 market wage rate

TABLE 4.8

LITTLE AND MIRRLEES - SOCIAL COSTS OF PROJECT
EXCLUDING TIMBER OPERATION AND USING
FARMERS CONSUMPTION LEVEL II
(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	848.1	442.9	-	1,291.0
1977	2,250.8	1,334.1	972.1	4,557.0
1978	4,106.6	2,406.2	2,190.8	8,703.6
1979	4,760.7	2,198.3	3,691.4	10,650.4
1980	4,354.8	1,157.1	4,286.6	9,798.5
1981	4,269.1	1,381.5	4,422.8	10,073.4
1982	5,093.6	3,098.9	3,426.1	11,618.6
1983	4,031.5	3,081.5	3,103.3	10,216.3
1984	4,060.8	4,288.4	2,654.5	11,003.7
1985	4,255.9	5,768.8	3,830.9	13,855.6
1986	4,464.4	7,468.5	4,236.7	16,169.6
1987	4,656.6	8,941.8	5,245.2	18,843.6
1988	4,812.8	10,132.4	5,582.3	20,527.5
1989	4,945.6	11,066.4	5,873.9	21,885.9
1990	5,047.5	11,576.5	6,024.9	22,648.9
1991	5,103.0	11,576.5	6,024.9	22,704.4
1992	5,158.5	11,576.5	6,024.9	22,759.9
1993	5,214.0	11,576.5	6,024.9	22,815.4
1994	5,269.5	11,576.5	6,024.9	22,870.9
1995	5,325.0	11,576.5	6,024.9	22,926.4

Notes

1. Farmers' consumption = 0.25 production
2. Shadow wage rate = 0.75 market wage rate

TABLE 4.9

LITTLE AND MIRRLEES - SOCIAL COSTS OF PROJECT
EXCLUDING TIMBER OPERATION AND USING
SHADOW WAGE RATE II
(G$'000)

Project Year	Sector			
	Estate	Cooperative Mill	750 Farmers	Total
1976	861.9	445.4	-	1,307.3
1977	2,295.1	1,339.8	1,574.1	5,209.0
1978	4,199.9	2,416.3	3,802.6	10,418.8
1979	4,904.8	2,210.2	6,399.9	13,514.9
1980	5,701.9	1,169.0	7,288.7	14,159.6
1981	4,438.9	1,381.5	7,398.5	13,218.9
1982	5,239.9	3,098.9	6,777.0	15,115.8
1983	4,185.3	3,081.5	6,463.5	13,730.3
1984	4,234.7	4,288.4	7,032.5	15,555.6
1985	4,437.3	5,768.8	9,186.0	19,392.1
1986	4,653.4	7,468.5	10,667.7	22,789.6
1987	4,853.2	8,941.8	11,950.3	25,745.3
1988	5,016.9	10,132.4	12,984.9	28,134.2
1989	5,157.3	11,066.4	13,806.7	30,030.4
1990	5,266.7	11,576.5	14,252.5	31,095.7
1991	5,329.8	11,576.5	14,252.5	31,158.8
1992	5,392.9	11,576.5	14,252.5	31,221.9
1993	5,455.9	11,576.5	14,252.5	31,284.9
1994	5,519.0	11,576.5	14,252.5	31,348.0
1995	5,582.0	11,576.5	14,252.5	31,411.0

Notes

1. Farmers' consumption = 0.95 production
2. Shadow wage rate = 0.85 market wage rate

TABLE 4.10

LITTLE AND MIRRLEES - SOCIAL COSTS OF PROJECT

INCLUDING TIMBER OPERATION

(G$'000)

Project Year	Sector			
	Estate	Cooperative Mill	750 Farmers	Total
1976	6,776.1	442.9	-	7,219.0
1977	11,146.8	1,334.1	1,574.1	14,055.0
1978	18,930.6	2,406.2	3,802.6	25,139.4
1979	19,584.7	2,198.3	6,399.9	28,182.9
1980	19,178.8	1,157.1	7,288.7	27,624.6
1981	4,269.1	1,381.5	7,398.5	13,049.1
1982	5,093.6	3,098.9	6,777.0	14,969.5
1983	4,031.5	3,081.5	6,463.5	13,576.5
1984	4,060.8	4,288.4	7,032.5	15,381.7
1985	4,255.9	5,768.8	9,186.0	19,210.7
1986	4,464.4	7,468.5	10,667.7	22,600.6
1987	4,656.6	8,941.8	11,950.3	25,548.7
1988	4,812.8	10,132.4	12,984.9	27,930.1
1989	4,945.6	11,066.4	13,806.7	29,818.7
1990	5,047.5	11,576.5	14,252.5	30,876.5
1991	5,103.0	11,576.5	14,252.5	30,932.0
1992	5,158.5	11,576.5	14,242.5	30,987.5
1993	5,214.0	11,576.5	14,252.5	31,043.0
1994	5,269.5	11,576.5	14,252.5	31,098.5
1995	5,325.0	11,576.5	14,252.5	31,154.0

Notes

1. Farmers' consumption = 0.95 production
2. Shadow wage rate = 0.75 market wage rate

Detailed estimates of estate, cooperative mill and farmers' costs are given in Appendices 4.8, 4.9 and 4.10.

4.3 Cash Flows

Tables 4.11 to 4.14 provide details of annual cash flows for the combinations discussed in Tables 4.7 to 4.10. The cash flow stream for the situation which excludes the timber operation uses a farmers consumption level equal to 95 per cent of production and a shadow wage rate equal to 75 per cent of the market wage rate. Its stream of incremental benefits shares negative figures for the first 7 project years followed by thirteen years of positive cash flows with the largest in project year 20, in which 33.3 million Guyana dollars are earned.

A comparison of this cash flow stream with those obtained when the items listed in section 4.2.2. are varied reveals that

(1) all streams change from negative to positive in the eighth project year;

(2) all streams, with the exception of that of the project including timber, yielded negative cash flows in the first 7 years;

To elaborate, the project area is logged before land preparation for oil palms in the first 5 years. Timber extraction is a very lucrative venture and yields cash flows in these early years to the order of 3 million Guyana dollars. Thereafter the stream of cash flows is identical to that of the first mentioned above. Oil palm products contribute 90 per cent of revenue after 1980. Although harvesting begins in 1980 revenue only becomes large enough to exceed costs in 1983. Thus after the logging of timber ceases in 1980 two negative cash flows still remain (1981, 1982).

(3) the use of farmers' lower consumption level (25 per cent of production) affects both the distribution and absolute values of the cash flows. Distribution-wise the cash flow of project year I is unaltered as there is no economic activity in the farmers' sector in that year. For all subsequent years there is an increase in the value of cash flows which peak at 41.6 million Guyana dollars, 25 per cent higher than with the higher

TABLE 4.11

LITTLE AND MIRRLEES - CASH FLOWS OF PROJECT
EXCLUDING TIMBER OPERATION

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	1,291.0	- 1,291.0
1977	986.9	5,159.0	- 4,172.1
1978	2,539.6	10,315.4	- 7,775.8
1979	4,617.5	13,358.9	- 8,741.4
1980	5,137.9	12,800.6	- 7,662.7
1981	6,142.4	13,049.1	- 6,906.7
1982	9,652.7	14,969.5	- 5,316.8
1983	13,750.1	13,576.5	173.6
1984	21,374.1	15,381.7	5,992.4
1985	29,262.6	19,210.7	10,051.9
1986	38,096.9	22,600.6	15,496.3
1987	45,546.9	25,548.7	19,998.2
1988	49,722.9	27,930.1	21,792.8
1989	56,367.8	29,818.7	26,549.1
1990	59,029.4	30,876.5	28,152.9
1991	59,029.4	30,932.0	28,097.4
1992	59,029.4	30,987.5	28,041.9
1993	59,029.4	31,043.0	27,986.4
1994	59,029.4	31,098.5	27,930.9
1995	64,490.6	31,154.0	33,336.6

Notes

1. Farmer's consumption = 0.95 production
2. Shadow wage rate = 0.75 market wage rate

TABLE 4.12

LITTLE AND MIRRLEES - CASH FLOWS OF PROJECT EXCLUDING TIMBER OPERATION AND USING FARMERS CONSUMPTION LEVEL II

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	1,291.0	- 1,291.0
1977	986.9	4,557.0	- 3,570.1
1978	2,539.6	8,703.6	- 6,164.0
1979	4,617.5	10,650.4	- 6,032.9
1980	5,137.9	9,798.5	- 4,647.6
1981	6,142.4	10,073.4	- 3,931.0
1982	9,652.7	11,618.6	- 1,965.9
1983	13,750.1	10,216.3	3,553.8
1984	21,374.1	11,003.7	10,370.4
1985	29,262.6	13,855.6	15,407.0
1986	38,096.9	16,169.6	21,927.3
1987	45,546.9	18,843.6	26,703.3
1988	49,722.9	20,527.5	29,195.4
1989	56,367.8	21,885.9	34,481.9
1990	59,029.4	22,648.9	36,380.5
1991	59,029.4	22,704.4	36,325.0
1992	59,029.4	22,759.9	36,269.5
1993	59,029.4	22,815.4	36,214.0
1994	59,029.4	22,870.9	36,158.5
1995	64,490.6	22,926.4	41,564.2

Notes

1. Farmer's consumption = 0.25 production
2. Shadow wage rate = 0.75 market wage rate

TABLE 4.13

LITTLE AND MIRRLEES - CASH FLOWS OF PROJECT EXCLUDING TIMBER OPERATION AND USING SHADOW WAGE RATE II

(G$'000)

Project Year	Social Benefits	Social Cost	Cash Flows
1976	-	1,307.3	- 1,307.3
1977	986.9	5,209.0	- 4,222.1
1978	2,539.6	10,418.8	- 7,879.2
1979	4,617.5	13,514.9	- 8,897.4
1980	5,137.9	14,159.6	- 9,021.7
1981	6,142.4	13,218.9	- 7,076.5
1982	9,652.7	15,115.8	- 5,463.1
1983	13,750.1	13,730.3	19.8
1984	21,374.1	15,555.6	5,818.5
1985	29,262.6	19,392.1	9,870.5
1986	38,096.9	22,789.5	15,307.4
1987	45,546.9	26,271.2	19,275.7
1988	49,722.9	30,892.0	18,830.9
1989	56,367.8	32,985.8	23,382.0
1990	59,029.4	34,160.9	24,868.5
1991	59,029.4	34,224.0	24,805.4
1992	59,029.4	34,287.1	24,742.3
1993	59,029.4	34,350.1	24,679.3
1994	59,029.4	34,413.2	24,616.2
1995	64,490.6	34,476.2	30,014.4

Notes

1. Farmers' consumption = 0.95 production
2. Shadow wage rate = 0.85 market wage rate

TABLE 4.14

LITTLE AND MIRRLEES - CASH FLOWS OF PROJECT INCLUDING TIMBER OPERATION

(G$'000)

Project Year	Social Benefits	Social Cost	Cash Flows
1976	10,584.0	7,219.0	3,365.0
1977	16,742.9	14,055.0	2,687.9
1978	28,999.5	25,139.4	3,860.1
1979	31,077.5	28,182.9	2,894.6
1980	31,597.9	27,624.6	3,973.3
1981	6,142.4	13,049.1	- 6,906.7
1982	9,652.7	14,969.5	- 5,316.8
1983	13,750.1	13,576.5	173.6
1984	21,374.1	15,381.7	5,992.4
1985	29,262.6	19,210.7	10,051.9
1986	38,096.9	22,600.5	15,496.4
1987	45,546.9	25,548.7	19,998.2
1988	49,722.9	27,930.1	21,792.8
1989	56,367.8	29,818.7	26,549.1
1990	59,029.4	30,876.5	28,152.9
1991	59,029.4	30,932.0	28,097.4
1992	59,029.4	30,987.5	28,041.9
1993	59,029.4	31,043.0	27,986.4
1994	59,029.4	31,098.5	27,930.9
1995	64,490.6	31,154.0	33,336.6

Notes

1. Farmers' consumption = 0.95 production
2. Shadow wage rate = 0.75 market wage rate

consumption level. Differences in other years varied and were mostly greater than 25 per cent;

(4) the use of the higher wage rate level (85 per cent of the market wage rate) affected all cash flows which, as would be expected, were lower in value than those with the 75 per cent level. The difference was not as dramatic as in (3) immediately above. The peak incremental benefit was 30 million Guyana dollars representing a 10 per cent change. Again this was not the lowest difference.

Hence the various alternatives could be arranged in descending order of anticipated profitability.

(1) Project using farmers' lower consumption level (II)
(2) Project including the timber operation
(3) Project excluding the timber operation
(4) Project using shadow wage rate II or the higher level

A most realistic set of cash flows for the project would be those accruing to the project when it includes the timber operation in combination with farmers' consumption level II.

The cash flows of the estate, cooperative mill and farmers' components (Appendices 4.11, 4.12 and 4.13) were also examined. In the estate sector there are no benefits in the first 4 project years and the first 7 project years have negative cash flows. The cooperative mill and farmers' sectors have no returns in the initial year but there is revenue from the sale of seedlings for the cooperative sector and from the sale of food crops in the farmers' sector in the five years following. All farmers' cash flows are negative when consumption at 95 per cent of production is used, but there are only 2 negative cash flows (1977 and 1981) when farmers' lower consumption level (II) is used to cost farmers' labour. Reasons for this are as follows.

With respect to 1977 this is the first year of palm establishment and although there is some revenue from intercrops establishment costs are very high.

The cash flow of 1981 is negative for the following reasons.

(1) Revenue is a little lower than the previous year because of the intercropping schedules (Appendix 4.3(b)).

(2) By this time all but the final lot of palms have been established. As such, costs are cumulative and include establishment costs and those costs for years 1, 2 and 3 plus for maintenance. The highest costs are in establishment, first and the third plus years' maintenance costs (in that same order). This becomes particularly relevant as one is dealing, in 1979, 1980 and 1981, with the largest annual averages.

(3) Subsidy levels are still quite high unlike the following year when they fall off steeply because of sole cropping of root crops and the termination of palm planting.

4.4. The Results

4.4.1. The Rates of Return

On the basis of the models outlined earlier for both the estate and the smallholder sectors of the project the economic rates of return would be as follows:

Entity	ROR (E)%
Entire Project	19.4
Estate	20.4
Cooperative Mill	31.6
750 Farmers	Negative Cash Flows for all years
Entire Project including Timber	Profitable but non-existent ROR.

In calculating these returns farmers' consumption has been assumed to be 95 per cent of production and the shadow wage rate to be 75 per cent of the market wage rate.

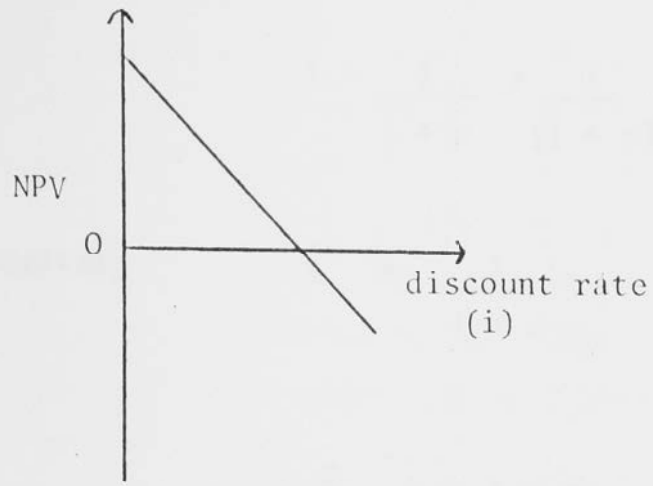
The presence of an entirely negative cash flow in the case of the farmers may tend to suggest that this system of production is far from beneficial to the community as a whole; the results may suggest that the entire project would be more beneficial under estate management. However, the explanation for such unlikely results lies in the Little and Mirrlees methodology for the costing of labour in the unorganized sector (Section 4.1.6). It may be recalled that, rather than cost farmers' labour directly using the shadow wage rate, consumption of everyone involved in production was taken as the cost to the economy because wages of additional employees, in many cases, come out of the farmers' profits and therefore such resources never really have the chance of becoming uncommitted government income.

In the absence of consumption data, an average rural consumption of 95 per cent of production was used. It is questionable whether such a high level of consumption is reasonable in this case and the difference which a lower level of consumption makes to the rate of return will, along with the sensitivity of the project to changes in other basic assumptions, be investigated.

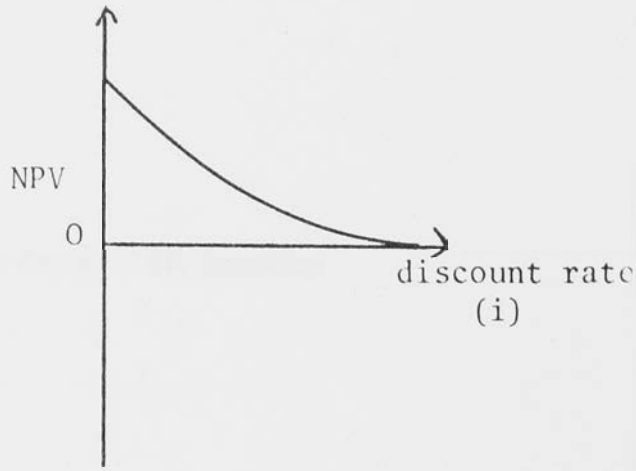
The explanation for the absence of any real rate of return for the entire project when timber extraction is included lies in the shape of the net present value (NPV) profile. The Internal Rate of Return (ROR) is the discount rate for which NPV is zero. In practice, problems often arise in the calculation of the ROR. The net present value profile of an investment project may take a number of shapes.

FIGURE 4.1

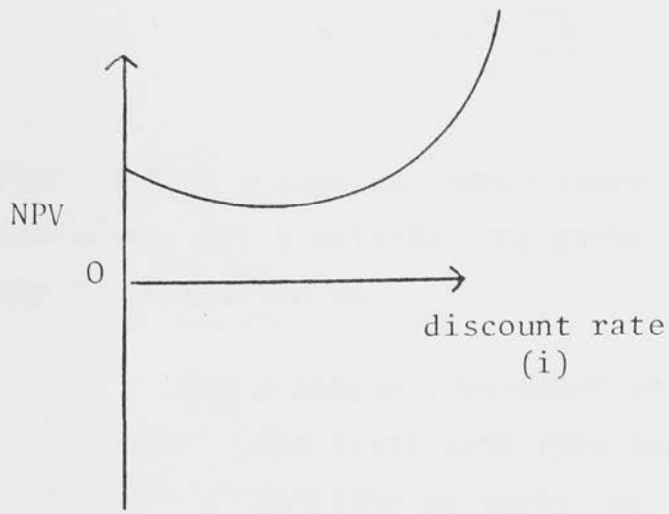
SOME POSSIBLE SHAPES OF NPV PROFILES



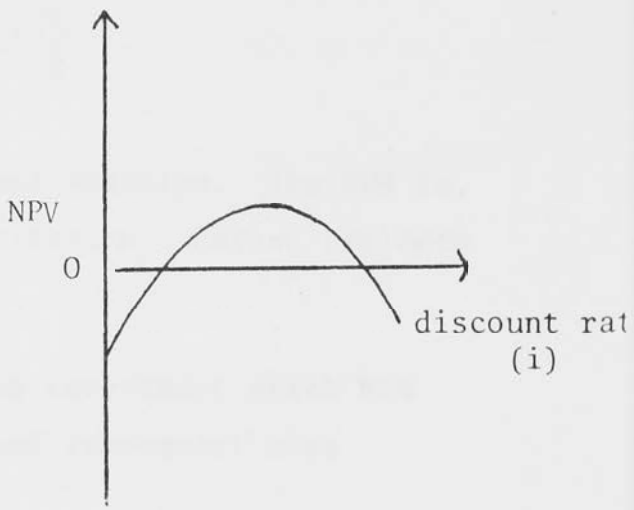
(a) Unique ROR exists



(b) Infinite ROR exists



(c) Non-existent ROR



(d) Multiple Rates of Return Exist

Figure 4.1 (a) is an example of a normal profile for which there is a unique rate of return. The case discussed here has a profile similar to (c). No real ROR exists. As an example, suppose cash flows of \$1, -\$1 and \$1 are obtained at the end of project years 0, 1 and 2. The ROR is the value of r such that

$$1 - \frac{1}{1 + r} + \frac{1}{(1 + r)^2} = 0$$

Setting $x = \frac{1}{1 + r}$ this condition becomes

$$x^2 - x + 1 = 0$$

This is a quadratic equation and may be solved for x as follows:

$$x = \frac{1 \pm \sqrt{1 - 4}}{2} = \frac{1}{2} \pm \frac{\sqrt{-3}}{2}$$

Since $\sqrt{-3}$ is a complex number there is no real solution. The ROR is, therefore, not a satisfactory probability criterion. Rather projects may be classified as

(1) a simple investment which is an investment which has the first cash flow negative and subsequent ones positive or zero; or

(2) a non-simple investment which is one with more than one negative cash flows.

As may be recalled, the project discussed has 2 negative cash flows in years 1981 and 1982. The project including the timber operation is therefore profitable but, quite appropriately, called a non-simple investment.

4.4.2. Benefits to Guyana

The development of oil palm is planned to be an important feature of the government's development programme to increase employment opportunities, to diversify agriculture, to promote import substitution and to increase export earnings. The proposed project would bring into production more than 25,000 acres of fertile land not presently used. By providing settlement opportunities the project would contribute to reducing population pressure in other parts of the country (mainly Georgetown and its environs) and aid exploitation of Guyana's vast unpopulated interior.

The project would bring 750 farmers into this new export-oriented industry. Additionally the project would create employment opportunities. Also the multiplier effects in the regional economy of the proposed investment may create project-induced jobs in the following areas.

(1) Local production of consumer goods, e.g. clothing, furniture, tools.
(2) Local production of marketing items, e.g. jute bags for root crops
(3) Processing, e.g. peanut butter; cassava flour needed in bauxite industry where it is used as a flocculent; soap
(4) Housing construction as tastes change with higher income
(5) Services, particularly transportation and banking

These effects may not, however, be substantial owing to the small population base.

Since manpower is lacking in the project area, migration of labourers can be anticipated, which will further help reduced population pressure in some continguous rural centres of the country and also aid in the reduction of unemployment among unskilled workers.

Further benefits would result from improved shipping services to the area as shipment of oil palm products would entail some improvement of present facilities and the construction of new facililities at the wharf at Kumaka. There may even be an additional ship on the Georgetown to Kumaka route. Thus the project is expected to act as a catalyst in inducing further development of the Mabaruma-Matthews Ridge area.

At maturity the oil palm project (farmers and estate) would produce about 31,890 tons of palm oil, 3,587 tons of palm kernel oil and 3,587 tons of palm kernel cake. The oil palm products resulting would replace imports of soybean and coconut oils and copra meal in the short term, saving an average of G$46.12 million of foreign exchange at full production. There will also be the additional production of sweet potatoes, cassava and peanuts amounting to 14.74 million lb. and 34.2 million lb. and 1.7 million lb. respectively. At maturity of the palms, 5.2 million lb of sweet potatoes, 11.2 million lb. of cassava and 2.2 million lb. of peanuts will be produced, contributing G$16.13 million to total agriculture production.

The net present worth of the incremental benefits to the project with and without timber extraction and using two accounting rates of interest (8 and 10 per cent) are found in Table 4.15. As can be seen from this table, the extraction of timber almost doubles the present worth of net benefits accruing to the economy as a whole.

TABLE 4.15

PRESENT VALUE OF NET BENEFITS

(G$'000)

		NPV
Discounting at 8%		
Net Benefits to	Entire Project excluding timber operation	54,630.3
	Entire Project including timber operation	90,531.8
Discounting at 10%		
Net Benefits to	Entire Project excluding timber operation	36,920.2
	Entire Project including timber operation	70,561.0

CHAPTER 5

COMPARISON OF LITTLE AND MIRRLEES AND CONVENTIONAL EFFICIENCY ANALYSIS APPROACHES TO PROJECT APPRAISAL

Discussion of the relative merits of various methods of project appraisal has continued for some time. Bruno (1972) has discussed the relative merits of the Domestic Resource Cost and the Effective Rate of Protection methods; Dasgupta (1970 and 1972) has discussed the UNIDO and Little and Mirrlees methods; Lal (1974) has discussed the UNIDO, DRC and Little and Mirrlees methods; Little and Mirrlees (1974) have compared their method with the DRC, EPR and UNIDO methods. There has also been some discussion of various methodologies by Imboden (1978). These discussions have, however, been undertaken at the theoretical level and in many cases emphasised the industrial application of these methods. To my knowledge, there have been no empirical comparisons of results contained, for the analysis of one project for the use of different methods. This chapter attempts to make such an assessment for the Little and Mirrlees and the Conventional Efficiency Analysis approaches to project appraisal.

The project analysed was first suggested by Ndaeyo and Isang (1975) as two projects:

(i) an estate of 10,000 acres with its own integrated mill and

(ii) a farmers' oil palm scheme comprising 15,000 acres of oil palm cultivated by 750 farmers together with a co-operative mill for processing farmers' fruit.

An economic analysis was undertaken for the 10,000 acre estate project. A financial analysis was attempted for the cooperative sector of the project but this was only confined to the first batch of settlers in the determination of the financial returns to the farmer. The method used for the economic appraisal appeared to be the Conventional Efficiency Analysis using existing market prices for inputs and output except for sensitivity analyses of the project where 1975 world prices and peak 1974 world prices for oil palm products were substituted.

In order to examine the applicability of the Little and Mirrlees method of project appraisal and judge its relative merits, a social cost-benefit analysis was also done using what is basically the Conventional Efficiency analysis used by the I.B.R.D. and other agencies. For this purpose only the entire project returns are compared.

Most of the data used was that presented in the report on Oil Palm Development in Guyana (Ndaeyo and Isang 1975). Some costs were used directly, for example, the estate and co-operative mill costs and quantities of produce. Other costs and benefits had to be calculated, for example, farmers' total costs and revenue especially, since farmers were to be settled in three batches with, as would be expected, different planting schedules and yield distributions. Again this was necessary because the Nigerians did not calculate social cost-benefit parameters. The prices used for palm oil, palm kernel oil, palm kernel cake and timber were the same as those used when using the Little and Mirrlees methods, as Gittinger (1972, p 39-40) does suggest the use of world prices for exportable products where possible. Since, however:

> "For many crops, of course, the question of world markets hardly enters and these have to be priced at the domestic price level - vegetables, cassava, meat and the like"

the domestic price level was used for farmers' root crops and fresh fruit bunches. All inputs have been costed at market prices.

5.1 Benefits and Costs

The breakdown of estate revenue is essentially the same as that of the Little and Mirrlees analysis (Appendix 4.5). The 1995 total is greater in this case because of the difference in salvage value of the estate enterprise. The benefits and costs of the other sectors differ from those in the Little and Mirrlees analysis and are found in Appendices 5.1 to 5.5.

A summary of project benefits can be found in Table 5.1 and that of costs in Table 5.2. The cash flows of the project excluding the extraction of timber are found in Table 5.3 and those including the timber operation in Table 5.4.

Cash flows of the component sectors of the project are found in Appendices 5.6, 5.7 and 5.8.

5.2 Sensitivity Analyses

The sensitivity of results to changes in certain of the assumptions used in both methods of analysis has been investigated. These include

1. Little and Mirrlees Farmers' Consumption - the level was changed from 95 per cent of production to 25 per cent of production and the effects on the entire project and on the farmers' sector were estimated.

2. Little and Mirrlees Shadow Wage Rate - the effect on the entire project of a change in the SWR from 75 per cent to 85 per cent of the market wage rate was investigated.

TABLE 5.1

CONVENTIONAL EFFICIENCY ANALYSIS - SOCIAL BENEFITS OF PROJECT EXCLUDING TIMBER OPERATION (G$'000)

Project Year	Sector			
	Estate	Co-operative Mill	Farmers	Total
1976	-	-	-	-
1977	-	12.4	1075.0	1087.4
1978	-	22.8	2873.7	2896.5
1979	-	34.3	4836.6	4870.9
1980	224.6	267.3	5360.7	5852.6
1981	716.3	849.6	5313.7	6879.6
1982	2218.5	2647.2	5983.7	10849.4
1983	4160.3	4789.6	6100.3	15050.2
1984	7050.7	8069.1	7817.9	22937.7
1985	10089.4	11523.1	9562.6	31175.1
1986	13574.5	15335.3	11483.9	40393.7
1987	16405.3	18623.8	13147.3	48176.4
1988	18801.9	19309.1	14514.9	52625.9
1989	20610.3	23313.9	15554.5	59478.7
1990	21694.9	24428.5	16132.5	62255.9
1991	21694.9	24428.5	16132.5	62255.9
1992	21694.9	24428.5	16132.5	62255.9
1993	21694.9	24428.5	16132.5	62255.9
1994	21694.9	24428.5	16132.5	62255.9
1995	26147.7	26802.3	16132.5	69082.5

TABLE 5.2

CONVENTIONAL EFFICIENCY ANALYSIS - SOCIAL COSTS OF PROJECT EXCLUDING TIMBER OPERATION

(G$'000)

Project Year	Sector			
	Estate	Co-operative Mill	Farmers	Total
1976	1543.2	609.3	-	2152.5
1977	2255.1	1719.0	1141.5	5115.6
1978	4294.3	2976.6	2677.4	9948.3
1979	4211.3	2703.3	4611.1	11525.7
1980	3210.6	1379.8	5604.6	10195.0
1981	3182.7	1706.8	5901.5	10791.0
1982	4288.8	3813.8	4574.6	12677.2
1983	2982.3	3842.5	4798.8	11623.6
1984	2890.2	5362.2	3741.9	11994.3
1985	3088.1	7224.6	3809.2	14121.9
1986	3772.0	9363.5	3841.2	16976.7
1987	3524.2	11217.1	3868.9	18610.2
1988	3679.9	12711.5	3891.7	20283.1
1989	3798.7	13890.7	3909.0	21598.4
1990	3870.1	14532.5	3918.7	22321.3
1991	3870.1	14532.5	3918.7	22321.3
1992	3870.1	14532.5	3918.7	22321.3
1993	3870.1	14532.5	3918.7	22321.3
1994	3870.1	14532.5	3918.7	22321.3
1995	3870.1	14532.5	3918.7	22321.3

TABLE 5.3

CONVENTIONAL EFFICIENCY ANALYSIS - CASH FLOWS OF PROJECT EXCLUDING TIMBER OPERATION

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	2152.5	-2152.5
1977	1087.4	5115.6	-4028.2
1978	2896.5	9948.6	-7051.8
1979	4870.9	11525.7	-6654.8
1980	5852.6	10195.0	-4342.4
1981	6879.6	10791.0	-3315.4
1982	10849.4	12677.2	-1827.8
1983	15050.2	11623.2	3427.0
1984	22937.7	11994.3	10943.4
1985	31175.1	14121.9	17053.2
1986	40393.7	16976.7	23417.0
1987	48176.4	18610.2	29566.2
1988	52625.9	20283.1	32342.8
1989	59478.7	21598.4	37880.3
1990	62255.9	22321.3	39934.6
1991	62255.9	22321.3	39934.6
1992	62255.9	22321.3	39934.6
1993	62255.9	22321.3	39934.6
1994	62255.9	22321.3	39934.6
1995	69082.5	22321.3	46761.2

TABLE 5.4

CONVENTIONAL EFFICIENCY ANALYSIS - CASH FLOWS OF PROJECT INCLUDING TIMBER OPERATION

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	10584.0	9562.5	1021.5
1977	16843.4	16235.6	607.8
1978	29356.5	28478.3	878.2
1979	31330.9	30055.7	1275.2
1980	32312.6	28725.0	3587.6
1981	6879.6	10791.0	-3911.4
1982	10849.4	12677.2	-1827.8
1983	15050.2	11623.6	3426.6
1984	22937.7	11994.3	10943.4
1985	31175.1	14121.9	17053.2
1986	40393.7	16976.7	23417.0
1987	48176.4	18610.2	29566.2
1988	52625.9	20283.1	32342.8
1989	59478.7	21598.4	37880.3
1990	62255.9	22321.3	39934.6
1991	62255.9	22321.3	39934.6
1992	62255.9	22321.3	39934.6
1993	62255.9	22321.3	39934.6
1994	62255.9	22321.3	39934.6
1995	69082.5	22321.3	46761.2

3. Little and Mirrlees and the Conventional Efficiency Analysis - Cost Over-run.

Some possible areas for cost over-run include:

(a) late implementation owing to the late disbursement of funds;[1]

(b) mill inefficiency, perhaps because an absence of spare parts, may lead to the purchase of other materials e.g. firewood to supplement boilers' fuel and to other operational bottle-necks;[2]

(c) Anti-pollution laws against the indiscriminate dumping of effluent water and sludge into rivers, especially navigable ones;[3]

(d) inflation.

The sensitivity of the project to a 10 per cent increase in costs is therefore investigated.

4. Little and Mirrlees and the Conventional Efficiency Analysis - Increase in Yields of Fresh Fruit Bunches.

The yields projected were thought to be somewhat low. Yields are therefore increased by 10 per cent and the effect on the project determined. It is assumed that there will be no need to change the capacity of the mills but the operational costs of harvesting, fresh fruit bunch transportation, processing and shipment will certainly be affected. Increase in harvesting costs were assumed to be negligible.

Relevant cash flows are found in Table 4.12, Appendix 4.13 , Tables 4.13, 5.5, 5.6, 5.7 and 5.8.

5.3 Results

Internal rates of return were calculated for the project with and without timber extraction and for the component sectors of the project.

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1 See Asian Development Bank (1976, p15-26).

2 See Asian Development Bank (1976, p15-26).

3 See Asian Development Bank (1976, p26) and Gill, Ranjit (1978).

TABLE 5.5

LITTLE AND MIRRLEES - CASH FLOWS OF PROJECT
USING A 10 PER CENT HIGHER COST LEVEL
(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	1420.1	-1420.1
1977	986.9	5674.9	-4688.0
1978	2539.6	11346.9	-8807.3
1979	4617.5	14694.8	-10077.3
1980	5137.9	14080.7	-8942.8
1981	6142.4	14354.0	-8211.6
1982	9652.7	16466.4	-11813.7
1983	13750.1	14934.1	-1184.0
1984	21374.1	16919.9	4454.2
1985	29262.6	21131.8	8130.8
1986	38096.9	24860.7	13236.2
1987	45546.9	28103.6	17443.3
1988	49722.9	30723.1	18999.8
1989	56367.8	32800.6	23567.2
1990	59029.4	33964.1	25065.3
1991	59029.4	34025.2	25004.2
1992	59029.4	34086.2	24943.2
1993	59029.4	34147.3	24882.1
1994	59029.4	34208.3	24821.1
1995	64490.6	34269.4	30221.2

Notes:

Cost level is equivalent to 110 per cent cost in control.

TABLE 5.6

CONVENTIONAL EFFICIENCY ANALYSIS - CASH FLOWS OF PROJECT USING A 10 PER CENT HIGHER COST LEVEL (G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	2367.7	-2367.7
1977	1087.4	5627.2	-4539.8
1978	2896.5	10943.1	-8046.6
1979	4780.9	12678.3	-7807.4
1980	5852.6	11214.5	-5361.9
1981	6879.6	11870.1	-4990.5
1982	10849.4	13944.9	-3095.5
1983	15050.2	12785.5	2264.7
1984	22937.7	13193.7	9774.0
1985	31175.1	15534.0	15641.1
1986	40393.7	18674.4	21719.3
1987	48176.4	20471.2	27705.2
1988	52625.9	22311.4	35720.5
1989	59478.7	23758.2	38494.7
1990	62255.9	24553.4	37702.5
1991	62255.9	24553.4	37702.5
1992	62255.9	24553.4	37702.5
1993	62255.9	24553.4	37702.5
1994	62255.9	24553.4	37702.5
1995	69082.5	24553.4	44529.1

Notes:

Cost level is equivalent to 110 per cent cost in control

TABLE 5.7

LITTLE AND MIRRLEES - CASH FLOWS OF PROJECT
USING A 10 PER CENT HIGHER YIELD LEVEL
(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	1291.0	-1291.0
1977	1113.8	5168.9	-4055.1
1978	2539.6	10315.3	-7775.7
1979	4243.4	13358.7	-9115.3
1980	5941.7	12956.6	-7014.9
1981	5982.3	13140.7	-7158.4
1982	10247.1	15207.0	-4959.9
1983	14935.9	14109.0	826.9
1984	23234.4	16940.7	6293.7
1985	31911.6	20192.1	11719.5
1986	41629.3	23984.3	17645.0
1987	49824.4	27219.6	22604.8
1988	54218.0	29833.5	24384.5
1989	61727.3	31905.5	29821.8
1990	64655.1	33063.4	31591.7
1991	64655.1	33118.9	31536.2
1992	64655.1	33174.4	31480.7
1993	64655.1	33229.9	31425.2
1994	64655.1	33285.4	31369.7
1995	72116.3	33340.9	38775.4

Notes:

Yield level is equivalent to 110 per cent yield in control.

TABLE 5.8

CONVENTIONAL EFFICIENCY ANALYSIS - CASH FLOWS OF PROJECT USING A 10 PER CENT HIGHER YIELD LEVEL

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	2152.5	-2152.5
1977	1087.4	5115.6	-4028.2
1978	2896.5	9948.3	-7051.8
1979	4870.9	11525.7	-6654.8
1980	5913.8	10214.0	-4300.2
1981	7987.2	10856.0	-2868.8
1982	11470.9	12844.3	-1373.4
1983	16208.7	11948.2	4260.5
1984	24885.0	12531.4	12353.6
1985	33946.1	14875.6	19070.5
1986	44086.5	17969.2	26117.3
1987	52647.5	19346.9	33300.6
1988	57542.0	21649.3	35892.7
1989	65080.0	23726.1	41353.9
1990	68134.9	23891.2	44243.7
1991	68134.9	23891.2	44243.7
1992	68134.9	23891.2	44243.7
1993	68134.9	23891.2	44243.7
1994	68134.9	23891.2	44243.7
1995	74961.5	23891.2	51070.3

Notes:

Yield level is equivalent to 110 per cent yield in control.

These results, along with those of the sensitivity analyses discussed above, certain net present values and cost-benefit ratios were used as parameters in comparing the Conventional Efficiency Analysis with that of Little and Mirrlees. Table 5.9 summarises the results of both appraisals.

5.4 Comparison of Profitability

As outlined earlier, the actual benefits estimated in both methods were almost identical, with two exceptions

(i) the cost of seedlings sold by the co-operative mill sector, sold at the average cost of production (and not at 9 cents per seedling). The subsidies were however taken into account in the latter case;

(ii) in the Little and Mirrlees appraisal, farmers' yields were shadow priced at 80 per cent (SCF was 0.8) of the market worth used in the Conventional Efficiency Analysis.

It was the costs that differed between the two methods. The main differences were in the accounting of labour.

(a) using the SWR which increased at a rate comparable to that reflected by recent trends and

(b) the use of 95 per cent of production as farm consumption in place of the SWR in the farmers' case.

The differences in the two rates of return to the project were 8.5 to 10.1 per cent in favour of the Conventional Efficiency Analysis. The major part of this difference is attributable to the high level of consumption assigned to farmers in the Little and Mirrlees method. This is shown by the fact that the ROR of the entire project and the benefit-cost ratio using the lower consumption level of 25 per cent are approximately equal to those results obtained with the Conventional Efficiency Analysis.

A breakdown of the project into its components endorses this. In the estate sector, where most of the labour on the project was employed and thus where the effect of the SWR should be felt most, there was only a minor difference of 2.2 per cent in rates of return between the two methods. This effect, together with the effect observed (1.6% difference for the entire project with a rise in SWR from 0.75 to 0.85) when the level of the SWR was altered, strongly suggests that the adoption of a SWR is unimportant in this project.

TABLE 5.9

COMPARISON OF RESULTS

Entity	POR	Net Present Value 8%	Net Present Value 10%	Benefit-Cost Ratios(8%)
Entire Project				
L+M cons = 0.95 production SWR = 0.75 MWR	19.4	54630.3	36920.2	1.3
L+M cons = 0.95 production SWR = 0.85 MWR	17.8			
L+M cons = 0.25 production SWR = 0.75 MWR	28.3	94588.5	69131.2	1.8
Conventional Efficiency Analysis	27.9	104069.3	75966.1	1.8
Estate				
L+M	20.4			
Conventional Efficiency Analysis	22.6			
Cooperative Mill				
L+M	31.6			
Conventional Efficiency Analysis	22.4			
Farmers				
L+M cons = 0.95 production	negative benefit stream			
cons = 0.25 production	50+			
Conventional Efficiency Analysis	26.1			
Project including timber operation				
L+M	non-existent	90531.8	70561.0	
Conventional Efficiency Analysis	non-existent	128055.6	96193.9	
Cost Level 10% higher				
L+M	15.1			1.2
Conventional Efficiency Analysis	24.7			1.6
Yield Level 10% higher				
L+M	21.1			1.4
Conventional Efficiency Analysis	29.6			1.9

In the co-operative mill sector the difference of 9.2 per cent in favour of the Little and Mirrlees method is due mainly to lower costs which used on average, a conversion factor of 0.8 for border prices. Very little unskilled labour was used in this sector and then only in the nursery attached which exists only for the first 5 years of the project.

The farmers' sector proves to be very interesting. Here, the entire cash flow stream is negative when the higher level of consumption is used. At the lower level of consumption the sign changes and the ROR becomes very favourable (over 50 per cent). This does point to the fact that the major difference between the two approaches could be attributed to the high level of consumption used.

The difference in rates of return between the two methods in the results of each of the sensitivity tests is in the order of 9 per cent - the same as for the entire project - and does not alter the results so far as the comparison of the methods is concerned. The net present values of benefit streams using the Little and Mirrlees method, on the whole, tend to be worth less than the present values of the benefit streams using Conventional Efficiency Analysis. Timber did make an appreciable difference to both, although the use of a lower consumption rate using the Little and Mirrlees criterion did yield a net present value higher than the incremental benefit stream including timber extraction. The latter situation only existed at low discounting rates. The use of an accounting rate of interest of 10 per cent produces the reverse effect, owing to the 'non-simplicity' of the investment when the timber operation is included, as discussed in Chapter 4.[1]

When uncertainty is considered, there was a difference of 4.3 per cent for Little and Mirrlees and 3.2 per cent for the Conventional Efficiency Analysis when costs rose by 10 per cent. The rates of return were still favourable, all remaining above 15 per cent. With a 10 per cent increase of yields there was a 1.7 per cent increase in the ROR for Little and Mirrlees and a 1.7per cent increase for the Conventional Efficiency Analysis criterion. It should be noted, however, that the difference in rates of return within

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[1] For an explanation of a non-simple investment see Section 4.4.1.

methods for a 10 per cent yield increase was not equal to that obtained when costs were increased by 10 per cent. This is because, in the former case, some items of operational costs also increased proportionately when the quantity of fresh fruit bunches increased. Identical changes in rates of return resulted for the two methods when yields were increased by 10 per cent because the same items of costs and benefits were affected and were necessarily increased by 10 per cent.

CHAPTER 6

CONCLUSIONS

In this study, an attempt was made to apply the Little and Mirrlees method of project appraisal to an oil palm project in Guyana and compare its results with those obtained by using the Conventional Efficiency Analysis. The analysis indicated different rates of return from the two approaches but no change was called for in the decisions taken for the project since both rates of return were quite high. For projects with fairly marginal returns however, the use of the Little and Mirrlees method could make the difference between acceptance and rejection.

Are the results of the Little and Mirrlees method more reliable than the Conventional Efficiency Analysis ? A number of simplifying assumptions were made in the application of the Little and Mirrlees method. The major one was that the cost of farm labour was a consumption stream comprising 95 per cent of production. The reasons for this were that the notion of employment can become quite vague in the unorganized sector and the wages of additional employees, in many cases, came out of the profits of the small businessman or farmer, so that the resources in question never had the chance of becoming uncommitted government income.

In the absence of a more up-to-date Input-Output table, one from 1956 was used. The relative prices then of the various sectors in 1956 were assumed to be the same as those in 1978. The port-to-user margins were assumed to be very small when computing the accounting ratios of tradables because of a lack of reliable and more precise information.

Closer approximations might have been possible had this study been done in Guyana with more direct access to data; this is debatable since more recent statistics for the economy are not yet available. Thus, the Little and Mirrlees method is more sophisticated than most other methods of project appraisal, and its use of a standard set of accounting prices for all appraisals could lead to the satisfaction of 'second best' optimality conditions in the economy, but it is questionable whether the data set available in Guyana would yield better results than obtained with data currently available to the author.

The estimation of accounting prices is time consuming and to suggest that it would be used broadly within a government would appear to suppose availability of highly trained manpower able to devote time to determining

accounting prices. This is questionable in the context of developing economies where not only does the urgency of development problems put a high pressure on government officials to process a large number of projects and to implement them rather than analyse them but time and skills are both scarce resources in the administrating bodies. Obtaining data in the long run will be costly and it is debatable whether there is sufficient value in the results obtained over those from alternative methods to justify such expenditure.

Given the necessary accounting prices and relevant weights the use of the Little and Mirrlees method would be very simple. Although it is true that a number of accounting prices could be determined using the SCF, this would remove the relative advantage, in a relatively open economy, of using the Little and Mirrlees method rather than one of the shadow exchange rate methods. This in practice depends essentially on the use of multiple conversion factors for converting non-traded goods and primary factors (domestic currency items) into foreign exchange (Little and Mirrlees numeraire) ; in contrast to the SER procedures which use a single conversion factor, a SER, for converting foreign currency into domestic currency.

6.1 Perspectives on Differences in Results

There are a number of reasons why results using the two methods were different. The most important reason appeared to be the shadow pricing of labour, particularly in the unorganized sector of the economy. Farm labour in the unorganized sector was costed at 95 per cent of additional production. This high level of consumption, of average consumption, is thought to be too high and reflects a general failure to take account of the nature of the prevailing conditions in the unorganized sector, in the framework of the more sophisticated methods of project appraisal. Little and Mirrlees allow here for the monetary aspects of the farm economy, but then the major part of farmers' requirements may be met from non-monetary subsistence production. Indeed this is the underlying expectation in the plan for the oil palm scheme. The latter may thus lead to a consumption of a lower proportion of money income. To this writer's knowledge no studies have taken this non-monetary production contribution to consumption into account. As the study showed, there was a substantial rise in the internal rate of return when the consumption level for the farmers' sector was reduced. This clearly points to the importance of

assumptions made on this point to the rates of return of the project obtained from the application of the Little and Mirrlees method. By the same token they greatly influence the differences between the rates of return obtained for the two methods.

Although the adoption of the shadow wage rate was not important to the project as a whole, a comparison of the returns obtained for the components of the project suggested a bias against farmer-oriented projects, and those with a large proportion of unskilled labour, in favour of those utilizing a high proportion of tradable goods. Little and Mirrlees penalize consumption, yet a high degree of consumption is associated with the lower income groups. This factor may seem to suggest that the employment effects are not a major consideration in the Little and Mirrlees approach. Although there is some allowance for this through the use of an employment premium, allowed for in the computation of the shadow wage rate, not only is its use strongly advised against, but it is not significant enough to influence the results.

In the study this situation is reflected by the differences in the rates of return for the two methods for the estate and the cooperative mill (section 5.4, Table 5.9). The Conventional Efficiency Analysis showed no appreciable difference in the rates of return between the two sectors but there was an appreciable difference using the Little and Mirrlees method.

Up to this point the comparative merits with respect to social rates of return have been discussed but there are some other points of interest which deserve mention. The first is the income distribution effect. The Conventional Efficiency Analysis considers this to be an intangible benefit, for the handling of which Gittinger (1972) suggests other policy instruments. However, Little and Mirrlees do make allowances for this in their method, that is, they allow for the differential weighting of savings and consumption and of consumption benefits accruing to different income groups thus illustrating the greater flexibility of their method in accommodating, not only the income distribution objective, but, implicitly, the employment objective. The estimation of efficiency benefits and the derivation of weights attributed to each category is very difficult and again requires additional data with respect to consumption of various groups.

In this study savings and consumption were differentially weighted but no allowance was made for the differential weighting of consumption benefits accruing to different income groups not only because the latter

is not a major policy objective of the government but also because income distribution is fairly equitable in Guyana and in any case other policy instruments appear to be presently aimed at this perhaps minor objective. As a consequence the bias for projects utilising a large quantity of tradable goods leads to an accompanying bias towards distributing income to the higher income groups in the industrial and services sector.

There is some indication that uncertainty is more important in the Little and Mirrlees approach. This was illustrated by a larger difference within the Little and Mirrlees method when yield levels were changed than those with the use of the Conventional Efficiency Analysis.

To conclude, if the aberration attributed to the high level of consumption used to cost farm labour is corrected, there is little real difference between the two methods used in the case of this oil palm project. To expand on this, the Conventional Efficiency Analysis prices only exportable products at world prices but, let us not forget that the main message of the Little and Mirrlees method is that all inputs and outputs should be valued in units of foreign exchange rather than just those things imported or exported. There is also preferential weighting of savings versus consumption in the Little and Mirrlees method. The similarity in results between the two methods can also be attributed to the relative 'openness' of the economy of Guyana. From this study, it may be deduced then, that the contribution of the Little and Mirrlees method may only be substantial in a situation where border prices are thought to differ substantially from domestic price levels. Owing to the relatively high cost involved in accumulating the additional data, one need not necessarily go all the way to Little and Mirrlees but may rather modify the Conventional Efficiency Analysis procedure (e.g. SER,SWR) and yet obtain very similar results. In other words, if one makes the same assumptions about the economic environment the two methods may yield the same investment priorities.

A point of interest quite apart from the comparison of the two methods is that the inclusion of the timber extraction operation not only almost doubled the net present worth of the project but provided an example of a cash flow stream, for which there is no possible internal rate of return. This occurrence precluded the use of the rate of return parameter as a probability criterion.

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APPENDICES

APPENDIX 2

LIST OF CASE STUDIES

Authors	Date	Country	Topic	Details of Publication
D.L.Bevan & D.W. Soskice	1976	Seychelles	Tourism	'Appraising Tourist Development in a Small Economy' Chapter VII of I.M.D. Little and Maurice Scott Using Shadow Prices. Heinemann Educational Books Ltd.
A. Chakravarti	1972	India	Industry and Training	The Social Profitability of Selected Public Sector Projects in India - An application of the Little-Mirrlees Method. B.Phil. Thesis, Oxford.
A. Chakravarti	1972	India	Workers' Training	'The Social Profitability of Training Unskilled Workers in Public Sector in India, Oxford Economic Papers, March.
E.V.K. Fitzgerald	1974	Central and South America	Public Infra-structure	Problems in the application of the Manual to Infrastructure Investment in Latin America, Cambridge (Mimeo).
A.M. Forbes	1976	Trinidad	Hotel	'The Trinidad Hilton: a Cost-Benefit Study of a Luxury Hotel, Chapter II of I.M.D. Little and Maurice Scott Using Shadow Prices Heinemann Educational Books Ltd.
G.A. Hughes		Kenya	Housing	Low Income Housing: A Kenyan Case-Study.
V.R. and H.E. Joshi	1975	India	Labour Market	Surplus Labour and the City: A Study of Bombay, O.V.P. (India).
H.E. Joshi	1971	Algeria	Petro chemicals	The use of the Little-Mirrlees Criterion for Project Evaluation in Developing Countries: An Algerian Case-Study. B. Litt. Thesis, Oxford.
A.R. Khan	1972	Bangladesh	Planning Model	The Economy of Bangladesh, London. Chapter 10.
A.R. Khan and J.A. Mirrlees.	1972	Bangladesh	Industrial Sectors	Optimal Prices for a Developing Economy, Typescript, Nuffield College, Oxford.

List of Case Studies (Continued)

Authors	Date	Country	Topic	Details of Publication
R.L.Kitchen	1974	Zambia	Housing	Social Cost-Benefit Analysis of Low-Cost Housing in Zambia, University of Bradford (Mimeo).
D. Lal	1972	India	Wells	Wells and Welfare O.E.C.D., Paris.
D. Lal	1975	India and Kenya	Foreign Private Investment	Appraising Foreign Investment in Developing Countries, London.
D. Lal and P. Duane	1972	India	Large Scale Irrigation	A Reappraisal of the Purner Irrigation Project in Maherashtia, India (Mimeo), Washington D.C., December.
I.M.D. Little and D.G. Tipping	1972	Western Malaysia	Oil Palm	A Social Cost-Benefit Analysis of the Kulai Oil Palm Estate O.E.C.D., Paris.
A.K. Nath	1974	India	Marginal Product of Farm Labour	'Estimating the Seasonal Marginal Product of Labour in Agriculture', Oxford Economic Papers, November.
D.M.G. Newbery	1976	Kenya	Private Investment	'The Social Value of Private Investment in Kenya', Chapter VI of I.M.D. Little and Maurice Scott Using Shadow Prices. The Pitman Press Bath Ltd.
J.M. Page	1976	Ghana	Timber Industries	'The Social Efficiency of Timber Industries in Ghana' Chapter IV of I.M.D. Little and Maurice Scott Using Shadow Prices. Heinemann Educational Books Ltd.
M.A. Parsonage	1974	Zambia	Shadow Wages	Employment, Wages and Shadow Wages in Zambia (Mimeo).
P.E. Sadler	1974	Ethiopia	Coffee Processing	A Social Cost-Benefit Analysis of a Proposed Regional Development Project for Washed Coffee Production in Ethiopia, (Mimeo) University College of North Wales.
M.F.G. Scott	1976	Mauritius	Shadow Prices	'Shadow Wages in Mauritius' Chapter 5 of I.M.D. Little and M.F.G. Scott. Using Shadow Prices Heinemann Educational Books Ltd.

List of Case Studies (Continued)

Authors	Date	Country	Topic	Details of Publication
M.F.G. Scott J.D. MacArthur and D.M.G. Newbery	1976	Kenya	Shadow Prices; Project Land Settlement; Beef Fattening	Appraisal in Practice: The Little-Mirrlees Method Applied in Kenya, London.
F. Seton	1972	Chile	Shadow Wages	Shadow Wages in the Chilean Economy, O.E.C.D., Paris.
L.A. Squire	1974	Thailand	Roads	The Social Cost-Benefit Analysis of Road Projects in Developing Countries Ph.D. thesis, Cambridge.
N.H. Stern	1972	Kenya	Tea	An Appraisal of Tea Production in Small-Holdings in Kenya, O.E.C.D Paris.
K.P. Teh		Western Malaysia	Investment Incentives	The role of Protection and fiscal Incentives in industrial development and employment of a small developing economy: W.Malaysia since Independence in 1951, Thesis to be submitted for a D.Phil. at Oxford.
D.G. Tipping	1971	Sri Lanka	Irrigation and Shadow Prices	Project Evaluation in Ceylon, Nuffield College, Oxford (Mimeo).
D.G. Tipping	1971	Tanzania	Shadow Prices	Project Evaluation in Tanzania, Nuffield College Oxford (Mimeo).

APPENDIX 3

PALM OIL IN THE WORLD FATS AND OILS ECONOMY

3.1 World Fats and Oils Economy

3.1.1 Introduction

Fats and oils may be subdivided in several ways depending on the criteria used. Using that of the end-uses, fats and oils may be divided into three categories:

(a) The edible group - which includes fats and oils used for cooking purposes, e.g. groundnut, olive, sesame seed, soyabean and sunflower seed oils and lard;

(b) the industrial group - which includes fats and oils used mainly in manufacturing for the production of such items as paint, soap, candles, varnish and lubricant. Fats and oils which are included in this group include castor, linseed, rapeseed and tung oils and tallow;

(c) the edible-industrial group - which includes those oils used extensively for both purposes. These include such oils as coconut, palm and palm kernel oils.

It is estimated that about three-quarters of fats and oils fall into the edible group, about one-fifth into the edible-industrial group and the remainder comprise the industrial group.

For international trade purposes fats and oils are more rigorously divided into edible oils, soft oils, lauric acid oils, other edible or soap fats and oils and technical oils. Those which are difficult to classify into any of the above groups are placed in the miscellaneous

category. The variety of products making up the fats and oils and a very closely related group, oil cakes and meals, is considerable. There are some sixteen fats and oils of importance in world trade, as well as a large number of minor oils. The production characteristics of the different products vary widely; some fats are by-products of animal production (lard and tallow); some oils are by-products of oilcake production (soy bean and fish oils); some cakes are by-products of oil production (including groundnuts, rapeseed, copra, palm kernel cakes); there are both perennial and annual oilseed and oil crops. There is a high interchangeability in the end-uses between different oils. There is some competition from substitutes outside the fats and oil group. The main threat to oils is from the synthetic substitutes and concerns lauric oils in non-food uses and technical oils.

3.1.2 Production

In the 1964-66 through 1972-74 period, estimated world production of fats and oils has increased from 36 million tons to 45.3 million tons (F.A.O. 1976/1977). This represented an average annual increase of nearly 1.2 million tons - or over 3.0 per cent (compound rate) over the period 1964-1974. This upward trend has been continuous except for a slight setback in 1973. Annual fluctuations in global output have ranged between the extremes of -1.6 per cent (between 1972-73) and 8.7 per cent (between 1973 and 1974). Using estimates of world production from the 1964-66 through 1974 period attached, the subsequent linear trend has been established. This is shown in Table 3.1 and Figure 3.1.

The upward trend in world output in fats and oils was, however, interrupted in 1975 with world production estimated at 45.4 million tons - or 1.1 million tons (over 2 per cent) less than the then record level in 1974. This decline had in part been attributed not only to a reduction in area under the U.S. soybean crop in late 1974, but also to lower yields generally owing to erratic weather conditions. There was also a smaller crop of sunflowerseed oil in the U.S.S.R. Sharply reduced production levels of these two crops were only partly offset by a larger output of coconut and palm oils. The overall reduction which followed the production of 4.1 million tons in 1974 over 1973 caused world output to be about 1.3 million tons below the level indicated by the above 1964-1974 trend.

TABLE 3.1

TOTAL FATS AND OILS

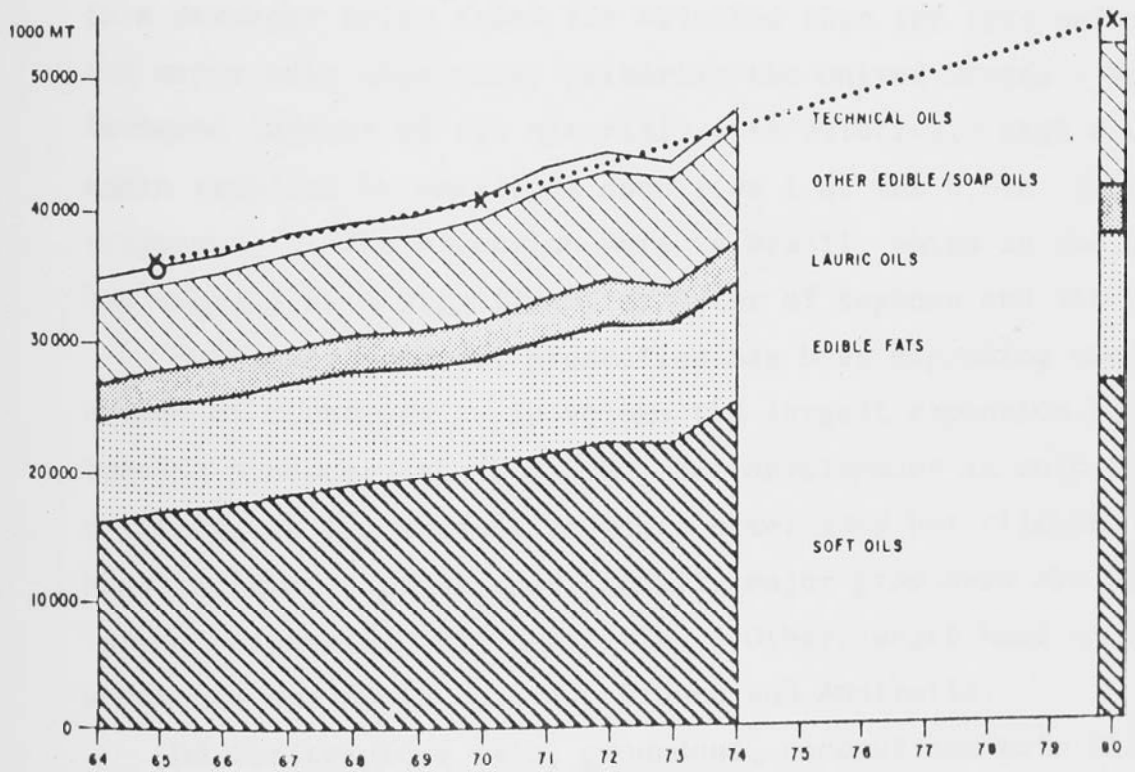
(Production - Average 1964-66 and annual 1967 to 1974)

(unit: 1000 metric tons)

	1964-66	1967	1968	1969	1970	1971	1972	1973	prelim. 1974
Butter	4 741	4 946	5 032	4 888	4 798	4 803	5 080	5 208	5 346
Lard	3 444	3 605	3 658	3 567	3 662	3 967	3 909	3 878	3 973
EDIBLE FATS	8 185	8 551	8 690	8 455	8 460	8 770	8 989	9 086	9 319
Cottonseed oil	2 557	2 325	2 276	2 600	2 511	2 541	2 775	2 959	2 901
Groundnut oil	3 309	3 199	3 416	3 188	3 395	3 655	3 699	3 075	3 334
Olive oil	1 438	1 401	1 517	1 564	1 400	1 578	1 699	1 591	1 503
Rapeseed oil	1 564	1 841	1 929	1 594	1 980	2 569	2 617	2 490	2 418
Sesameseed oil	573	567	602	567	630	713	659	626	650
Soybean oil	4 552	5 466	5 688	6 338	6 534	6 709	7 193	7 836	9 556
Sunflowerseed oil	2 741	3 465	3 703	3 752	3 837	3 655	3 689	3 549	4 558
SOFT OILS	16 734	18 264	19 131	19 603	20 287	21 420	22 331	22 126	24 920
Coconut oil	2 260	2 149	2 227	2 223	2 275	2 524	2 858	2 535	2 558
Palm kernel oil	546	526	584	598	638	652	651	675	721
LAURIC ACID OILS	2 806	2 675	2 811	2 821	2 913	3 176	3 509	3 210	3 279
Fish oil	1 150	1 375	1 314	1 140	1 248	1 350	1 095	938	1 057
Palm oil	1 513	1 560	1 686	1 800	2 031	2 271	2 415	2 543	2 842
Tallow	4 016	4 272	4 339	4 345	4 559	4 749	4 750	4 620	4 785
OTHER EDIBLE/SOAP FATS & OILS	6 679	7 207	7 339	7 285	7 838	8 370	8 260	8 101	8 684
EDIBLE/SOAP FATS & OILS	34 404	36 697	37 971	38 164	39 498	41 736	43 089	42 523	46 202
Castor oil	341	381	370	370	357	358	366	382	460
Linseed oil	1 083	969	801	933	1 163	1 272	891	755	794
Tung oil	139	148	128	107	100	123	123	118	118
TECHNICAL OILS	1 563	1 498	1 299	1 410	1 620	1 755	1 380	1 255	1 372
GRAND TOTAL	35 967	38 195	39 270	39 574	41 118	43 489	44 469	43 778	47 574
Developed	15 235	16 259	16 377	17 058	17 532	18 352	18 649	18 464	20 001
Developing	12 038	12 032	12 817	12 807	13 734	14 913	15 505	15 000	15 952
Centrally Planned	8 694	9 904	10 076	9 709	9 852	10 224	10 315	10 314	11 621

FIGURE 3.1

LINEAR TREND FOR OILS AND FATS, 1967-1974



After this setback in 1975, world production recovered to new record levels in 1976 with increased production of soybeans from the United States and competing Brazil, and groundnuts in India. Table 3.2 shows the world production of selected oilseeds, fats and oils for 1960, the average for 1967-69, 1975, 1976 and those projected for 1980-85. This table gives some idea of the relative importance of the different fats and oils.

Soybean is the most important oil by volume. Its share of the total of the most important oils and fats has risen from 12.3 per cent in 1960 to 19.2 per cent in 1975 and 22.1 in 1976. The second most important oil is sunflower seed oil. It is interesting to note that both of these oils are by-products of oilcake production. The demand for oilcakes in the major importing countries i.e. Western Europe and Japan has been growing much faster than for oils and fats, reflecting a rising demand for livestock products and more intensive feeding practices. This has resulted in a stronger price trend for oilcakes than for fats and oils, benefiting the major cake exporters, primarily the United States - and has also favoured imports of raw materials with relatively high cake and low oil content again supplied by developed countries i.e. the U.S.A. (soybean) and Canada (rapeseed). The exception here is Brazil, which in the past few years has emerged as a significant exporter of soybean and its products.

Sunflower seed oil production has been expanding over the period in a number of countries. In volume the largest expansion has been by the leading producer, the U.S.S.R., but development in output has been uneven, declining in the successive years after 1969 but climbing to an all time high in 1974. Other traditionally major producers are Romania, Bulgaria, Turkey, Argentina and Yugoslavia. Others which have emerged as substantial producers are Spain, U.S.A., France and Australia.

Of the tropical oils, groundnut, coconut and palm oil are the major ones, each accounting for approximately 8, 7 and 7 per cent shares respectively of the total production of major fats and oils. By far the most significant development has been in palm oil, the production of which has achieved spectacular gains, with an annual growth rate of 7% over the 1964/66 to 1972/74 period and a share rising from 4 to 6 per cent over the same period. These developments have reflected the gradual acceleration of the maturation of vast oil palm development schemes, primarily in Malaysia but also in the Ivory Coast and Columbia, and a growing output in Indonesia and other main producers, with the exception of Nigeria where estimated production has not yet regained the pre-civil unrest levels.

TABLE 3.2

WORLD PRODUCTION OF SELECTED OILSEEDS, FATS AND OILS (FAT OR OIL EQUIVALENT), ACTUAL 1960, AVERAGE 1967-69, 1976, PROJECTED 1980 AND 1985

(In 1000 Metric Tons)

Fat/Oil	1960		1967-69		1975		1976		1980		1985	
	1000 MT	% Share	1000 MT	% Share	1000 MT	% Share	1000 MT	% Share	1000 MT	% Share	1000 MT	% Shar
Soybean Oil	3,295	12.3	5,358	15.5	8,550	19.2	10,470	22.2	11,900	22.4	13,500	23.2
Sunflowerseed Oil	1,665	6.2	3,652	10.5	4,070	9.2	3,620	7.6	5,200	9.8	5,400	9.3
Cottonseed Oil	2,165	8.1	2,310	6.7	3,005	6.8	2,550	5.4	3,400	6.4	3,700	6.4
Groundnut Oil	2,555	9.6	3,248	9.4	3,245	7.3	3,800	8.0	3,600	6.8	3,800	6.5
Rapeseed Oil	1,105	4.1	1,655	4.8	2,495	5.6	2,810	5.9	2,800	5.3	3,000	5.2
Olive Oil	1,180	4.4	1,307	3.8	1,500	3.4	1,690	3.6	1,600	3.0	1,700	2.9
Palm Oil	1,250	4.7	1,382	4.0	2,925	6.6	3,120	6.6	4,600	8.7	5,900	10.1
Coconut Oil	1,955	7.3	2,072	5.9	2,515	5.7	3,200	6.7	3,000	5.6	3,200	5.5
Palm Kernel Oil	440	1.7	383	1.1	695	1.6	700	1.5	900	1.7	1,000	1.7
Fish Oil	462	1.7	1,058	3.0	1,250	2.8	1,130	2.4	1,300	2.4	1,400	2.4
Butter	3,855	14.4	4,017	11.6	5,135	11.5	5,230	11.0	5,300	10.0	5,500	9.4
Tallow	3,050	11.4	4,228	12.2	5,085	11.4	5,140	10.8	5,500	10.2	5,900	10.1
Lard	3,733	14.1	3,988	11.5	3,950	8.9	4,020	8.5	4,100	7.7	4,300	7.3
TOTAL	26,710	100.0	34,658	100.0	44,420	100.0	47,480	100.0	53,200	100.0	58,300	100.0

Source: World Bank 1976.

Among the other edible/soap fats and oils, world marine output, largely a by-product of fish processing for meal production, tended to increase until 1971, when the catch off the coasts of Peru and Chile was thought to have reached or even exceeded the maximum sustainable yield. Thereafter output has fallen dramatically as a result of the temporary disappearance of fish from the traditional grounds off South America.

The production of technical oils reached a peak in 1971 and has fallen considerably in subsequent years, reflecting a sharp contraction in the output of linseed oil, by far the largest in the group. Output in the 1972-74 period averaged 15% less than at the beginning of the period under review and accounted for only 3 per cent of the total fats and oils production. In 1976 the share decreased further to 1.6% of total fats and oils production.

Distribution of production between the developed, the developing and the centrally planned economies (Table 3.3) shows that

TABLE 3.3

PRODUCTION OF FATS AND OILS
BY ECONOMIC REGION

Region	1967		1970		1973		1976	
	'000 tons	%	'000 tons	%	'000 tons	%	'000 tons	%
Developed	16500	43.6	18290	42.9	18900	42.4	21090	41.7
Developing	11300	30.0	14070	33.0	15460	34.7	18730	37.0
Centrally planned	10000	26.4	10300	24.1	10230	22.9	10740	21.2
Total:	37800	100.0	42660	100.0	44590	100.0	50560	100.0

Source: F.A.O. various issues.

the relative share of total production of the developing countries has increased substantially more than either the developed countries or the centrally planned economies and apparently mainly at the expense of the latter. In volume terms production has increased substantially more in the developing countries than in each of the other two economic groups.

Worldwide the production expansion has been reflected in an increased per capita output of fats and oils for all uses edible or inedible.

3.1.3 Demand and Consumption

It has been observed that the regional pattern of consumption of fats and oils reflects the pattern of production. In the U.S.A. for example, soybean and cottonseed oils are widely used; in Russia, sunflowerseed oil and cottonseed oil are the major edible oils and in many tropical areas, coconut and palm oils predominate. The four largest producers and consumers are the U.S.A., U.S.S.R., China and India. It has been projected that the demand for fats and oils is likely to grow faster both relatively and absolutely in developing countries than in high-income countries. In the developed countries higher per caput consumption appears to depend more on population growth than on increases in income and demand in these countries appears not very responsive to price. On the other hand, demand in developing countries is responsive to changes in both price and income as well as being at a very low per caput level; with increasing populations, total demand is expected to increase rapidly. The main constraint on total consumption levels will be whether sufficient fats and oils can be provided at low enough cost to enable demand to become effective; this will depend on price levels of both domestically produced and imported fats and oils, as well as on foreign exchange problems that remain a constraint.

World consumption rises an average 1.2 million tons each year. However, in 1975, as a result of the relatively high prices ruling at the beginning of the year and because of a world recession, a hitherto expanding trend in consumption not only came to a halt but declined. It is anticipated that in 1976 an increase of over 10% in consumption was required to absorb the available supplies.

World demand departed from its upward trend in late 1974 and early 1975. There were, however, some signs of recovery in 1976 mainly connected with the beginning of the up-turn in economic activity which has already started in the United States and is expected to be followed in other developed countries, although both the timing and the strength is uncertain. Demand for fats and oils will not only benefit from economic recovery but also the fact that prices continued to fall sharply after the 1973 peak levels. This is expected to cause some increase in demand for food uses and more particularly perhaps, for non-food uses with the possible displacement of petrochemical derivatives

by natural oils and fats in certain industrial uses, which indeed would also be encouraged by the current high prices of synthetic products relative to those of natural products.

3.1.4 Trade

Oilseeds, fats and oils, oil cakes and meals are of some importance in international trade. These products accounted for 16 per cent of trade in main agricultural exports (F.A.O. 1977) in 1976 amounting to U.S.$13,785 million and were of roughly similar importance (16-17%) for developed and developing countries alike.

During the sixties, exports of fats and oils experienced an upward trend with a yearly increase of about 4.3% (representing an annual increase of approximately 475,500 tons) to reach an estimated 13.3 million tons in 1969-1971. This rate of growth could be credited to increased demand from Europe and Japan, the main commercial markets for fats and oils. The average annual rate of growth of exports within the 1971-76 period was 4.4 per cent, with large increases in 1972 and 1976 of 5.3 and 13.1 per cent respectively. In 1973 there was a reversal of the upward trend, reflecting a decrease in shipments of tropical oils and a marked decline in linseed oil exports. Table 3.4 shows the world exports of selected oilseeds, fats and oils for 1960 and 1975, the average of 1967-69 and the projected for 1980 and 1985.

Table 3.5 shows fat and oil exports by region. During the sixties, and continuing the trend of earlier years, the earnings of the developing countries have expanded much less rapidly, in relative and absolute terms, than those of the developed countries. While the world experienced a greater than 6.5 per cent annual rate of increase in export earnings from the products in the 1961-71 period, the rate of increase for the developing countries has been only 2.6 per cent each year in contrast to 9 per cent for the developed countries and over 7 per cent for the centrally planned economies. However in the 1972-75 period the rates of growth all approximated an average 9 per cent annually for developing countries and developed countries and 10 per cent for the centrally planned economies from a small base.

TABLE 3.4

WORLD EXPORTS OF SELECTED OILSEEDS, FATS AND OILS (FAT OR OIL EQUIVALENT), ACTUAL 1960, AVERAGE 1967-69, 1975 PROJECTED 1980 AND 1985

(In 1000 Metric Tons)

Fat/Oil	1960		1967-69		1975		1980		1985	
	1000 MT	% Share	1000 MT	% Share	1000 MT	% Share	1000 MT	% Share	1000 MT	% Share
Soybean Oil	1,400	19.8	1,991	19.8	3,565	27.1	4,900	28.0	5,700	27.8
Sunflowerseed Oil	245	3.3	1,138	11.3	765	5.8	1,250	7.2	1,300	6.3
Cottonseed Oil	294	4.1	226	2.3	425	3.2	460	2.6	510	2.5
Groundnut Oil	826	11.4	1,037	10.3	745	5.7	940	5.4	950	4.6
Rapeseed Oil	92	1.3	439	4.4	745	5.7	920	5.3	1,020	5.0
Olive Oil	69	1.0	82	0.8	63	0.5	100	0.6	110	0.6
Palm Oil	587	8.1	607	6.0	1,800	13.7	3,050	17.5	4,690	22.9
Coconut Oil	1,152	15.9	1,182	11.8	1,425	10.8	1,650	9.4	1,750	8.5
Palm Kernel Oil	407	5.6	299	3.0	396	3.0	420	2.4	435	2.1
Fish Oil	222	3.1	672	7.7	600	4.6	740	4.2	790	3.9
Butter	426	5.9	514	5.1	717	5.5	790	4.5	830	4.1
Tallow	1,076	14.9	1,447	14.4	1,400	10.7	1,820	10.4	1,950	9.5
Lard	407	5.6	409	4.1	490	3.7	440	2.5	460	2.2
TOTAL	7,243	100.0	10,043	100.0	13,136	100.0	17,480	100.0	20,495	100.0

Source : World Bank 1976.

TABLE 3.5

EXPORTS OF FATS AND OILS BY ECONOMIC REGION

Region	Average 1961 - 1963		Average 1969 - 1971		Average 1972 - 1975	
	Quantity '000 tonnes	Value $US m	Quantity '000 tonnes	Value $US m	Quantity '000 tonnes	Value $US m.
Developed	4417	1019	7469	1672	7767	4110
Developing	4264	500	4481	732	5232	1760
Centrally planned	591	191	1343	391	1120	540
World Total:	9372	1310	13,239	2725	14,119	6410

Source: F.A.O. and U.S.D.A. publications.

Generally, the rate of growth has fallen below the trend in spite of an exceptionally strong import demand from 1972 through the early part of 1974. This was because of:

1. low export availability of oils and fats owing to the faster growing demand for high meal-yielding types of seeds, mainly soybean and rapeseed from the U.S.A. and Canada, and the accompanying substantial development of the crushing capacity in a number of the main developed importing countries. Since oil cakes are not readily storable for long periods, the increase in stock of oil cakes had the effect of restricting supplies;
2. drastically reduced shipments from the Philippines which was still suffering from the effects of the drought in 1973;
3. a small part of the U.S.S.R.'s sunflower seed oil supply was released by the government for export; and
4. India's increased groundnut oil production was retained to supply the domestic market.

The volume of exports was below the long term trend and the value of exports fell sharply by 9.2 per cent not only because of consumer reaction to higher prices prevailing in July to October 1974 following exceptionally high prices in 1973 but also because of widespread recession in consumer spending.

In spite of the fall in exports of oils and fats below the trend, the use of the oils extracted from the imported seed above has not only been favoured by more plentiful availability of seed, but by the considerable technical and economic substitutability between oils and fats of various origins as ingredients for processed fat, and also by the trend in consumer taste in a number of the major developed countries towards an increase in per caput consumption of liquid oils.

On the import side, the increasing consumption requirements of W. Europe, which absorbs 50 per cent of world retained imports of fats and oils, has been met by domestically produced supplies. Protection is also given to domestic suppliers if their products face competition from those offered on the world market. This protection has taken the form of price support schemes, tariffs and other measures which ultimately affect the demand for imported oilseeds, oils and fats. In contrast only a small part of Japan's requirement, which accounts for about 30 per cent of world inputs of fats and oils, is produced locally. Western Europe and Japan account for not less than 80 per cent of world imports.

The import requirements of the developing countries tend to be a relatively small portion of consumption requirements. Their imports, however, have grown at nearly double the rate for the world as a whole during the sixties but from a small base.

In contrast the export of commodities supplied almost solely from developing countries, such as coconut, groundnut, palm kernel products, and palm oil, has lagged behind, although palm oil has shown an upward trend in recent years. Export earnings have been markedly lower than those of the temperate products above. Fish oil has done well but supply limitations will not allow expansion.

Exports from the developing countries tend to fall in the hard oils group and to be of oilseeds with low yields of cake and as such are less suited to the recent trend in demand in international markets. On the supply side, economic problems, such as lack of investment resources have added and have been linked to the technical problems such as poor cultivation practices, lack of adequate disease and pest control measures, low usage of fertilizers, inadequate transport and marketing facilities. On the side of domestic demand, growth in population in the developing countries has led to a rapid expansion in domestic consumption.

3.1.5 Policy Developments and Issues

Fats and oils, as well as oil cakes and meals, appear likely over the long term to continue their past record of growth in production and trade. However, recent events concerning both supply and demand have shown that these markets, in spite of the large number of competing products involved and the wide range of end uses, can show a marked degree of instability both in the movement of export earnings and prices. A measure of this is the coefficient of instability which measures the year to year fluctuations after excluding the effect of any long term upward or downward trend. For example, a coefficient of instability of 10 m export earnings means that in 95 cases out of 100 the fluctuations in export earnings would not exceed 10 per cent up or down from the trend value.

TABLE 3.6

COEFFICIENTS OF INSTABILITY IN EXPORT EARNINGS BY ECONOMIC REGIONS 1961-1971

Region	Oilseeds	Fats & Oils	Oilcakes	Total
Developed	6	6	9	5
Developing	7	11	9	8
Centrally Planned	25	18	51	19
Total of the World	6	6	8	8

Source: F.A.O. 1973

Table 3.6 shows the coefficients of instability in export earnings by economic regions and Table 3.7 shows the coefficients of instability in export earnings and export unit value of products. Those of oils and fats have been compared with those of other agricultural products.[1]

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[1] The coefficient of instability utilized is given by

$$\sum_{1}^{N}{}_{i} \; (X_i - X_i^*)/N\text{-}100$$

where

x_i = the actual observation

x^*_i = the theoretical trend observation

N = the number of observations

TABLE 3.7

COEFFICIENT OF INSTABILITY IN EXPORT EARNINGS AND EXPORT UNIT VALUES BY PRODUCTS, 1961-71

	Fats and Oilcakes + meals		Other Products		
	Earnings	Unit Values		Earnings	Unit Values
Soybean Oil	22	11	Coffee	5	7
Groundnut Oil	6	8	Cocoa	8	12
Rapeseed	19	11	Bananas	5	4
Fish Oil	18	26	Wheat	7	2
Palm Oil	18	18	Maize	9	4
Tallow	13	11	Rice	9	8
Coconut Oil	11	7	Rubber	8	5
Palm Kernel Oil	10	7	Sisal	15	15
Linseed Oil	14	7	Cotton	5	4
Castor Oil	12	14			
Soybeancake	8	3	Oilseeds	6	-
Groundnutcake	14	9	Fats + Oils	6	-
Fish meal	11	4	Oilcakes	8	-

Source: F.A.O. 1973.

Comparison of the instability coefficients with other agricultural commodities suggests that, when taken as product groups, oilseeds, fats and oils and oilcakes tend to be no more unstable than other commodities. But when considered individually, specific oils and oilcakes must be ranked as relatively unstable when compared with other commodities. Whereas sisal is the only other product showing an instability coefficient for export earnings above 10, all but two of the thirteen oil and cake products shown do so.

Some of the factors contributing to this instability have been discussed above, but worthy of mention is the extent to which certain national policy measures (whether longstanding, recently adopted or still under consideration) which have had an impact on the quantities available for export have contributed to such instability. During the period of short supplies and high prices in 1974 a number of governments imposed export regulations which affected the level of actual exports during that year. These restrictions were designed to maintain adequate domestic supplies and to control rises in domestic prices, whether these were caused by inflation or by short supplies. Some of these are still in force while others have been relaxed or discontinued. In addition to those recently initiated a number of countries have longstanding policies that include an element of government control over export supplies. There are also important policy initiatives under consideration which under certain conditions could be expected to affect the flow of exports.

Brazil (soybeans and products, castor oil), Philippines (copra and copra products), Spain (olive oil) and the United States (mainly soybeans and soybean meal) introduced measures to deal with the 1974 circumstances. Some of the measures implemented, for example in the United States, have been discontinued.

The U.S.S.R. and the Eastern European countries, the governments of which possess some control over quantities exported, have long caused uncertainties as to supplies likely to be offered in world markets. The government of Argentina can alter the profitability of exports and of supplying the domestic market; Peru, having nationalised the fish production industry, controls production and export policy and Indonesia has banned exports of copra and coconut oil for some time. Brazil, a fast growing producer of oilseed and oilseed products extended its system of export controls in 1974 in order to favour orderly marketing and to maintain

adequate and reasonably priced domestic supplies. The United States, in 1975, was considering the reintroduction of what was basically a flow price system for soybeans.

Many of these policy developments took place in direct response to conditions prevailing from 1972-1974 and were undertaken by exporting countries in order to stabilize their own markets. However, the overall effect of them on international markets has probably tended to increase the extent of instability and particularly of price fluctuations. In addition, uncertainties as to the type, timing and duration of policy measures which may be decided on by important individual exporters tend to accentuate market instability. Export availabilities have tended in recent years to be increasingly concentrated in relatively few countries and policy actions taken by them do not necessarily help solve the problems of other smaller exporters. The developing countries tend to fall in the latter category. If a larger measure of market stability is to be achieved, it will require wider based policy initiatives which take account of the interests of both exporters - large and small.

There are two recent international policy initiatives which are worthy of mention.

1. Lomé convention between the E.E.C. and 46 developing countries of the African, Caribbean and Pacific regions, which represents one attempt to stabilize, through financial transfers, foreign exchange earnings of developing signatory countries from exports to the community of selected groups of commodities (including groundnut, coconut and oil palm products).
2. UNCTAD's Intergovernmental Group on Oilseeds, Oils and Fats continues, as requested by a number of governments, to investigate the particular difficulties and problems of these commodities, as well as the possibilities and limitations of short term policy actions and of long term international arrangements to solve them.

3.2 Interchangeability between Fats and Oils

3.2.1 Technical and Economic Aspects

The characteristics of various oils and fats are, to some extent, determined by the predominant fatty acid. Fatty acids, saturated or unsaturated, determine the melting point, viscosity, storability and

substitutability between fats and oils. The saturated oils with the exception of coconut oil tend to be 'hard' or have relatively higher melting points while the unsaturated fats tend, generally, to be 'soft' possessing lower melting points and therefore tend to be liquid at room temperatures. Substitution among oils is relatively easier within groups than between groups.

New developments in the field of oil technology have made it possible to modify the chemical properties of fats and oils and have allowed a greater scope for substitution. With hydrogenation, one such process, unstable oils may be made more stable, thereby reducing the rate of deterioration. The process also allows for greater interchangeability between fats and oils in the manufacture of edible products.

Technical characteristics per se, however, do not lead to substitution between oils. Economic facts, such as the availability of supply and prices of the raw products do have a greater influence on the manufacturers' choice with respect to substituting one oil for another. Generally it can be said that if the price differential between two interchangeable oils is significantly large, manufacturers will resort to purchasing the cheaper oil.

3.2.2 Prices and Price Movements

Table 3.8 indicates the actual prices of various fats and oils until 1976 and projections until 1985 together with the price indices for oils and fats for the various years concerned. Table 3.9 gives prices stated in terms of constant U.S. dollars. As discussed in Section 3.1.5 prices have been relatively unstable. 1970 appears to have heralded a 5-year period of rising prices which reached unprecedented levels in December 1973 and especially in October 1974. The price indices of soft oils and lauric oils were almost double their 1973 values.

This trend reflected original supply shortages and deterioration in the prospects for the U.S. soybean crop of late 1974. The prices of lauric oils reached their peak in March 1974, reflecting a shortage of export supplies. Thence international prices deteriorated rapidly, falling off by 34% in 1975. However this downward pressure which really started in late 1974 continued to ease during the early months of 1976 due to the improved economic outlook in the developed importing countries and poorer 1976 harvest prospects for some major oilseed crops.

TABLE 3.8

PRICES AND PRICE INDEX OF SELECTED FATS AND OILS [1] CIF EUROPE, 1960-1980 AND 1985

(In US dollars per metric ton)

Year	Soybean	Sunflower	Cottonseed	Groundnut	Rapeseed	Olive	Palm	Coconut	Palm Kernel	Fish	Lard	Butter	Tallow	Price Index
1960	225	243	235	326	219	585	228	312	317	155	214	851	142	33.5
61	287	311	305	331	230	561	232	254	263	139	225	706	158	33.1
62	227	245	266	275	221	631	216	251	255	104	218	822	137	30.5
63	223	236	243	268	215	871	222	286	287	160	216	900	141	32.3
64	205	255	250	315	252	586	240	297	299	203	251	931	168	34.1
1965	270	294	278	324	263	663	273	348	353	217	293	918	200	38.2
66	261	263	333	296	244	661	236	324	271	196	282	833	180	34.9
67	216	212	378	283	206	690	224	328	249	127	205	817	144	31.2
68	178	172	305	271	161	681	169	399	367	99	169	709	129	28.6
69	228	213	291	332	200	666	181	361	306	150	216	709	166	32.2
1970	307	331	354	379	293	699	260	397	429	248	271	733	202	41.0
71	323	375	392	441	295	727	261	371	335	221	262	1048	196	43.6
72	270	326	324	426	232	916	217	234	244	182	251	1209	179	37.3
73	465	480	500	546	395	1399	378	513	491	342	373	975	356	59.1
74	795	983	939	1077	745	2174	669	998	1010	559	602	1216	448	100.0
1975	619	739	726	857	551	2436	433	393	439	344	479	1669	340	75.5
76	376	600	645	675	390	2350	370	340	360	330	410	1760	381	62.4
77	416	615	638	714	416	2168	397	403	423	337	383	1719	370	64.5
78	464	628	650	755	450	2000	433	485	485	343	428	1670	371	63.0
79	514	721	644	796	476	1833	471	583	568	353	460	1626	376	72.6
1980	568	689	640	836	506	1675	509	693	657	361	509	1568	361	76.3
1985	910	1013	1130	1320	835	2790	737	1094	1060	610	795	2556	592	120.2

1 Descriptions:

Soybean Oil: Crude, US, CIF Rotterdam.
Sunflower Oil: Any origin, ex-tank Rotterdam.
Cottonseed Oil: US PBSY, CIF Rotterdam.
Groundnut Oil: Nigerian/Gambian/Any Origin, CIF Europe.
Rapeseed Oil: Dutch, FOB ex-mill.
Olive Oil: Spanish, edible, 1% drums.
Palm Oil: Malaysian, 5%, CIF UK.

Price Index weighted by current world exports (1974-100.

Coconut Oil: Philippines/Indonesian, bulk, CIF Rotterdam. For 1973, Dutch, 5%, ex-mill; prior to 1973, White Ceylon, 1% bulk, ex-tank Rotterdam.
Palm Kernel Oil: West African, CIF UK.
Fish Oil: Any Origin, crude, CIF Europe. Prior to March 1973, Peruvian, semi-refined.
Lard: EEC refining quality, CIF UK. Prior to February 1973, US, Prime Steam, CIF UK.
Butter: Dutch, bulk, unsalted, UK markets.
Tallow: US, bulk, bleachable fancy, CIF Rotterdam.

TABLE 3.9

PRICES AND PRICE INDEX OF SELECTED FATS AND OILS [1] CIF EUROPE, 1960-1980 AND 1985

(In constant US dollars per metric ton)

Year	Soybean	Sunflower	Cottonseed	Groundnut	Rapeseed	Olive	Palm	Coconut	Palm Kernel	Fish	Lard	Butter	Tallow	Price Index
1960	444.9	480.5	464.7	644.7	433.1	1156.8	450.9	617.0	626.9	306.5	423.2	1682.8	280.8	66.3
61	699.3	757.8	806.5	606.5	682.3	1367.0	565.3	618.9	640.8	338.7	548.2	1720.3	385.0	80.8
62	445.8	483.1	522.4	540.1	434.0	1239.2	424.2	492.9	500.8	204.2	428.1	1614.3	369.0	59.8
63	434.9	460.2	473.9	522.6	419.3	1698.5	432.9	557.7	559.7	312.0	421.2	1755.1	275.0	62.9
64	397.0	493.8	484.1	610.0	488.0	1134.5	464.8	575.1	579.0	393.1	486.1	1802.9	325.3	66.1
1965	515.1	560.9	530.3	618.1	501.7	1264.8	520.8	663.9	673.4	414.0	558.9	1751.2	381.5	72.9
66	486.8	490.6	621.2	552.1	455.1	1233.0	440.2	604.4	505.5	365.6	526.0	1553.8	335.8	65.0
67	399.8	392.4	699.6	523.8	381.3	1277.1	414.6	607.1	460.9	235.1	379.4	1512.1	266.5	57.8
68	331.3	320.1	567.7	504.4	299.6	1267.4	314.5	742.6	683.0	184.3	314.5	1319.6	240.1	53.2
69	409.0	382.1	522.0	595.5	358.7	1194.6	324.7	647.5	548.9	269.1	387.4	1271.7	297.8	57.7
1970	514.8	555.4	593.7	635.6	491.4	1172.2	436.0	665.8	719.4	415.9	454.5	1229.2	338.8	68.7
71	510.0	592.1	619.0	696.4	465.8	1148.0	412.1	585.8	529.0	349.0	413.7	1654.8	309.5	68.8
72	392.0	473.4	470.5	618.6	336.9	1330.0	315.1	339.8	354.3	264.3	364.5	1755.5	259.9	54.1
73	569.2	587.6	612.1	618.6	483.5	1712.0	462.7	628.0	601.1	418.7	456.6	1193.5	435.8	72.3
74	795.0	983.0	939.0	1077.0	745.0	2174.0	669.0	998.0	1010.0	559.0	602.0	1216.0	443.0	100.0
1975	540.7	645.5	634.1	748.5	481.3	2127.7	378.2	343.3	383.4	300.5	418.4	1457.8	297.0	66.0
76	308.3	492.0	528.9	553.6	319.8	1927.2	303.4	278.8	295.2	270.6	336.2	1443.3	311.6	51.2
77	314.7	465.2	490.2	540.1	314.7	1639.9	300.3	304.8	320.0	254.9	289.7	1300.3	279.9	48.0
78	325.0	439.9	455.3	528.9	315.2	1401.1	303.3	339.8	339.8	240.3	299.8	1169.9	259.9	47.6
79	335.0	470.0	419.8	518.8	310.3	1194.8	307.0	380.0	370.2	230.1	299.8	1059.8	245.1	47.5
1980	345.9	419.6	389.7	509.1	308.1	1020.0	310.0	422.0	400.1	219.8	310.0	954.8	219.8	46.5
1985	395.2	439.9	490.7	573.2	362.6	1211.5	320.0	475.1	460.3	264.0	345.0	1109.9	257.1	52.2

1 Descriptions:

Soybean Oil: Crude, US, CIF Rotterdam.
Sunflower Oil: Any Origin, ex-tank Rotterdam.
Cottonseed Oil: US, PBSY, CIF Rotterdam.
Groundnut Oil: Nigerian/Gambian/Any Origin, CIF Europe.
Rapeseed Oil: Dutch, FOB, ex-mill.
Olive Oil: Spanish, edible, 1% drums.
Palm Oil: Malaysian, 5% CIF UK.

Price Index weighted by constant world exports (1974-100).

Coconut Oil: Philippines/Indonesian, bulk, CIF Rotterdam. For 1973, Dutch, 5% ex-mill; prior to 1973, White Ceylon, 1% bulk, ex-tank Rotterdam.
Palm Kernel Oil: West African, CIF UK.
Fish Oil: Any Origin, crude, CIF Europe. Prior to March 1973, Peruvian, semi-refined.
Lard: EEC refining quality, CIF UK. Prior to February 1973, US, Prime Steam, CIF UK.
Butter: Dutch, bulk, unsalted, UK markets.
Tallow: US, bulk, bleachable fancy, CIF Rotterdam.

TABLE 3.10

CORRELATION MATRIX FOR PRICES OF SELECTED OILS 1960-1976

Fat or Oil	Soybean Oil	Sunflower Oil	Cottonseed Oil	Ground-Nut Oil	Rapeseed Oil	Olive Oil	Coconut Oil	Palm Kernel Oil	Butter	Lard	Tallow	Palm Oil	Fish Oil
Soft Oils													
Soybean oil	1.000	0.921**	0.789**	0.887**	0.952**	0.387	0.096	0.656**	- 0.201	- 0.301	0.142	0.668**	- 0.273
Sunflower oil		1.000	0.770**	0.954**	0.913**	0.571**	0.281	0.550**	- 0.162	- 0.357	- 0.042	0.626**	- 0.129
Cottonseed oil			1.000	0.774**	0.735**	0.463*	0.049	0.555**	- 0.441*	- 0.302	- 0.079	0.403	- 0.046
Groundnut oil				1.000	0.857**	0.524**	0.270	0.604**	- 0.250	- 0.325	0.032	0.629**	- 0.040
Rapeseed oil					1.000	0.310	0.179	0.677**	- 0.047	- 0.226	0.779	0.704**	- 0.188
Olive oil						1.000	0.231	0.055	- 0.362	- 0.433*	0.015	0.392	- 0.143
Lauric Oils													
Coconut oil							1.000	0.235	- 0.059	- 0.241	- 0.348	- 0.124	0.084
Palm Kernel oil								1.000	- 0.336	- 0.247	- 0.015	0.391	- 0.009
Edible Fats													
Butter									1.000	0.097	0.164	- 0.106	- 0.065
Lard										1.000	0.162	- 0.116	0.213
Other Edible/Soap Fats and Oils													
Tallow											1.000	0.236	- 0.504
Palm oil												1.000	- 0.219
Fish oil													1.000

** highly significant, i.e. ≤ 0.01 * significant, i.e. $\leq s \leq 0.05$ Others - not significant.

As mentioned above, the chief economic factors affecting interchangeability of fats and oils are their relative prices and, conversely, increasing interchangeability among fats and oils has had two salient effects on their prices over time. The spread of prices of the various interchangeable fats and oils has become narrower over a long period.

The increasing scope for substituting cheaper products for more expensive products has contributed to this. It has tended to raise the long term price of the former and lower the price level of the latter.

The extent to which different fats and oils move together provides some form of indication of interchangeability among them. These price movements may be affected by the correlation coefficients which we found in Table 3.10. It can be observed that the price movements of oils of the same group tend to be highly correlated. The price movements of the soft oils, with the exception of olive oil, tend to be very highly correlated, for example soybean and rapeseed have a correlation coefficient of 0.952 at the .001 level of significance. However that of soybean and coconut is only 0.096 the significance of which is 0.357. Exceptions are palm and palm kernel oil which not only have fairly high correlation coefficients with the soft oils but are significantly correlated. They share common usage with the soft oils. One can therefore conclude that the higher the correlation coefficient the greater is the possibility of substitution between oils. Using the same data used for the correlation matrix which is that contained in Table 3.9 until 1976, tallow was discovered to be the lowest priced fat. Table 3.11 shows the means of the various oils in descending order of magnitude.

The price of coconut oil appears to move independently of the other oils. The same could be said for tallow and fish oil.

3.3 The Place of Palm Oil

3.3.1 World Production and Trade in Palm Oil

Palm oil is a relatively minor oil in international trade accounting for only 7.7 per cent over the 1966-76 period. After a period of relative stability in production from 1957 to 1967 when deviations were less than 5 per cent, 1968 saw the beginning of an

TABLE 3.11

AVERAGE PRICES OF SELECTED OILS, 1960-1976

Fat or Oil	Average Price US$
Butter	1525.5
Olive oil	1436.7
Groundnut oil	642.1
Cottonseed oil	589.8
Coconut oil	586.3
Palm kernel oil	568.9
Sunflower	535.3
Soybean oil	482.0
Rapeseed oil	457.5
Lard	442.3
Palm oil	431.1
Fish oil	329.4
Tallow	320.7

expansionary trend which continued well into 1976, mainly due to the progressive maturity of Malaysian oil palm plantings during the 1960 s and steadily increasing production in Indonesia, Zaire and the Ivory Coast. Palm oil's share in the exports of fats and oils has grown from 5 per cent in 1967[1] to 12.5 per cent in 1975. The share however dropped to 11.9 per cent in 1976. The share of palm oil in world production of fats and oils rose 3.4 per cent in 1967 to 6.2 per cent in 1976.

Throughout the first half of this century Africa led the world in the production and export of palm oil with Nigeria and Zaire (formerly the Congo) as leaders. But growing commercial planting of the oil palm species Elaeis Guineensis in South East Asia during the first half of the

1. 1967 was a year when the upward trend was reversed. Compare 5 per cent with 5.9per cent average for the 1964-1966 period. This deviation could be explained by the civil war in Nigeria at that time.

century coupled with Nigeria's increasing local consumption of the oil spelled the end of Africa's dominance as a net world exporter of palm oil.

By 1966, Malaysia and Indonesia together had surpassed Africa's total palm oil exports even though Nigeria alone produced more that year than Malaysia and Indonesia combined. Tables 3.12 and 3.13 give the five-year averages and percentage shares of palm oil production and exports in the major producing and exporting countries. Figures 3.2 and 3.3 show palm oil production and exports for selected countries.

Table 3.14 gives the palm oil imports by the main importing countries, again the five-year average and percentage shares are given. The top eight major importers of palm oil are shown below in Table 3.15.

Eight countries therefore import about 82 per cent of all palm oil imports. As can be observed, Western Europe is the major deficit area (47 per cent of the World's total). Singapore's share is large but this country serves as an entrepot for palm oil on its way mainly to Western Europe. The trend for individual countries is not as obvious. Some countries have increased their imports substantially, for example the United States, where the average volume imported in the seventies is ten times that imported in the fifties. Their share in the seventies is five times that of the fifties. A somewhat similar phenomenon can be observed with Japan, although not of the same magnitude. On the other hand there are others like India amongst the developing countries where shares have been halved, and yet others like the United Kingdom where there has been a downward trend in the relative volumes imported over the years in spite of increases in the absolute volumes imported.

TABLE 3.12

PALM OIL PRODUCTION IN MAJOR PRODUCTION COUNTRIES, FIVE-YEAR AVERAGES AND PERCENTAGE SHARES

	1955-59		1960-64		1965-69		1970-74	
	1000MT	%	1000MT	%	1000MT	%	1000MT	%
Western Africa	536.06	46.69	763.64	59.95	750.98	53.88	995.23	43.02
Nigeria	433.28	37.74	499.98	39.09	431.60	30.96	533.40	23.06
Liberia	39.94	3.48	40.48	3.18	41.20	2.96	7.00	0.30
Sierra Leone	-	-	36.20	2.84	41.40	2.97	58.00	2.51
Dahomey	13.80	1.20	38.80	3.05	32.92	2.36	42.60	1.84
Ivory Coast	7.06	0.61	2.86	0.22	30.50	2.19	91.48	3.95
Cameroon	18.50	1.51	38.64	3.03	48.36	3.47	57.60	2.49
Angola	14.10	1.23	26.80	2.10	35.60	2.55	74.60	3.22
Eastern Africa	225.80	19.67	225.04	17.67	172.58	12.38	182.82	7.90
Zaire	224.28	19.54	223.72	17.57	170.80	12.25	180.18	7.79
Latin America - Caribbean	17.56	1.53	27.67	2.17	53.48	3.84	92.16	3.98
Columbia	-	-	0.01	0.00	9.72	0.70	38.62	1.67
Costa Rica	3.36	0.29	6.00	0.47	10.00	0.72	14.44	0.62
Mexico	11.92	1.04	13.36	1.05	13.00	0.93	11.32	0.49
East Asia - Pacific	218.64	19.05	256.00	20.10	416.86	29.90	1043.31	45.10
Indonesia	155.22	13.52	147.52	11.58	176.42	12.65	273.72	11.84
Malaysia	63.42	5.53	108.48	8.52	240.44	17.25	728.10	31.47
Others	163.12	14.21	92.97	7.30	111.94	8.03	202.46	8.75
Total World	1148.00	100.00	1273.82	100.00	1393.90	100.00	2313.52	100.00

Source: World Bank 1976

TABLE 3.13

PALM OIL WORLD EXPORTS BY MAJOR PRODUCING COUNTRIES FIVE-YEAR AVERAGES AND PERCENTAGE SHARES 1955 - 1974

	1955-59		1960-64		1965-69		1970-74	
	1000MT	%	1000MT	%	1000MT	%	1000MT	%
Western Africa	212.46	36.76	191.67	31.30	105.45	14.96	86.02	6.38
Nigeria	180.40	31.21	147.64	24.13	65.23	9.25	5.96	0.44
Dahomey	12.64	2.19	11.61	1.89	30.86	1.54	11.65	0.86
Ivory Coast	1.14	0.20	0.88	0.14	0.92	0.13	48.90	3.62
Cameroon	0.46	0.08	8.26	1.34	8.42	1.19	7.35	0.54
Angola	8.79	1.52	15.45	2.52	13.44	1.90	7.35	0.54
Eastern Africa	160.53	27.78	148.87	24.31	114.24	16.21	89.98	6.67
Zaire	160.53	27.78	148.79	24.30	114.19	16.20	89.97	6.67
Latin America - Caribbean	0.16	0.03	2.28	0.37	3.67	0.52	5.22	0.38
Paraguay	-	-	1.75	0.28	2.67	0.37	4.54	0.33
S.East Asia - Pacific	188.33	32.58	222.31	36.31	385.44	51.69	903.67	67.05
Indonesia	121.17	20.96	113.88	18.60	153.56	21.78	229.70	17.04
Malaysia	67.16	11.62	106.48	17.71	231.88	32.90	673.97	50.00
Singapore	-	-	27.02	4.41	74.15	10.52	196.43	14.57
Others	25.66	4.44	30.52	4.98	9.31	1.32	71.89	5.34
World Total	577.95	100.00	612.23	100.00	704.63	100.00	1347.71	100.00

FIGURE 3.2

PALM OIL PRODUCTION FOR SELECTED COUNTRIES (1961-1974)

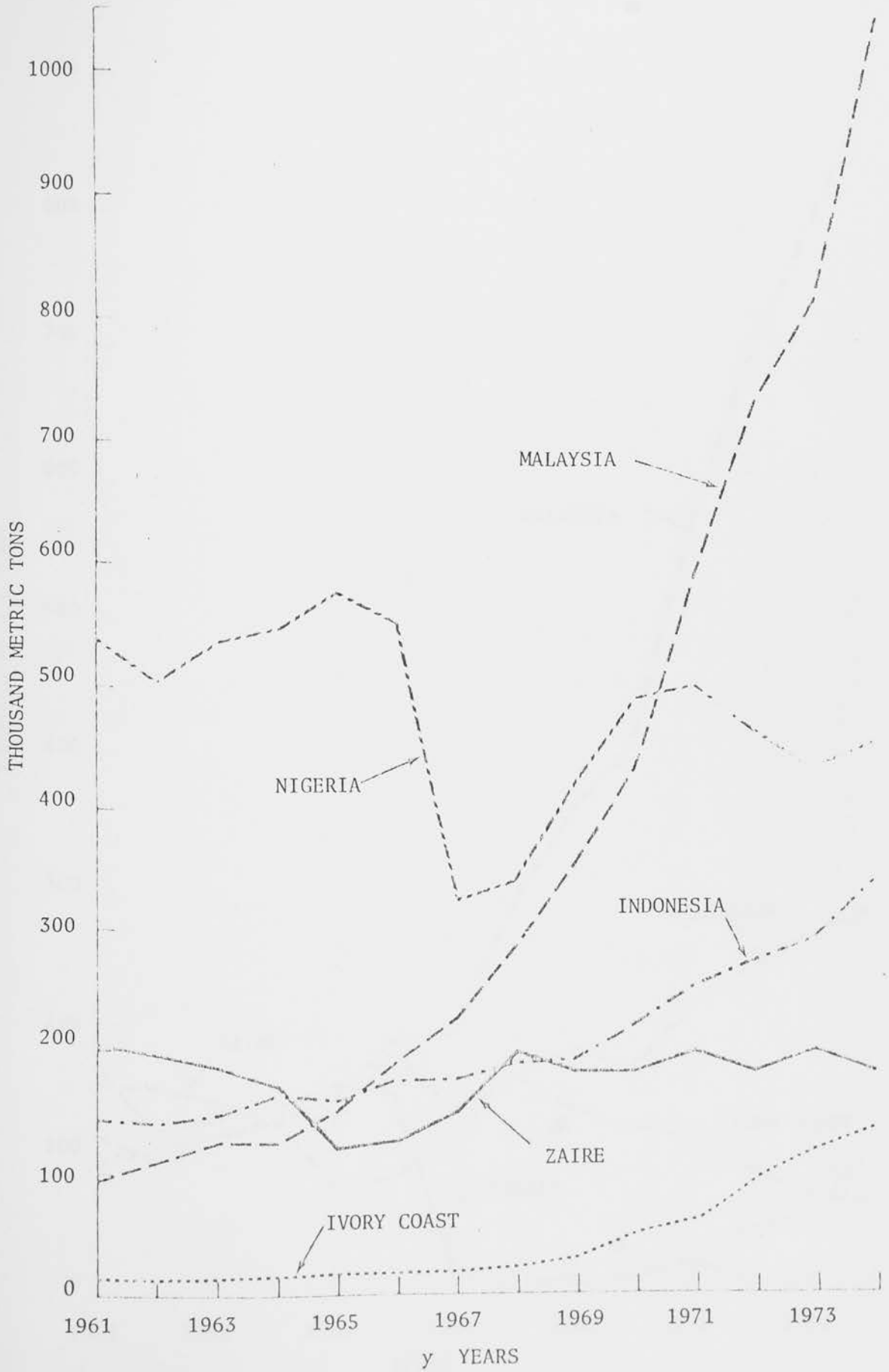

FIGURE 3.3

PALM OIL EXPORTS FOR SELECTED COUNTRIES (1961-1974)

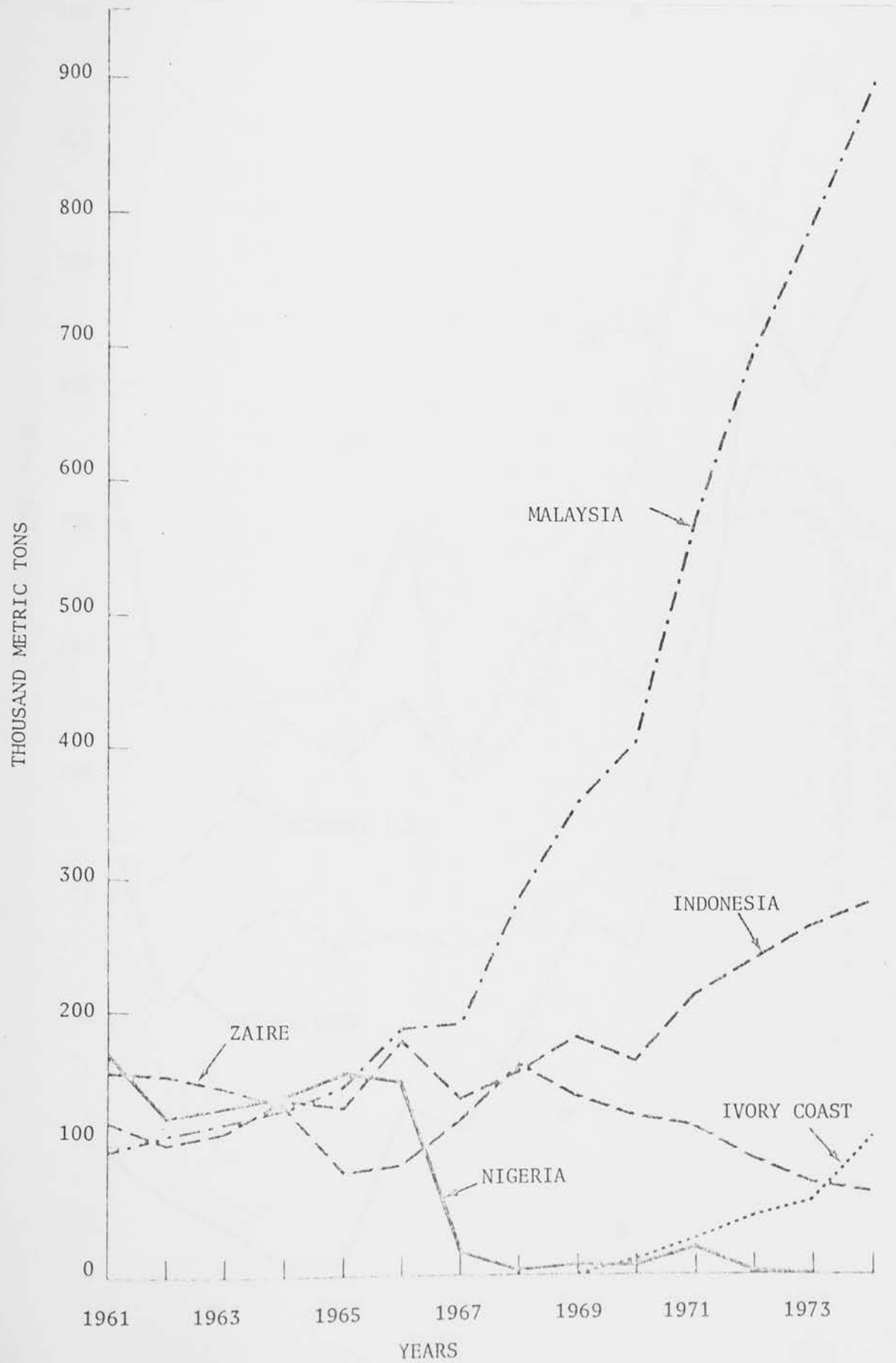

FIGURE 3.4

PALM OIL IMPORTS FOR SELECTED COUNTRIES (1961-1974)

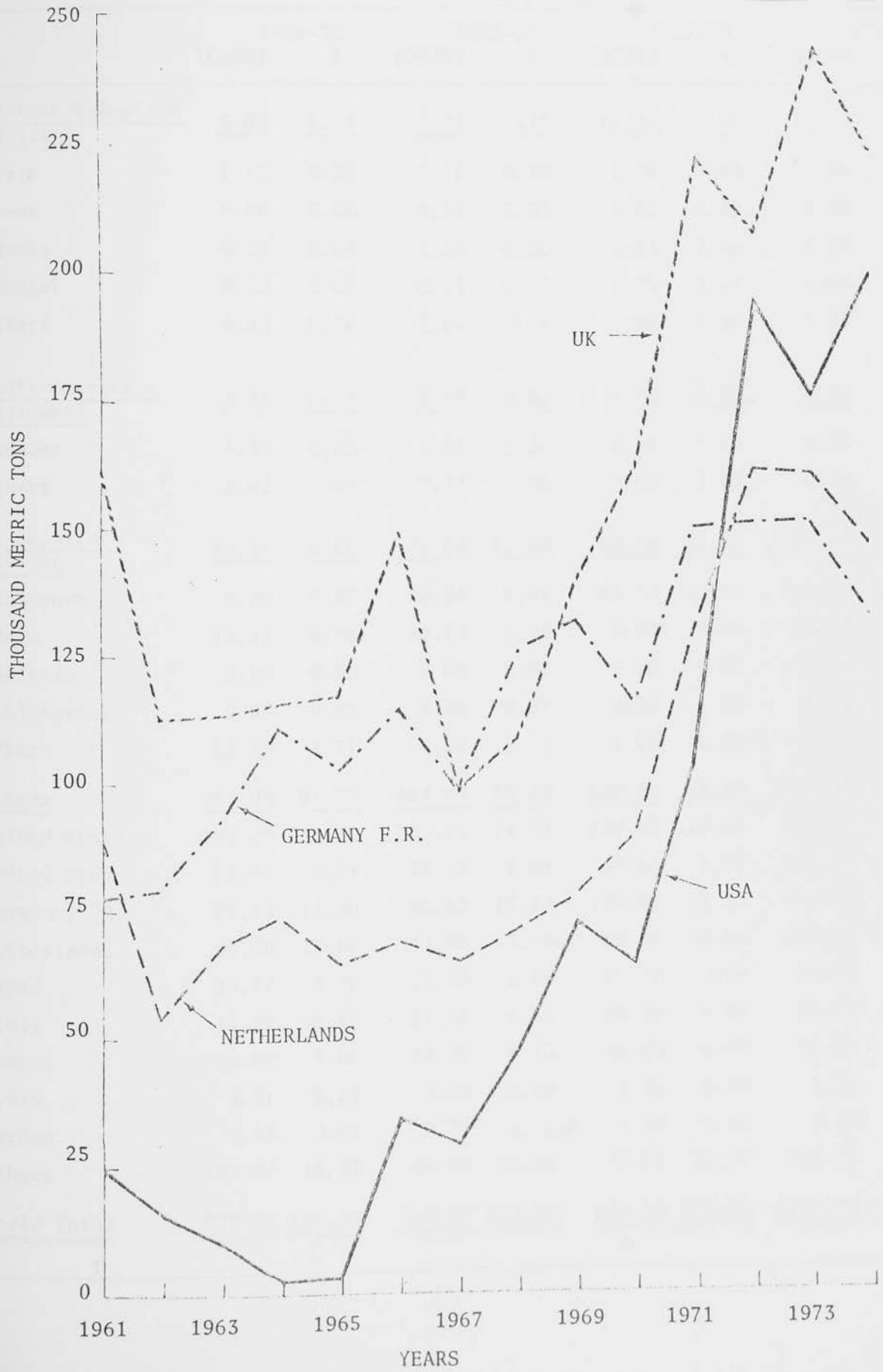

TABLE 3.14

PALM OIL IMPORTS BY MAJOR IMPORTING COUNTRIES FIVE-YEAR AVERAGES AND PERCENTAGE SHARES, 1955-74

	1955-79		1960-64		1965-69		1970-74	
	1000MT	%	1000MT	%	1000MT	%	1000MT	%
Eastern & Western Africa	6.42	1.08	7.71	1.35	15.37	2.42	27.50	2.20
Kenya	1.52	0.25	1.76	0.30	5.94	0.93	13.36	1.07
Ghana	0.00	0.00	0.21	0.03	1.45	0.22	3.78	0.30
Uganda	0.28	0.04	1.76	0.30	1.43	0.22	2.29	0.18
Senegal	0.20	0.03	0.01	0.00	0.73	0.12	1.86	0.14
Others	4.42	0.76	3.97	0.72	5.82	0.93	6.21	0.51
Latin America - Caribbean	3.95	0.66	5.25	0.92	4.56	0.72	6.27	0.50
Ecuador	1.33	0.22	1.51	0.26	0.94	0.14	5.39	0.43
Others	2.62	0.44	3.74	0.66	3.62	0.58	0.88	0.07
S, SE.Asia - Pacific	38.46	6.50	71.69	12.60	85.06	14.45	263.67	20.82
Singapore	0.00	0.00	28.54	5.01	69.34	10.96	221.36	17.73
India	17.42	2.94	34.13	6.00	5.52	0.87	23.27	1.86
Pakistan	0.00	0.00	0.00	0.00	2.12	0.33	9.93	0.79
Philippines	5.05	0.85	4.99	0.87	6.99	1.10	4.32	0.34
Others	15.99	2.71	4.03	0.72	1.09	1.19	4.79	0.10
Others	541.98	91.73	483.92	85.10	527.60	83.39	950.44	75.85
United Kingdom	197.05	33.35	136.70	24.04	122.85	19.42	212.13	16.99
United States	15.01	2.54	15.25	2.68	37.15	5.87	147.86	11.84
Germany, FR	72.43	12.26	86.57	15.22	115.07	18.19	140.40	11.20
Netherlands	80.80	13.68	74.50	13.10	69.32	10.95	137.56	11.02
Japan	19.77	3.35	15.30	2.69	25.70	4.06	70.35	5.63
Italy	15.52	2.63	27.59	4.85	38.18	6.03	51.71	4.14
France	29.99	5.08	34.90	6.13	38.00	6.00	49.14	3.93
Syria	3.51	0.59	3.40	0.59	1.92	0.30	3.39	0.27
Jordan	0.13	0.02	0.72	0.12	1.94	0.30	3.13	0.25
Others	107.77	18.23	18.99	15.68	77.47	12.27	134.77	10.58
World Total	590.81	100.00	568.57	100.00	632.59	100.00	1247.88	100.00

TABLE 3.15

SHARES OF THE EIGHT MAJOR PALM OIL IMPORTING COUNTRIES 1970-74

Country	Share
Singapore	17.73
United Kingdom	16.99
United States	11.84
Germany, FR	11.25
Netherlands	11.02
Japan	5.63
Italy	4.14
France	3.93
Total	82.53

3.3.2 End Uses of Palm Oil

Historical evidence shows a wide range of useful applications for palm oil. These have ranged from hand cream and medicine in 18th century Britain to a lubricant for the modern tin plate manufacturing industry in the United States. Today, most is consumed as edible oil, especially in shortening and margarine, while advances in fractionation methods have expanded its use in the manufacture of salad oils. Although little information on the breakdown of end-uses is available, S.O.R.C.A.[1] (1971) arrived at the following breakdown in its uses.

TABLE 3.16

END USES OF PALM OIL IN WESTERN EUROPE

End Uses	1969	1975
Margarine	34	35
Cooking fats	17	19
Other edible uses	24	27
Soap	4	2
Metallurgy	10	7
Other non-edible uses	10	10
Total	100	100

In the manufacture of edible products such as margarine and cooking oils, palm oil faces strong competition from soybean, sunflower and marine oils and lard. Because of the ease of substitution, a number of formulae exist for the manufacture of margarine. The degree of substitution is, however, limited as some contributing factors are specific consumer

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1 S.O.R.C.A. Societé de Recherche Operationale et d'Econome Applique (1971).

requirements. There are preferences for specific finished products such as for margarine high in linoleic acid for improved fat digestion, thereby resulting in a low level of cholesterol in the blood stream. As is publicized, a high cholesterol level is highly correlated with the incidence of heart disease.

The use of tallow and synthetics which tend to be cheaper and technically easier to use has served to reduce the use of palm oil in soap manufacture. It is hoped that this trend may be reversed by a preference for bio-degradable products owing to a growing concern for the effects of chemicals on the environment.

APPENDIX 4.1

DETERMINATION OF SPECIFIC ACCOUNTING RATIOS FOR TRADED AND NON-TRADED GOODS

The shadow price of a traded commodity i, P^a_i, is given by the c.i.f. (f.o.b.) price plus (minus) the cost of the trade and transport margins at accounting prices to the point of consumption (production). Thus if,

P^{cif}_i, P^{fob}_i are the cif price if the commodity i is an importable or the fob price if it is an exportable

t_i is the tariff of the commodity of if it is an importable

m_i is the trade and transport margin

P^d_i is the producer price of the commodity (that is net of excise taxes)

A_i is the accounting ratio P^a_i/P^d_i which converts the value of the commodity at domestic prices into accounting values

A_m is the accounting ratio for trade and transport margins,

then

$$P^a_i = P^{cif}_i[1+(1+t_i)m_iA_m] \quad \text{(for an importable)}$$

or $P^{fob}_i[1-m_iA_m]$ (for an exportable)

$$P^d_i = P^{cif}(1+t_i)(1+m_i) \quad \text{(for an importable)}$$

or $P^{fob}(1-m_i)$ (for an exportable, assuming no export subsidies a taxes)

Hence:

$$A_i = 1+ (1+t_i)m_i.A_m/(1+t_i)(1+m_i) \quad \text{(for an importable)} \qquad 1.1$$

or

$$= (1-m_i.A_m)/(1-m_i) \quad \text{(for an exportable)}$$

Table A4.1.1 indicates the tariff rates and accounting ratios for 34 traded goods. The list includes fertilizer, vehicles, motor accessories, building and construction items and a few consumer items e.g. poultry and stationery. The main idea, here, was to have a bundle of items as 'representative' as possible of those to be used in the project . The tariff levels were obtained from the International Customs Journal for

TABLE A.4.1.1

ACCOUNTING RATIOS

Item	Tariff level % (t_i)	Accounting Ratio $A=1/(1+t_i)$
Sulphate of Ammonia	5	0.95
Muriate of Potash	5	0.95
Magnesium Sulphate	5	0.95
Trace elements	0	1.00
Superphosphate	5	0.95
Lorries	50	0.67
Tractor & Trailer	10	0.91
Other Motor Vehicles	25	0.80
Tyres	50	0.67
Gasolene	25	0.80
Lubricating oil	25	0.80
Oil filters	50	0.67
Grease	50	0.67
Paint	40	0.71
Bricks	40	0.71
Nails	10	0.91
Radio apparatus	40	0.71
Envelopes	40	0.71
Registers	40	0.71
Clothing	60	0.63
Steak	20	0.83
Mutton	20	0.83
Pork	20	0.83
Poultry	20	0.83
Salted Pork	10	0.91
Ham	10	0.91
Fish	10	0.91
Mackerel	10	0.91
Soybean oil	60	0.63
Olive oil	60	0.63
Coconut oil	60	0.63
Onions	15	0.87
Oranges	20	0.83
Bacon	10	0.91

Guyana (1971-1972). Since it has not been possible to obtain reliable trade and transport margins for Guyana, these have been disregarded, hence the accounting ratios for the commodities can simply be given as $1/(1+t_i)$. These 'specific conversion factors' so obtained were used to convert input costs valued at market prices to those at border prices.

The 'specific conversion factors' for 3 services were determined with the help of the 1959 Inter-industry Table of the Economy published in 1963. These services were building and construction, fuel, power and water and transportation. First one had to determine the proportion of input costs which were associated with wages, salaries, foreign exchange and taxes. These were determined by the costs listed under households, professionals and foreign exchange and then supplemented by costs accruing to these sectors by subdividing the other major services involved. This exercise yielded the following breakdown:

Sector	Wages	Salaries	Foreign Exchange	Tax
Building & Construction	33.0	0.6	26.0	40.0
Fuel, Power & Water	9.0	0.5	54.0	36.5
Transportation	68.0	0.4	21.0	10.6

The next step involved the estimation of 'specific conversion factors' in the following way:

1. An expenditure on each service of $100,000 was assumed.
2. Using the fractions above this total was divided into wages, salaries and foreign exchange. Profits were not included as these were not listed in the Inter-industry table.
3. These quantities in market prices were converted to their border price equivalent by applying conversion factors of 0.75 to wages (first guess), 0.8 to foreign exchange (conversion factor for traded goods analysed so far) and 0.9 to salaries for reasons suggested in the relevant section of chapter 4 (4.1.7).
4. The resulting totals were amalgamated and expressed as a fraction of $100,000.
5. The fraction of (4) was the accounting ratio or 'specific

conversion factor' for that service.

The specific conversion factors derived thus were

Sector	Specific Conversion Factor
Building & Construction	0.45
Fuel, Power & Water	0.47
Transportation	0.67

All conversion factors were used in determining the 'Standard Conversion Factor' by the method outlined in Chapter 4.

APPENDIX 4.2

PLANTING TARGETS FOR THE ESTATE

Project Years	Field Planting Acreage
1976 or year 1	-
1977 or year 2	1000
1978 or year 3	1500
1979 or year 4	2500
1980 or year 5	2500
1981 or year 6	2500

APPENDIX 4.3

FARMERS ANNUAL PLANTING TARGETS

PER FARMER AND PER BATCH

(a)

OIL PALMS

Farmers		Year						Total
Batch No		1976	1977	1978	1979	1980	1981	
				Acreage Per Farmer				
1st		-	6	5	4	3	2	20
2nd		-	-	6	5	5	4	20
3rd		-	-	-	6	7	7	20
				Acreage Per Batch				
1st	230	-	1380	1150	920	690	460	4600
2nd	230	-	-	1380	1150	1150	920	4600
3rd	290	-	-	-	1740	2030	2030	5800
Total		-	1380	2530	3810	3870	3410	15000

APPENDIX 4.3

(b)

FOOD CROPS

Project Year	Crop	Acreage per Farmer			Total Acreages Produced
		1st Batch 230 farmers	2nd Batch 230 farmers	3rd Batch 290 farmers	
1976	Sweet Potato	-	-	-	-
	Cassava	-	-	-	-
	Peanuts	-	-	-	-
1977	Sweet Potato	3	-	-	690
	Cassava	2	-	-	460
	Peanuts	1	-	-	230
1978	Sweet Potato	4	3	-	1610
	Cassava	4	2	-	1380
	Peanuts	1	1	-	460
1979	Sweet Potato	4	4	3	2710
	Cassava	4	4	2	2420
	Peanuts	1	1	1	750
1980	Sweet Potato	3	4	4	2770
	Cassava	4	4	4	3000
	Peanuts	1	1	1	750
1981	Sweet Potato	2	3	4	2310
	Cassava	3	4	4	2770
	Peanuts	1	1	1	750
1982	Sweet Potato	1	3	4	2080
	Cassava	3	4	4	2770
	Peanuts	1	1	1	750
1983 onwards	Sweet Potato	1	1	1	750
	Cassava	1	1	1	750
	Peanuts	1	1	1	750

Yields (lb) used were:	Full Crop	Inter-crops
Sweet Potato	7000	5320
Cassava	15000	11400
Peanuts	3000	2280

APPENDIX 4.4

(a)

SCHEDULE OF MILL INSTALLATIONS

Details	Palm Oil Extraction Unit		Palm Kernel Crushing Unit	
	1st phase	2nd phase	1st phase	2nd phase
a) Date of placing orders	Late 1977	Mid 1981	Late 1979	Mid 1982
b) Date of delivery	Late 1978	Mid 1982	Late 1980	Mid 1983
c) Date to complete installation	End 1979	End 1982	End 1981	End 1983
d) Date to commence operation	Early 1980	Early 1983	Early 1982	Early 1984

APPENDIX 4.4

(b)

FRESH FRUIT BUNCHES YIELD PER ACRE AND EXTRACTION RATES OF PALM OIL, PALM KERNEL OIL AND PALM KERNEL CAKE AT CAPE HOSKINS, PAPUA NEW GUINEA

Year of Planting	Year of Harvesting	Yield of f.f.b. tons per acre	Extraction Rates			
			Palm Oil %	Palm Kernel %	Palm Kernel Oil %	Palm Kernel Cake %
4	1	3.2	18	3.0	1.5	1.5
5	2	6.7	19	3.4	1.7	1.7
6	3	8.7	20	3.5	1.75	1.75
7	4	9.5	21	3.6	1.8	1.8
8	5	9.9	21	3.6	1.8	1.8
9	6	9.9	20	3.5	1.75	1.75
10	7	9.7	19	3.4	1.7	1.7
11	8	9.5	19	3.4	1.7	1.7
12	9	9.3	19	3.4	1.7	1.7
13	10	9.1	19	3.4	1.7	1.7
14	11	8.9	19	3.4	1.7	1.7
15	12	8.7	19	3.4	1.7	1.7
16	13	8.5	19	3.4	1.7	1.7
17	14	8.3	19	3.4	1.7	1.7
18	15	7.9	19	3.4	1.7	1.7
19	16	7.7	19	3.4	1.7	1.7
20	17	7.3	19	3.4	1.7	1.7

APPENDIX 4.5

LITTLE AND MIRRLEES - ESTATE REVENUE

(G$'000)

Item	Project Year							
	1976	1977	1978	1979	1980	1981	1982	1983
1.Palm Oil	-	-	-	-	224.6	716.3	1879.5	3694.1
2.Palm Kernel Oil	-	-	-	-	-	-	291.7	401.2
3.Palm Kernel Cake	-	-	-	-	-	-	47.3	65.0
Total	-	-	-	-	224.6	716.3	2218.5	4160.3
Timber	10584.0	15756.0	26460.0	26460.0	26460.0	-	-	-
Salvage Value	-	-	-	-	-	-	-	-
Total	10584.0	15756.0	26460.0	26460.0	26684.6	716.3	2218.5	4160.3

APPENDIX 4.5 (Cont'd)

Item	Project Year						
	1984	1985	1986	1987	1988	1989	1990-1995
1.Palm Oil	6221.3	8842.1	11824.8	14196.0	16224.0	17784.0	18720.0
2.Palm Kernel Oil	713.7	1073.3	1505.6	1901.0	2218.2	2431.9	2559.9
3.Palm Kernel Cake	115.7	174.0	244.1	308.3	359.7	394.4	415.1
Total	7050.7	10080.4	13574.5	16405.3	18801.9	20610.3	21694.9
Timber (1.2)	-	-	-	-	-	-	-
Salvage Value	-	-	-	-	-	-	3562.2
Total	7050.7	10080.4	13574.5	16405.3	18801.9	20610.3	21694.9*

* 1995 Total = 25257.1

APPENDIX 4.6

LITTLE AND MIRRLEES - COOPERATIVE MILL REVENUE

(G$'000)

Items	Project Years							
	1976	1977	1978	1979	1980	1981	1982	1983
1.Palm Oil	-	-	-	-	232.5	818.9	2136.8	4255.8
2.Palm Kernel Oil	-	-	-	-	-	-	439.2	459.3
3.Palm Kernel Cake	-	-	-	-	-	-	71.2	74.5
Sub Total	-	-	-	-	232.5	818.9	2647.2	4789.6
Seedlings	-	126.9	240.6	374.1	392.2	356.2	-	-
Salvage Value (1995)	-	-	-	-	-	-	-	-
Total	-	126.9	240.6	374.1	624.7	1175.1	2647.2	4789.6

APPENDIX 4.6 (Cont'd)

Items	Project Years						
	1984	1985	1986	1987	1988	1989	1990-1995
1.Palm Oil	7121.5	10095.4	13343.5	16111.3	18387.0	20116.9	21078.7
2.Palm Kernel Oil	815.4	1228.5	1713.9	2161.9	2514.4	2750.9	2882.4
3.Palm Kernel Cake	132.2	199.2	277.9	350.6	407.7	446.1	467.4
Sub Total	8069.1	11523.1	15335.3	18623.8	19309.1	23313.9	24428.5
Seedlings	-	-	-	-	-	-	-
Salvage Value (1995)	-	-	-	-	-	-	1899.0
Total	8069.1	11523.1	15335.3	18623.8	19309.1	23313.9	24428.5*

* 1995 Total = 26327.5

APPENDIX 4.7

LITTLE AND MIRRLEES - FARMERS REVENUE

(G$'000)

Item	Project Years							
	1976	1977	1978	1979	1980	1981	1982	1983
Fresh Fruit Bunches	-	-	-	-	155.2	533.0	1349.8	2635.3
Sweet Potato	-	440.5	1027.8	1730.1	1768.4	1474.7	1327.9	630.0
Cassava	-	104.9	786.6	1379.4	1710.0	1578.9	1578.9	562.5
Peanuts	-	529.6	1059.3	1727.1	1727.1	1727.1	1727.1	2272.5
Total	-	1075.0	2873.7	4836.6	5360.7	5313.7	5983.7	6100.3
Total X0.8 (SCF)	-	860.0	2299.0	3869.3	4288.6	4251.0	4787.0	4800.2

APPENDIX 4.7 (Cont'd)

Item	Project Years						
	1984	1985	1986	1987	1988	1989	1990-1995
Fresh Fruit Bunches	4352.9	6097.6	8018.9	9682.3	11049.9	12089.5	12667.5
Sweet Potato	630.0	630.0	630.0	630.0	630.0	630.0	630.0
Cassava	562.5	562.5	562.5	562.5	562.5	562.5	562.5
Peanuts	2272.5	2272.5	2272.5	2272.5	2272.5	2272.5	2272.5
Total	7817.9	9562.6	11483.9	13147.3	14514.9	15554.5	16132.5
Total X0.8 (SCF)	6254.3	7650.1	9187.1	10517.8	11611.9	12443.6	12906.0

APPENDIX 4.8

LITTLE AND MIRRLEES-ESTATE COSTS

(G$'000)

Item	Project Years									
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
(Conversion Factor)										
1.Labour (0.75)	101.7	325.7	684.4	1057.1	1450.0	1247.0	1074.6	1128.6	1276.5	1332.0
2.Salaries (0.90)	106.6	142.6	174.8	230.4	300.3	312.6	341.7	368.3	385.9	397.9
3.Materials	321.2	658.9	1239.8	1727.8	2185.0	1956.3	1965.0	1965.0	1965.0	1965.0
4.Transportation Charges (0.67)										
a) Establishment and Maintenance	6.2	19.2	31.3	57.6	44.1	30.2	8.0	7.7	8.8	8.8
b) Shipping	-	-	-	-	3.4	11.0	34.8	65.0	110.3	157.9
5.Services and Miscellaneous (0.80)	78.3	95.0	95.2	94.4	114.2	136.6	173.2	226.3	314.3	394.3
6.Buildings and Equipment (0.45 and 0.80)	234.1	1009.4	1881.1	1593.4	257.8	575.4	1496.3	270.6	-	-
Total	848.1	2250.8	4106.6	4760.7	4354.8	4269.1	5093.6	4031.5	4060.8	4255.9
Timber	5928.0	8896.0	14824.0	14824.0	14824.0	-	-	-	-	-
Total with Timber	6776.1	11146.8	18930.6	19584.7	19178.8	4269.1	5093.6	4031.5	4060.8	4255.9

APPENDIX 4.8 (CONT'D)

Item	Project Years									
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
(Conversion Factor)										
1.Labour (0.75)	1387.5	1443.0	1498.5	1554.0	1609.5	1665.0	1720.5	1776.0	1831.5	1887.0
2.Salaries (0.90)	406.5	422.6	422.6	422.6	422.6	422.6	422.6	422.6	422.6	422.6
3.Materials (*)	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0
4.Transportation Charges (0.67)										
a)Establishment and Maintenance	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
b)Shipping	212.6	257.2	294.9	323.1	340.2	340.2	340.2	340.2	340.2	340.2
5.Services and Miscellaneous (0.80)	484.0	560.0	623.0	672.1	701.4	701.4	701.4	701.4	701.4	701.4
6.Buildings and Equipment (0.45 and 0.80)	-	-	-	-	-	-	-	-	-	-
Total	4464.4	4656.6	4812.8	4945.6	5047.5	5103.0	5158.5	5214.0	5269.5	5325.0
Timber	-	-	-	-	-	-	-	-	-	-
Total with Timber	4464.4	4656.6	4812.8	4945.6	5047.5	5103.0	5158.5	5214.0	5269.5	5325.0

APPENDIX 4.9

LITTLE AND MIRRLEES COOPERATIVE MILL COSTS

(G$'000)

Item		Project Years							
		1976	1977	1978	1979	1980	1981	1982	1983
(conversion factor)									
1.Labour	(0.75)	19.6	43.9	77.9	91.3	91.0	-	-	-
2.Salaries	(0.90)	72.3	89.0	96.2	112.0	152.5	167.1	179.7	198.7
3.Materials		129.0	236.5	356.1	361.7	318.7	-	-	-
4.Transportation Charges	(0.67)								
a) Nursery		4.1	7.5	11.3	11.5	10.2	-	-	-
b) Shipping		-	-	-	-	3.5	12.6	41.8	74.8
5.Services and Miscellaneous	(0.80)	59.4	89.8	110.6	117.6	270.6	600.2	1345.8	2411.0
6.Buildings and Equipment	(0.45+0.80)	158.5	867.4	1754.1	1504.2	310.7	601.6	1531.6	397.0
Total		442.9	1334.1	2406.2	2198.3	1157.1	1381.5	3098.9	3081.5

APPENDIX 4.9 (Cont'd)

Item		Project Years						
		1984	1985	1986	1987	1988	1989	1990-1995
(conversion factor)								
1.Labour	(0.75)	-	-	-	-	-	-	-
2.Salaries	(0.90)	208.6	216.3	219.3	223.7	223.7	223.7	223.7
3.Materials		-	-	-	-	-	-	-
4.Transportation Charges	(0.67)							
a)Nursery		-	-	-	-	-	-	-
b)Shipping		126.2	180.4	240.2	291.9	317.3	365.5	383.1
5.Services and Miscellaneous	(0.80)	3885.6	5372.1	7009.0	8426.2	9591.4	10477.2	10969.7
6.Buildings and Equipment	(0.45+0.80)	68.0	-	-	-	-	-	-
Total		4288.4	5768.8	7468.5	8941.8	10132.4	11066.4	11576.5

APPENDIX 4.10

LITTLE AND MIRRLEES - FARMERS' COSTS

(G$'000)

Item	Project Year							
	1976	1977	1978	1979	1980	1981	1982	1983
1. Consumption = 0.95 Revenue	-	817.0	2184.0	3675.8	4074.2	4038.4	4547.6	4560.2
2. Materials and Equipment (0.80) and Agro-chemicals	-	145.9	439.7	903.6	1323.2	1667.1	1837.9	1682.3
3. Transportation Charges								
a) To Collection Point	-	-	-	-	1.7	5.8	14.9	29.2
b) Other	-	8.6	29.3	49.9	65.1	65.1	42.4	11.8
4. Subsidies	-	602.6	1149.6	1770.6	1824.5	1622.1	334.2	180.0
Total	-	1574.1	3802.6	6399.9	7288.7	7398.5	6777.0	6463.5
Consumption = 0.25 Revenue	-	215.0	572.2	967.3	1072.1	1062.7	1196.7	1200.0
Total	-	972.1	2190.8	3691.4	4286.6	4422.8	3426.1	3103.3

APPENDIX 4.10 (Cont'd)

Item	Project Year						
	1984	1985	1986	1987	1988	1989	1990-1995
1.Consumption = 0.95	5941.6	7267.6	8727.8	9991.9	11031.3	11821.4	12260.7
2.Materials and Equipment (0.80) and Agro-chemicals	1650.7	1657.0	1657.0	1657.0	1657.0	1657.0	1657.0
3.Transportation Charges							
a)To Collection Point	48.4	68.1	89.6	108.1	103.3	135.0	141.5
b)Other	11.8	13.3	13.3	13.3	13.3	13.3	13.3
4.Subsidies	180.0	180.0	180.0	180.0	180.0	180.0	180.0
Total	7032.5	9186.0	10667.7	11950.3	12984.9	13806.7	14252.5
Consumption = 0.25 Revenue	1563.6	1912.5	2296.8	3286.8	3628.7	3888.6	4033.1
Total	2654.5	3830.9	4236.7	5245.2	5582.3	5873.9	6024.9

APPENDIX 4.11

LITTLE AND MIRRLEES - COMPONENT CASH FLOWS

ESTATE EXCLUDING THE TIMBER OPERATION

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	848.1	-848.1
1977	-	2250.8	-2250.8
1978	-	4106.6	-4106.6
1979	-	4760.7	-4760.7
1980	224.6	4354.8	-4130.0
1981	716.3	4269.1	-3552.8
1982	2218.5	5093.6	-2875.1
1983	4160.3	4031.5	128.8
1984	7050.7	4060.8	2989.9
1985	10089.4	4255.9	5833.5
1986	13574.5	4464.4	9110.1
1987	16405.3	4656.6	11748.7
1988	18801.9	4812.8	13989.1
1989	20610.3	4945.6	15664.7
1990	21694.9	5047.5	16647.4
1991	21694.9	5103.0	16591.9
1992	21694.9	5158.5	16536.4
1993	21694.9	5214.0	16480.9
1994	21694.9	5269.5	16425.4
1995	25257.1	5325.0	19932.1

Note: Shadow Wage Rate = 0.75 Market Wage Rate.

APPENDIX 4.12

LITTLE AND MIRRLEES - COMPONENT CASH FLOWS

COOPERATIVE MILL

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	442.9	-442.9
1977	126.9	1334.1	-1207.2
1978	240.6	2406.2	-2165.6
1979	374.1	2198.3	-1824.2
1980	624.7	1157.3	-532.6
1981	1175.1	1381.5	-206.4
1982	2647.2	3098.9	-451.7
1983	4789.6	3081.5	1708.1
1984	8069.1	4288.4	3780.7
1985	11523.1	5768.8	5754.3
1986	15335.3	7468.5	7866.6
1987	18623.8	8941.8	9682.0
1988	19309.1	10132.4	9176.7
1989	23313.9	11066.4	12247.5
1990	24428.5	11576.5	12852.0
1991	24428.5	11576.5	12852.0
1992	24428.5	11576.5	12852.0
1993	24428.5	11576.5	12852.0
1994	24428.5	11576.5	12852.0
1995	26327.5	11576.5	14751.0

APPENDIX 4.13

LITTLE AND MIRRLEES-COMPONENT CASH FLOWS

750 FARMERS

(G$'000)

Project Year	Social Benefits	Social Costs		Cash Flows	
		Consumption Level I	Consumption Level II	Consumption Level I	Consumption Level II
1976	-	-	-	-	-
1977	860.0	1574.1	972.1	714.1	-112.1
1978	2299.0	3802.6	219.8	-1503.6	108.2
1979	3869.3	6399.9	3691.4	-2530.6	177.9
1980	4288.6	7288.7	4286.6	-3000.1	2.0
1981	4251.0	7398.5	4422.8	-3147.5	-171.8
1982	4787.0	6777.0	3426.1	-1990.0	1360.9
1983	4800.2	6463.5	3103.3	-1663.3	1696.9
1984	6254.3	7032.5	2654.5	- 778.2	3599.8
1985	7650.1	9186.0	3830.9	-1535.9	3819.2
1986	9187.1	10667.7	4236.7	-1480.6	4950.4
1987	10517.8	11950.3	5245.2	-1432.5	5272.6
1988	11611.9	12984.9	5582.3	-1373.0	6029.6
1989	12443.6	13806.7	5873.9	-1363.1	6569.7
1990	12906.0	14252.5	6024.9	-1346.5	6881.1
1991	12906.0	14252.5	6024.9	-1346.5	6881.1
1992	12906.0	14252.5	6024.9	-1346.5	6881.1
1993	12906.0	14252.5	6024.9	-1346.5	6881.1
1994	12906.0	14252.5	6024.9	-1346.5	6881.1
1995	12906.0	14252.5	6024.9	-1346.5	6881.1

APPENDIX 5.1

CONVENTIONAL EFFICIENCY ANALYSIS - COOPERATIVE MILL REVENUE

(G$'000)

Item	Project Year							
	1976	1977	1978	1979	1980	1981	1982	1983
1.Palm Oil	-	-	-	-	232.5	818.9	2136.8	4255.8
2.Palm Kernel Oil	-	-	-	-	-	-	439.2	459.3
3.Palm Kernel Cake	-	-	-	-	-	-	71.2	74.5
Total	-	-	-	-	232.5	818.9	2647.2	4789.6
Seedlings ($9/acre)	-	12.4	22.8	34.3	34.8	30.7	-	-
Salvage Value	-	-	-	-	-	-	-	-
Total	-	12.4	22.8	34.3	267.3	849.6	2647.2	4789.6

APPENDIX 5.1 (Cont'd)

Item	Project Year						
	1984	1985	1986	1987	1988	1989	1990-1995
1.Palm Oil	7121.5	10095.4	13343.5	16111.3	18387.0	20116.9	21078.7
2.Palm Kernel Oil	815.4	1228.5	1713.9	2161.9	2514.4	2750.9	2882.4
3.Palm Kernel Cake	132.2	199.2	277.9	350.6	407.7	446.1	467.4
Total	8069.1	11523.1	15335.3	18623.8	19309.1	23313.9	24428.5
Seedlings ($9/acre)	-	-	-	-	-	-	-
Salvage Value	-	-	-	-	-	-	2373.8
Total	8069.1	11523.1	15335.3	18623.8	19309.1	23313.9	24428.5*

* 1995 Total = 26802.3

APPENDIX 5.2

CONVENTIONAL EFFICIENCY ANALYSIS - FARMERS' REVENUE
(G$'000)

Items	Project Years							
	1976	1977	1978	1979	1980	1981	1982	1983
Fresh Fruit Bunches	-	-	-	-	155.2	533.0	1349.8	2635.3
Sweet Potato	-	440.5	1027.8	1730.1	1768.4	1474.7	1327.9	630.0
Cassava	-	104.9	786.6	1379.4	1710.0	1578.9	1578.9	562.5
Peanuts	-	529.6	1059.3	1727.1	1727.1	1727.1	1727.1	2272.5
Total	-	1075.0	2873.7	4836.6	5360.7	5313.7	5983.7	6100.3

APPENDIX 5.2 (CONT'D)

Items	Project Years						
	1984	1985	1986	1987	1988	1989	1990-1995
Fresh Fruit Bunches	4352.9	6097.6	8018.9	9682.3	11049.9	12089.5	12667.5
Sweet Potato	630.0	630.0	630.0	630.0	630.0	630.0	630.0
Cassava	562.5	562.5	562.5	562.5	562.5	562.5	562.5
Peanuts	2272.5	2272.5	2272.5	2272.5	2272.5	2272.5	2272.5
Total	7817.9	9562.6	11483.9	13147.3	14514.9	15554.5	16132.5

APPENDIX 5.3

CONVENTIONAL EFFICIENCY ANALYSIS - ESTATE COSTS

(G$'000)

Item	Project Year							
	1976	1977	1978	1979	1980	1981	1982	1983
1.Capital Investment	1327.8	1978.0	3851.8	3898.6	2543.7	2183.5	2706.4	815.7
2.Operating and Maintenance								
a) Transportation (f.f.b.)	-	-	-	-	2.5	7.7	19.7	38.1
b) Processing	-	-	-	-	9.7	30.2	77.0	148.7
c) Shipping	-	-	-	-	5.1	16.4	52.0	97.0
3.Other	215.4	277.1	442.5	312.7	649.6	944.9	1433.7	1882.8
Total	1543.2	2255.1	4294.3	4211.3	3210.6	3182.7	4288.8	2982.3
Timber	7410.0	11120.0	18530.0	18530.0	18530.0	-	-	-
Total	8953.2	13375.1	22824.3	22741.3	21740.6	3182.7	4288.8	2982.3

APPENDIX 5.3 (Cont'd)

Item	Project Year						
	1984	1985	1986	1987	1988	1989	1990-1995
1. Capital Investment	12.0	-	-	-	-	-	-
2. Operating and Maintenance							
a) Transportation (f.f.b.)	63.4	89.0	117.8	142.2	162.5	178.1	187.5
b) Processing	247.4	347.3	459.5	554.5	633.7	694.7	731.2
c) Shipping	164.6	235.7	317.3	383.9	440.1	482.3	507.8
3. Other	2402.8	2416.1	2877.4	2443.6	2443.6	2443.6	2443.6
Total	2890.2	3088.1	3772.0	3524.2	3679.9	3798.7	3870.1
Timber	-	-	-	-	-	-	-
Total	2890.2	3088.1	3772.0	3524.2	3679.9	3798.7	3870.1

APPENDIX 5.4

CONVENTIONAL EFFICIENCY ANALYSIS - COOPERATIVE MILL COSTS

(G$'000)

Item	Project Year							
	1976	1977	1978	1979	1980	1981	1982	1983
Capital Investment	261.1	1153.0	2197.0	1889.0	388.4	752.0	1914.5	496.2
Nursery	193.6	354.9	534.5	542.9	478.4	-	-	-
Operating and Maintenance								
a) Purchase of f.f.b.	-	-	-	-	155.2	533.0	1349.8	2635.3
b) Processing	-	-	-	-	10.1	34.6	87.7	171.3
c) Shipping	-	-	-	-	5.3	18.8	62.4	111.7
d) Others	154.6	211.1	245.1	271.4	342.4	368.4	399.4	428.0
Total	609.3	1719.0	2976.6	2703.3	1379.8	1706.8	3813.8	3842.5

APPENDIX 5.4 (Cont'd)

Item	Project Year						
	1984	1985	1986	1987	1988	1989	1990-1995
Capital Investment	85.0	-	-	-	-	-	-
Nursery	-	-	-	-	-	-	-
Operating and Maintenance							
a) Purchase of f.f.b.	4352.9	6097.6	8018.9	9682.3	11049.9	12089.5	12667.5
b) Processing	282.9	396.3	521.2	629.3	718.2	785.8	823.4
c) Shipping	188.4	269.2	358.5	435.7	473.6	545.6	571.8
d) Others	453.0	461.5	464.9	469.8	469.8	469.8	469.8
Total	5362.2	7224.6	9363.5	11217.1	12711.5	13890.7	14532.5

APPENDIX 5.5

CONVENTIONAL EFFICIENCY ANALYSIS - FARMERS' COSTS
(G$'000)

Item	Project Year							
	1976	1977	1978	1979	1980	1981	1982	1983
Sweet Potato	-	82.2	191.8	322.8	330.0	275.2	247.8	117.6
Cassava	-	125.3	375.9	659.2	817.3	754.6	754.6	268.8
Peanuts	-	92.8	185.7	302.8	302.8	302.8	302.8	398.4
Oil Palms								
Transportation to Collection Point	-	-	-	-	2.5	8.7	22.2	43.6
Transportation	-	12.8	43.7	74.5	97.2	97.5	63.3	17.7
Subsidies (all crops)	-	602.6	1149.6	1770.6	1824.5	1622.1	334.2	180.0
Materials and Equipment	-	76.8	143.7	220.4	230.8	213.8	29.8	23.4
Others	-	149.0	587.0	1260.8	1999.5	2626.8	2819.9	3749.3
Total	-	1141.5	2677.4	4611.1	5604.6	5901.5	4574.6	4798.8

APPENDIX 5.5 (Cont'd)

Item	Project Year						
	1984	1985	1986	1987	1988	1989	1990-1995
Sweet Potato	117.6	117.6	117.6	117.6	117.6	117.6	117.6
Cassava	268.8	268.8	268.8	268.8	268.8	268.8	268.8
Peanuts	398.4	398.4	398.4	398.4	398.4	398.4	398.4
Oil Palms							
Transportation to Collection Point	72.3	101.7	133.7	161.4	184.2	201.5	211.2
Transportation	17.5	19.8	19.8	19.8	19.8	19.8	19.8
Subsidies (all crops)	180.0	180.0	180.0	180.0	180.0	180.0	180.0
Materials and Equipment	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Others	2660.3	2695.9	2695.9	2695.9	2695.9	2695.9	2695.9
Total	3741.9	3809.2	3841.2	3868.9	3891.7	3909.0	3918.7

APPENDIX 5.6

CONVENTIONAL EFFICIENCY ANALYSIS - COMPONENT CASH FLOWS

ESTATE EXCLUDING TIMBER OPERATION

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	1543.2	-1543.2
1977	-	2255.1	-2255.1
1978	-	4294.3	-4294.3
1979	-	4211.3	-4211.3
1980	224.6	3210.6	-2986.0
1981	716.3	3182.7	-2466.4
1982	2218.5	4288.8	-2070.3
1983	4160.3	2982.3	1178.0
1984	7050.7	2890.2	4160.5
1985	10089.4	3088.1	7001.3
1986	13574.5	3772.0	9802.5
1987	16405.3	3524.2	12881.1
1988	18801.9	3679.9	15122.0
1989	20610.3	3798.7	16811.6
1990	21694.9	3870.1	17824.8
1991	21694.9	3870.1	17824.8
1992	21694.9	3870.1	17824.8
1993	21694.9	3870.1	17824.8
1994	21694.9	3870.1	17824.8
1995	26147.7	3870.1	22277.6

APPENDIX 5.7

CONVENTIONAL EFFICIENCY ANALYSIS - COMPONENT CASH FLOWS

COOPERATIVE MILL

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	609.3	-609.3
1977	12.4	1719.0	-1706.6
1978	22.8	2976.6	-2953.8
1979	34.3	2703.3	-2669.0
1980	267.3	1379.8	-1112.5
1981	849.6	1706.8	- 857.2
1982	2647.2	3813.8	-1166.6
1983	4789.6	3842.5	947.1
1984	8069.1	5362.2	2706.9
1985	11523.1	7224.6	4298.5
1986	15335.3	9363.5	5971.8
1987	18623.8	11217.1	7406.7
1988	19309.1	12711.5	6597.6
1989	23313.9	13890.7	9423.2
1990	24428.5	14532.5	9896.0
1991	24428.5	14532.5	9896.0
1992	24428.5	14532.5	9896.0
1993	24428.5	14532.5	9896.0
1994	24428.5	14532.5	9896.0
1995	26802.3	14532.5	12269.8

APPENDIX 5.8

CONVENTIONAL EFFICIENCY ANALYSIS - COMPONENT CASH FLOWS

750 FARMERS

(G$'000)

Project Year	Social Benefits	Social Costs	Cash Flows
1976	-	-	-
1977	1075.0	1141.5	-66.5
1978	2873.7	2677.4	196.3
1979	4836.6	4611.1	225.5
1980	5360.7	5604.6	-243.9
1981	5313.7	5901.5	-587.8
1982	5983.7	4574.6	1049.1
1983	6100.3	4798.8	1301.5
1984	7817.9	3741.9	4076.0
1985	9562.6	3809.2	5753.4
1986	11483.9	3841.2	7642.7
1987	13147.3	3868.9	9278.4
1988	14514.9	3891.7	10623.2
1989	15554.5	3909.0	11645.5
1990	16132.5	3918.7	12213.8
1991	16132.5	3918.7	12213.8
1992	16132.5	3918.7	12213.8
1993	16132.5	3918.7	12213.8
1994	16132.5	3918.7	12213.8
1995	16132.5	3918.7	12213.8

APPENDIX 5.9

LITTLE AND MIRRLEES - SOCIAL BENEFITS OF PROJECT WITH YIELDS LEVEL II

(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	-	-	-	-
1977	-	126.9	860.0	1113.8
1978	-	240.6	2299.0	2539.6
1979	-	374.1	3869.3	4243.4
1980	247.1	1257.0	4437.6	5941.7
1981	787.9	900.8	4293.6	5982.3
1982	2440.3	2911.9	4894.9	10247.1
1983	4576.3	5268.6	5091.0	14935.9
1984	7755.8	8876.0	6602.6	23234.4
1985	11098.3	12675.4	8137.9	31911.6
1986	14931.9	16868.8	9828.6	41629.3
1987	18045.8	20486.2	11292.4	49824.4
1988	20682.1	21240.0	12495.9	54218.0
1989	22671.3	25645.3	13410.4	61727.3
1990	23864.4	26871.3	13919.4	64655.1
1991	23864.4	26871.3	13919.4	64655.1
1992	23864.4	26871.3	13919.4	64655.1
1993	23864.4	26871.3	13919.4	64655.1
1994	23864.4	26871.3	13919.4	64655.1
1995	27426.6	28770.3	13919.4	72116.3

APPENDIX 5.10

LITTLE AND MIRRLEES - SOCIAL COSTS OF PROJECT

WITH YIELDS LEVEL II

(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	848.1	442.9	-	1291.0
1977	2250.8	1344.0	1574.1	5168.9
1978	4106.6	2406.1	3802.6	10315.3
1979	4760.5	2198.3	6399.9	13358.7
1980	4355.5	1170.7	7430.4	12956.6
1981	4272.6	1428.2	7439.9	13140.7
1982	5103.3	3222.7	6881.0	15207.0
1983	4049.9	3316.5	6742.6	14109.0
1984	4091.6	4680.9	8168.2	16940.7
1985	4299.6	6306.3	9656.2	20192.1
1986	4522.5	8175.7	11286.1	23984.3
1987	4726.7	9795.9	12697.0	27219.6
1988	4893.0	11105.5	13835.0	29833.5
1989	5033.6	12132.9	14739.0	31905.5
1990	5140.0	12694.1	15229.3	33063.4
1991	5195.5	12694.1	15229.3	33118.9
1992	5251.0	12694.1	15229.3	33174.4
1993	5306.5	12694.1	15229.3	33229.9
1994	5362.0	12694.1	15229.3	33285.4
1995	5417.5	12694.1	15229.3	33340.9

APPENDIX 5.11

CONVENTIONAL EFFICIENCY ANALYSIS - SOCIAL BENEFITS OF PROJECT WITH YIELDS LEVEL II

(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	-	-	-	-
1977	-	12.4	1075.0	1087.4
1978	-	22.8	2873.7	2896.5
1979	-	34.3	4836.6	4870.9
1980	247.1	290.5	5376.2	5913.8
1981	787.9	1832.3	5367.0	7987.2
1982	2440.3	2911.9	6118.0	11470.9
1983	4576.3	5268.6	6363.8	16208.7
1984	7755.8	8876.0	8253.2	24885.0
1985	11098.3	12675.4	10172.4	33946.1
1986	14931.9	16868.6	12285.8	44086.5
1987	18045.8	20486.2	14115.5	52647.5
1988	20682.1	21240.0	15619.9	57542.0
1989	22671.3	25645.3	16763.4	65080.0
1990	23864.4	26871.3	17399.2	68134.9
1991	23864.4	26871.3	17399.2	68134.9
1992	23864.4	26871.3	17399.2	68134.9
1993	23864.4	26871.3	17399.2	68134.9
1994	23864.4	26871.3	17399.2	68134.9
1995	28317.2	29245.1	17399.2	74961.5

APPENDIX 5.12

CONVENTIONAL EFFICIENCY ANALYSIS - SOCIAL COSTS OF PROJECT WITH YIELDS LEVEL II

(G$'000)

Project Year	Sector			Total
	Estate	Cooperative Mill	750 Farmers	
1976	1543.2	609.3	-	2152.5
1977	2255.1	1719.0	1141.5	5115.6
1978	4294.3	2976.6	2677.4	9948.3
1979	4211.3	2703.3	4611.1	11525.7
1980	3212.3	1396.9	5604.8	10214.0
1981	3188.1	1765.5	5902.4	10856.0
1982	4303.7	3963.8	4576.8	12844.3
1983	3010.7	4134.3	4803.2	11948.2
1984	2937.7	5844.6	3749.1	12531.4
1985	3155.3	7900.9	3819.4	14875.6
1986	3861.4	10253.2	3854.6	17969.2
1987	3632.2	11829.7	3885.0	19346.9
1988	3803.5	13935.7	3910.1	21649.3
1989	3934.2	15862.8	3929.1	23726.1
1990	4012.7	15938.7	3939.8	23891.2
1991	4012.7	15938.7	3939.8	23891.2
1992	4012.7	15938.7	3939.8	23891.2
1993	4012.7	15938.7	3939.8	23891.2
1994	4012.7	15938.7	3939.8	23891.2
1995	4012.7	15938.7	3939.8	23891.2

APPENDIX 5.13

LITTLE AND MIRRLEES - SOCIAL COSTS OF ESTATE

WITH YIELDS LEVEL II

(G$'000)

Items	Project Years									
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1.Labour	101.7	325.7	684.4	1057.1	1450.0	1247.0	1074.6	1128.6	1276.5	1332.0
2.Salaries	106.6	142.6	174.8	230.4	300.3	312.6	341.7	368.3	385.9	397.9
3.Materials	321.2	658.9	1239.8	1727.8	2185.0	1956.3	1965.0	1965.0	1965.0	1965.0
4.Transportation Charges										
a)Establishment and Maintenance	6.2	19.2	31.3	57.6	44.1	30.2	8.0	7.7	8.8	8.8
b)Shipping	-	-	-	-	3.7	12.1	38.3	71.5	121.3	173.7
5.Services and Miscellaneous	78.3	95.0	95.2	94.4	115.0	139.0	179.4	238.2	334.1	422.2
6.Buildings and Equipment	234.1	1009.4	1881.1	1593.4	257.4	575.4	1496.3	270.6	-	-
Total	848.1	2250.8	4106.6	4760.5	4355.5	4272.6	5103.3	4049.9	4091.6	4299.6

APPENDIX 5.13 (CONT'D)

Items	Project Years									
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1.Labour	1387.5	1443.0	1498.5	1554.0	1609.5	1665.0	1720.5	1776.0	1831.5	1887.0
2.Salaries	406.5	422.6	422.6	422.6	422.6	422.6	422.6	422.6	422.6	422.6
3.Materials	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0	1965.0
4.Transportation Charges										
a) Establishment and Maintenance	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
b) Shipping	233.9	282.9	324.4	355.4	374.2	374.2	374.2	374.2	374.2	374.2
5.Services and Miscellaneous	520.8	604.4	673.7	727.8	759.9	759.9	759.9	759.9	759.9	759.9
6.Buildings and Equipment	-	-	-	-	-	-	-	-	-	-
Total	4522.5	4726.7	4893.0	5033.6	5140.0	5195.5	5251.0	5306.5	5362.0	5417.5

APPENDIX 5.14

LITTLE AND MIRRLEES - SOCIAL COSTS OF COOPERATIVE MILL

WITH YIELDS LEVEL II

(G$'000)

Items	Project Years							
	1976	1977	1978	1979	1980	1981	1982	1983
1.Labour	19.6	43.9	77.9	91.3	91.0	-	-	-
2.Salaries	72.3	89.0	96.2	112.0	152.5	167.1	179.7	198.7
3.Materials	129.0	236.5	356.1	361.7	318.7	-	-	-
4.Transportation Charges								
a)Nursery	4.1	7.5	11.3	11.5	10.2	-	-	-
b)Shipping	-	-	-	-	3.8	13.9	46.0	85.3
5.Services	59.4	89.7	110.5	117.6	283.8	645.6	1464.4	2635.5
6.Buildings and Equipment	158.5	867.4	1754.1	1504.2	310.7	601.6	1531.6	397.0
Total	442.9	1334.0	2406.1	2198.3	1170.7	1428.2	3222.7	3316.5

APPENDIX 5.14 (CONT'D)

Items	Project Years						
	1984	1985	1986	1987	1988	1989	1990-1995
1.Labour	-	-	-	-	-	-	-
2.Salaries	208.6	216.3	219.3	223.7	223.7	223.7	223.7
3.Materials	-	-	-	-	-	-	-
4.Transportation Charges							
a)Nursery	-	-	-	-	-	-	-
b)Shipping	138.8	198.4	264.2	321.1	349.0	402.0	421.4
5.Services	4265.5	5891.6	7692.2	9251.1	10532.8	11507.2	12049.0
6.Buildings and Equipment	68.0	-	-	-	-	-	-
Total	4680.9	6306.3	8175.7	9795.9	11105.5	12132.9	12694.1

APPENDIX 5.15

LITTLE AND MIRRLEES - FARMERS' COSTS

WITH YIELDS LEVEL II

(G$'000)

Items	Project Years							
	1976	1977	1978	1979	1980	1981	1982	1983
Consumption = 0.95 Revenue	-	817.0	2184.0	3675.8	4215.7	4078.9	4650.1	4836.4
Materials and Equipment and Agrochemicals	-	145.9	439.7	903.6	1323.2	1667.1	1837.9	1682.3
Transportation Charges								
a) To Collection Point	-	-	-	-	1.9	6.4	16.4	32.1
b) Other	-	8.6	29.3	49.9	65.1	65.1	42.4	11.8
Subsidies	-	602.6	1149.6	1770.6	1824.5	1622.1	334.2	180.0
Total	-	1574.1	3802.6	6399.9	7430.4	7439.6	6881.0	6742.6

APPENDIX 5.15 (CONT'D)

Items	Project Years						
	1984	1985	1986	1987	1988	1989	1990-1995
Consumption = 0.95 Revenue	6272.5	7731.0	9337.2	10727.8	11871.1	12740.2	13223.4
Materials and Equipment and Agrochemicals	1650.7	1657.0	1657.0	1657.0	1657.0	1657.0	1657.0
Transportation Charges							
a) To Collection Point	53.2	74.9	98.6	118.9	113.6	148.5	155.6
b) Other	11.8	13.3	13.3	13.3	13.3	13.3	13.3
Subsidies	180.0	180.0	180.0	180.0	180.0	180.0	180.0
Total	8168.2	9656.2	11286.1	12697.0	13835.0	14739.0	15229.3

APPENDIX 5.16

CONVENTIONAL EFFICIENCY ANALYSIS - SOCIAL COSTS OF ESTATE

WITH YIELDS LEVEL II

(G$'000)

Items	Project Years							
	1976	1977	1978	1979	1980	1981	1982	1983
Capital Investment	1327.8	1978.0	3851.8	3898.6	2543.7	2183.5	2706.4	815.7
Operating and Maintenance								
Transportation of f.f.b.	-	-	-	-	2.7	8.5	21.7	41.9
Processing	-	-	-	-	10.7	33.2	84.7	163.6
Shipping	-	-	-	-	5.6	18.0	57.2	106.7
Other	215.4	277.1	442.5	312.7	649.6	944.9	1433.7	1882.8
Total	1543.2	2255.1	4294.3	4211.3	3212.3	3188.1	4303.7	3010.7

APPENDIX 5.16 (CONT'D)

Items	Project Years						
	1984	1985	1986	1987	1988	1989	1990-1995
Capital Investment	12.0	-	-	-	-	-	-
Operating and Maintenance							
Transportation of f.f.b.	69.7	97.9	129.6	156.4	178.7	195.9	206.2
Processing	272.1	382.0	505.4	609.9	697.1	764.2	804.3
Shipping	181.1	259.3	349.0	422.3	484.1	530.5	558.6
Other	2402.8	2416.1	2877.4	2443.6	2443.6	2443.6	2443.6
Total	2937.7	3155.3	3861.4	3632.2	3803.5	3934.2	4012.7

APPENDIX 5.17

CONVENTIONAL EFFICIENCY ANALYSIS - SOCIAL COSTS OF COOPERATIVE MILL WITH YIELDS LEVEL II

(G$'000)

Items	Project Years											
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Capital Investment	261.1	1153.0	2197.0	1889.0	388.4	752.0	1914.5	496.2	85.0	-	-	-
Nursery	193.6	354.9	534.5	542.9	478.4	-	-	-	-	-	-	-
Operating and Maintenance												
Purchase of f.f.b.	-	-	-	-	170.7	586.3	1484.8	2898.8	4788.2	6707.4	8820.7	10188.5
Processing of f.f.b.	-	-	-	-	11.1	38.1	96.5	188.4	311.2	435.9	573.3	692.2
Shipping	-	-	-	-	5.9	20.7	68.6	122.9	207.2	296.1	394.3	479.2
Others	154.6	211.1	245.1	271.4	342.4	368.4	399.4	428.0	453.0	461.5	464.9	469.8
Total	609.3	1719.0	2976.6	2703.3	1396.9	1765.5	3963.8	4134.3	5844.6	7900.9	10253.2	11829.7

APPENDIX 5.17 (CONT'D)

Items	Project Years		
	1988	1989	1990-1995
Capital Investment	-	-	-
Nursery	-	-	-
Operating and Maintenance			
Purchase of f.f.b.	12154.9	13298.4	13934.2
Processing of f.f.b.	790.0	864.4	905.7
Shipping	521.0	600.2	629.0
Others	469.8	469.8	469.8
Total	13935.7	15862.8	15938.7

APPENDIX 5.18

CONVENTIONAL EFFICIENCY ANALYSIS - SOCIAL COSTS OF FARMERS

WITH YIELDS LEVEL II

(G$'000)

Item	Project Year							
	1976	1977	1978	1979	1980	1981	1982	1983
Sweet Potato	-	82.2	191.8	322.8	330.0	275.2	247.8	117.6
Cassava	-	125.3	375.9	659.2	817.3	754.6	754.6	268.8
Peanuts	-	92.8	185.7	302.8	302.8	302.8	302.8	398.4
Oil Palms								
Transportation to Collection Point	-	-	-	-	2.7	9.6	24.4	48.0
Transportation	-	12.8	43.7	74.5	97.2	97.5	63.3	17.7
Subsidies (all crops)	-	602.6	1149.6	1770.6	1824.5	1622.1	334.2	180.0
Materials and Equipment	-	76.8	143.7	220.4	230.8	213.8	29.8	23.4
Others	-	149.0	587.0	1260.8	1999.5	2626.8	2819.9	3749.3
Total	-	1141.5	2677.4	4611.1	5604.8	5902.4	4576.8	4803.2

APPENDIX 5.18 (Cont'd)

Item	Project Year						
	1984	1985	1986	1987	1988	1989	1990-1995
Sweet Potato	117.6	117.6	117.6	117.6	117.6	117.6	117.6
Cassava	268.8	268.8	268.8	268.8	268.8	268.8	268.8
Peanuts	398.4	398.4	398.4	398.4	398.4	398.4	398.4
Oil Palm							
Transportation to Collection Point	79.5	111.9	147.1	177.5	202.6	221.6	232.3
Transportation	17.5	19.8	19.8	19.8	19.8	19.8	19.8
Subsidies (all crops)	180.0	180.0	180.0	180.0	180.0	180.0	180.0
Materials and Equipment	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Others	2660.3	2695.9	2695.9	2695.9	2695.5	2695.5	2695.5
Total	3749.1	3819.4	3854.6	3885.0	3910.1	3929.1	3939.8