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ANALYSIS OF SMALLHOLDER TEA DEVELOPMENT IN TANZANIA

by

© SOSPETER RWEHUMBIZA KAKIZIBA BUKAGILE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

in

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "Analysis of Smallholder Tea Development in Tanzania" submitted by Sospeter Rwehumbiza Kakiziba Bukagile in partial fulfilment of the requirements for the degree of Master of Science.

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[illegible]

Date 24 June 1977

ABSTRACT

An extensive smallholder tea expansion programme was started in 1971 in Tanzania. Growers obtain a loan for the purchase of planting material, planting fertilizer for the first three years of the tea establishment, and annual maintenance fertilizer. The maintenance fertilizer loan continues until such a time that a farmer can buy his fertilizer in straight cash. Growers are charged an interest rate of 8.5 percent per annum and the total loan is supposed to be repaid by deducting a cess from the proceeds of green leaf sales.

In 1974, fertilizer prices rose tremendously in the country. This abrupt change suggested to the author that the financial viability of smallholder tea planting was affected sufficiently to cause disincentives to the farmers. Since fertilizer application is an essential ingredient in modern tea culture, this study is addressed to two important issues:

1. Whether or not the investment has sound financial returns to farmers at current fertilizer prices, and

2. Whether tea growers will be able to retire the principal loan plus interest under the present loan repayment plan.

Through cash flow projections an attempt is made to determine the average cash return on labour over the life of the smallholder's tea investment. Sensitivity analysis varying green leaf production levels, green leaf price levels, fertilizer price levels and cess rate levels is used to determine the earning capacity of a tea garden.

The results obtained from the study indicate that smallholder tea production is financially viable. The calculated average cash return on labour over the life of a tea project ranges between Tsh 5.12 and

Tsh 5.90 per adult-equivalent day. This rate of return on labour is higher than the estimated current minimum rural wage rate of about Tsh 4.40 per day.

At the current cess rate of 0.20 Tsh/kg, farmers in category A schemes can retire the tea loan in 33 years while those in category B schemes are likely to remain in perpetual indebtedness. It was, however, realized that tea growers in all schemes could retire their tea loans within 20 years if a consolidated cess of about .30 Tsh/kg could be charged after the fifth year of tea establishment.

Results of the sensitivity analysis indicate that the level of green leaf yields per holding, the price of green leaf, and the cess level have a direct impact on the average cash return to labour while fertilizer price level has an inverse effect on the returns to the farmers.

The analysis of the study also indicate that there are two long term problems which limit the returns to growers from their tea planting. First, an average rural farm family cannot afford to establish more than 0.4 ha because of the year to year changes which take place in the family labour potential. The second problem is the price inelastic nature of tea in international auctions.

Despite the two problems, smallholder tea production has a big role to play in the country. Farmers should therefore be encouraged to maintain the required cultural practices and the government should give every support possible to keep the tea industry competitive with its counterparts in the neighbouring countries.

ACKNOWLEDGEMENTS

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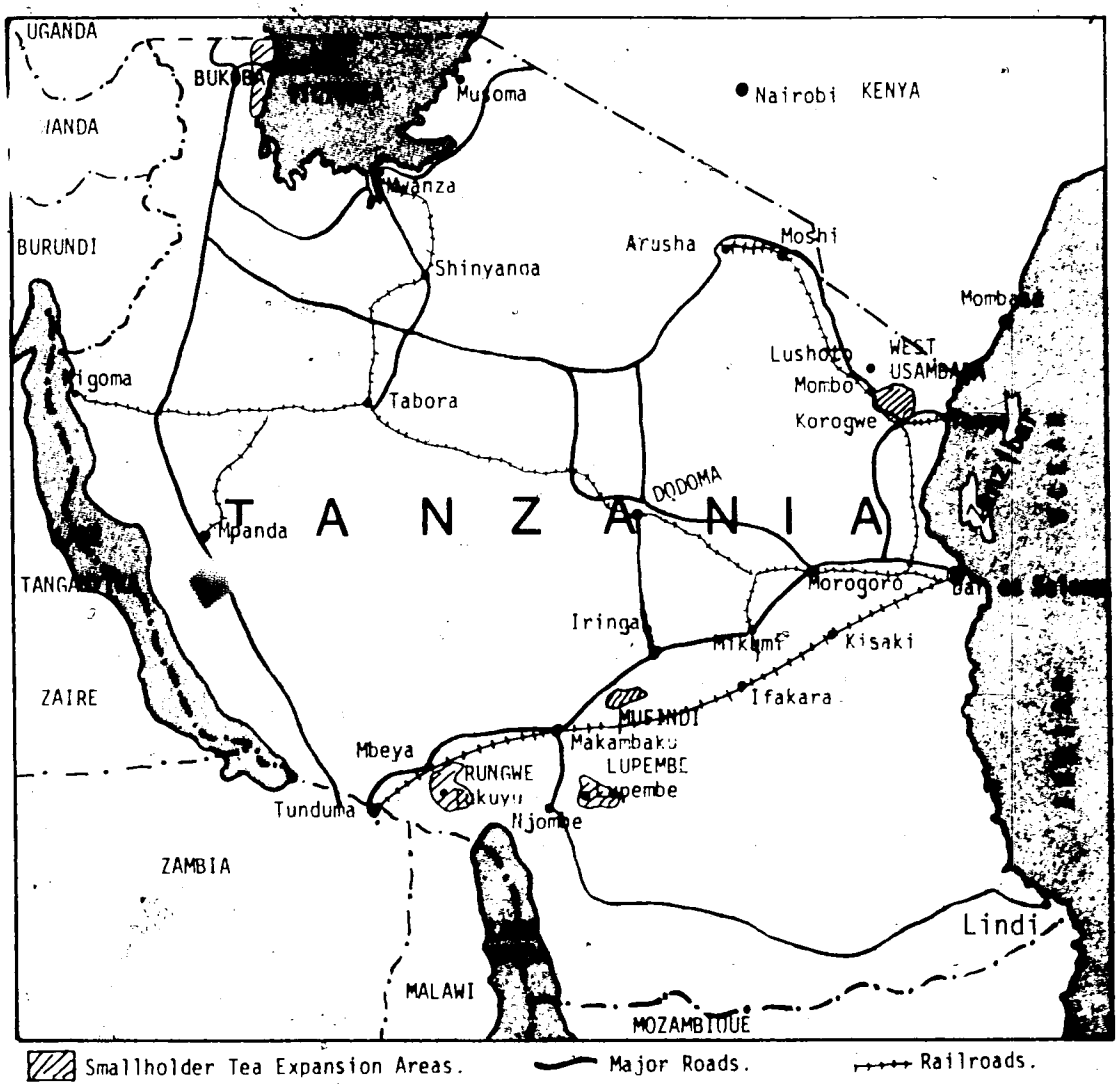

CHAPTER I

EMERGING PROBLEMS OF SMALLHOLDER TEA DEVELOPMENT IN TANZANIA AND THE RATIONALE OF THE STUDY

Preface

Though African communities in Tanzania have grown such cash crops as coffee, cotton and tobacco since early pre-colonial days, tea planting by smallholders started with national independence in 1961. Until then many technical, legal, financial and administrative constraints prevented peasant farmers from growing tea for the international and domestic markets.

After independence, the new government decided to remove many of the prohibitive constraints by providing essential services for small scale tea growing. In 1969 the Tanzania Tea Authority (TTA), a para-statal[1] body corporate, was established and charged with the promotion of the smallholder tea sector in the country. Goals and strategies behind the programme were well meant and sound.

(1) To meet the principal economic concern of the country through earning a larger net foreign exchange from the export of tea.

(2) To provide means of earning additional income for farmers, a developmental aspect to rural population and the nation as a whole.

(3) To provide employment opportunities in rural areas, thus reducing the migration of people to towns and cities which would otherwise increase the social cost involved in supporting the unemployed in urban areas.

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[1] Similar to a crown corporation in North America.

(4) To make rural people aware of the economic potential in smallholders enterprise and thereby to involve them meaningfully in a shared enterprise in which they would not only be shareholders but participants in management and planning as well.

The Problem

In 1971, an international loan was provided by the World Bank for the smallholder tea development programme in Tanzania. Tea growers could obtain a tea establishment loan at an 8.5 percent interest rate per annum. The original plan was that the overall tea loan would be extended to farmers for the first five years without having to pay back the loan, only the interest being capitalized. Beginning with the sixth year, a fixed cess[1] per kg of green leaf sold had to be paid to meet the loan repayment plan. Yearly expenditure on maintenance fertilizer was to be paid for in straight cash by tea growers from the total annual proceeds of green leaf sales.

In the process of implementing the programme, two significant changes took place. First, there was a drastic rise in fertilizer prices as shown in Table 1.1; second, there was a policy change that tea growers should get maintenance fertilizer on a loan basis. Reasons for the change in policy were that:

(1) Revenue from green leaf sales was insufficient for the first eight years of tea planting.

(2) Tea growers could not make the purchase of maintenance fertilizer a top priority for spending their scarce revenue from the tea and other cash earning activities on their subsistence homesteads.

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[1] Levy per unit value of green leaf sold.

TABLE 1.1

FERTILIZER PRICES IN TANZANIA
1970-1976 (Tsh/kg)

Year	Sulphate of Ammonia 21% N	Triple Super Phosphate (T.S.P.)	NPK (25-5-5)	NPK (20-10-10)
1970	.40	.75	.60	.61
1971	.43	.80	.60	.68
1972	.45	.89	.72	.79
1973	.51	.97	.92	1.00
1974	2.98	2.20	2.70	2.61
1975	2.04	3.00	2.75	2.75
1976*	1.00	1.40	1.40	1.40

* Subsidized by the government effective July 1976.

NB: International fertilizer prices have also been declining since 1975.

Source: Tanzania Tea Authority, Dar es Salaam, January 1977.

Consequently, TTA had to make sure that the tea was actually going to be fertilized to achieve acceptable yields and quality.

A preliminary analysis of costs and returns under the terms of the loan and its repayment procedure suggested to the author that tea growers are led into a situation of perpetual indebtedness to the national institutions responsible for the tea loans.

Purpose of the Study

Changes in production volume, product and factor mix and product and factor prices in any industry may have extremely important effects on its economic performance. Since the tea development programme is getting into its second phase, it is justifiable to search for and rectify some of the bottlenecks which could lead to poor financial performance of either the tea project participants or the lending institutions. Therefore, the prime objectives of this study are:

(1) To assess the viability of the smallholders' tea growing enterprise.

(2) To examine the indebtedness of tea growers and the time taken to repay the loan under the existing loan repayment plan.

(3) To search for an alternative repayment plan which would enable a tea grower to pay back the tea loan in shorter time and then be able to meet short-term credit for maintenance fertilizer from the proceeds of green leaf sales.

(4) To examine recommendations for promoting growth of the smallholder tea industry in the country.

Available Information

Apart from the author's five years experience as a tea extension officer in the smallholder tea schemes, data about the crop pattern, inputs used and operating cash expenses incurred, yields from crop, income received, etc., were obtained in two ways. First, through the Appraisal Report findings of the International Bank for Reconstruction and Development (IBRD), various Annual Statistical reports of the Tanzania Tea Authority (TTA) and the Ministry of Agriculture, FAO Commodity Review and Outlook publications and the information obtained directly from the TTA headquarters in Dar es Salaam. Second, part of the information related to this study is a result of interviews carried out by the author with Area Tea Development officers, factory managers and various tea growers in Rungwe, Njombe, Mufindi and Bukoba tea schemes between May and August, 1974.

Plan of the Study

The first chapter briefly discusses the problem, the purpose of the study, and the source of information and data used in the analysis.

Chapter II provides information on the development and present status of the tea industry in Tanzania. A description of the cultural practices, factory processing techniques, and marketing procedure is also included in this chapter.

Chapter III provides a detailed discussion on the importance of labour in tea growing. The chapter gives some highlights on the availability of family labour, in practical terms, in tea growing areas.

Chapter IV sketches the general theory of agricultural project analysis. Then, the methodology and tools that are used in the study are

briefly discussed.

Chapter V presents both cash and fund[1] flow analysis. Computational techniques are used to determine the return on labour and the tea grower's indebtedness. The chapter ends with a brief summary and the implications of the computational results.

Chapter VI consists of a sensitivity analysis, results of the analysis and conclusions.

Chapter VII briefly focuses on the world tea economy and its impact on the smallholder tea industry in Tanzania.

The final chapter, Chapter VIII, presents a summary and conclusions from the study as a whole and provides a number of recommendations.

---

[1] of principal loan, interest and cess on a farmer's account erative society in which he is a member.

CHAPTER II

DEVELOPMENT AND PRESENT STATUS OF THE TEA INDUSTRY IN TANZANIA

Botanical Characteristics of Tea Plants

Tea is made from the young leaves and the unopened buds of an evergreen plant Camellia sinensis (L.O.) Ktze or Chinese Camellia,[1] a species of plant which includes widely different varieties.[2] The most common ones planted are the China jat,[3] the Assam, the Cambodia and hybrids between all three.[4] The Assam is most suited for East African conditions.

Though tea planters at large talk of tea "bushes", tea plants in their natural state are small and tall forest trees, but when grown in isolation or at wide planting distances, the better type bushes are roughly cone-shaped. Some varieties of the tea plant would grow to heights of 30 to 60 feet; but when cultivated in a tea field, they are subdued into bushes by having their tops pruned and maintained at a height of

---

[1] Tea is a camellia, agreed, but until as recently as 1950, the name of the plant always incorporated, through all vicissitudes, the word "thea" --tea. It was used in the first, though not in the second, volume of Linnaeus' "Species Planatarum" (1973). Camellia thea... Camellia theifera... Thea sinensis... nothing to be said against any of these. Now only one genus is recognized, and for technical reasons which need not concern us here, the 6th Botanical Congress of Amsterdam (1933) finally robbed the tea plant of its distinctive title, and decreed that the Tea Camellia should be the Chinese Camellia and nothing more! For more details, see: D.M. Forrest, A Hundred Years of Ceylon Tea (London: Chatto and Windus, 1967), p. 47.

[2] For a more detailed description of the plant, its cultivation and wide geographical dispersion, see C.R. Harler's small book, Tea Growing, (Oxford University Press, 1966).

[3] "Jat" is Hindu, meaning caste.

[4] All varieties hybridize freely, see P.H. Carpenter, The Wealth of India: An Article on Camellia sinensis (Delhi: C.S.I.R.I., 1950).

about three feet. As tea bushes or "stumps" are planted close together, a mature tea field appears like a luxuriant, well kept lawn raised three feet off the ground for convenient plucking. Tea plants can live for 60 to 80 years, depending on the degree of husbandry and climatic conditions of a given area.

Tea grows well in tropical and subtropical areas having rainfall of at least 1,100 mm per annum. With less rainfall, the crop cannot be grown economically. The rainfall must be well distributed throughout the year and should be in excess of potential evaporation. The most favourable climate to tea culture is also characterized by a small daily range in temperature and the absence of strong dry winds and freezing temperatures. Research in all tea growing regions has shown that the crop flourishes well in deep soils, free draining to a depth of at least 2 meters. The soil should nevertheless be moisture retentive and should ideally have an acidic reaction of pH between 6.0 as an upper limit and 4.0 as a lower limit without the presence of free acid.[1]

Historical Background of Tea Production

Tea is said to have been cultivated and manufactured as a cottage industry in both black (fermented) and green (unfermented) forms in South-east China for over 3,000 years. The first reliable account about tea was written in China in 780 A.D. Around 800 A.D. the plant was introduced to Japan. There it was first regarded as a medicine, but green tea later became the national beverage.

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[1] T. Eden, Tea, (Second Edition; London: Longman's Green & Co., Ltd., 1965), p. 10.

The extension of the industry in its modern form started in India. In 1934, the English East India Company planted its first commercial estates in Assam with seeds imported from China. The system spread to South India and Sri Lanka during the second half of the 19th century, and later to other countries. Many countries such as the U.S.S.R., Turkey, Kenya, Uganda, Tanzania, and South American countries adopted serious tea planting programmes in the latter part of the 20th century. Today there are 38 countries growing tea with the majority lying between latitudes 40° North and 33° South (Appendix A).

Introduction of Tea Planting in Tanzania

Tea was first planted in Tanzania in 1902 by the Germans who founded an Agricultural Institute at Amani in the East Usambara Mountains, but it was not until after World War I that the crop was grown on a commercial basis in the country. The first estate was established by one of the multinational tea companies in 1924 in Rungwe, then known as the Southern Highlands. The second plantation was established in 1931 at Ambangulu in the West Usambara Mountains. Thereafter, new estates and expansion of production grew quickly, but in 1934 tea planting was severely restricted under the International Tea Agreement to which East Africa adhered until 1947, when the Agreement was terminated. By 1947, the total area under tea was about 2,700 ha. Since then planting has picked up again at a steady pace. By 1960, several tea estates had been established in Rungwe, Mufindi, Njombe (Lupembe), Usambara Mountains and Bukoba with a total of about 7,300 ha producing about 3,700 tons of made[1] tea.

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[1] Factory terminology for processed tea.

Until 1960, tea production in Tanzania was along the lines that had become accepted practice in the leading tea exporting countries, India and Sri Lanka (Table 2.1). Large estates of about 250 to 1,000 ha each were cleared and planted with tea by companies that usually had extensive tea interests in Asia. The main reasons for this change of of direction probably were high wage rates, labour unrest and the uncertain future of foreign companies in traditional tea producing countries constrasted with the low wage rates and comparatively calm and seemingly secure future of foreign companies in the then British East Africa. All along, however, indigenous people were legally prohibited from tea growing.

Although the crop is both labour and capital intensive, it was possible to economically operate an estate of more than 60 ha because labour was relatively cheap. Processing factories were using either coal or firewood as a source of power as opposed to gas, the price of which quadrupled in the seventies. Moreover, modern technology and the standards of tea planting had not transformed the appearance and yields of tea per unit area as it is today-- as it will be elaborated later in this chapter.

Small scale tea growing came in with independence in 1961 when the new government decided to promote the tea industry in the country on a smallholder basis. During the 1961-62 planting season, a total of 60 ha were established by 366 tea growers living in the neighbourhood of tea estates in Usambara, Lupembe and Rungwe (Tukuyu). By 1968, four smallholders tea schemes were already in full swing in Western Usambara, Rungwe, Njombe and Bukoba with a total of 1,685 ha and 4,249 small growers (Table 2.2). Prior to the 1968-1969 planting season, promotion of the smallholder tea industry in the country was carried out by the Tanganyika

TABLE 2.1

COMPARATIVE STATISTICS ON TEA AREA, PRODUCTION AND EXPORTS OF INDIA, SRI LANKA AND EAST AFRICA, 1960-1974

	Area				Production				Exports			
	1960	1965	1970	1974	1960	1965	1970	1974	1960	1965	1970	1974
	(1,000 ha)				(1,000 t)				(1,000 t)			
India	331.2	345.3	356.5	*	321.1	366.4	418.5	492.1	193.1	199.4	200.2	206.0
Sri Lanka (Ceylon)	235.5	240.5	241.8	242.2	197.2	228.2	212.2	204.0	185.9	224.3	208.3	175.2
East Africa of which	30.1	44.7	69.7	96.1	22.2	33.9	67.8	88.1	19.4	28.1	58.2	76.0
Tanzania Contributed	7.3	9.4	11.9	16.8	3.7	5.7	8.5	13.0	3.3	4.4	7.1	9.8

* Not available.

SOURCE: International Tea Committee, Annual Bulletin of Statistics, (London, 1972 and 1975).

TABLE 2.2

LAND PLANTED WITH TEA BY SMALLHOLDERS, ESTATE AND TOTAL 1961/62 - 1975/76

Year	Small Growers Cumulative To Date	Estates Cumulative To Date	National Cumulative To Date
	(Hectares)		
1961/62	61	8,046	8,107
1962/63	148	8,267	8,415
1963/64	370	8,520	8,890
1964/65	645	8,788	9,433
1965/66	1,028	8,996	10,024
1966/67	1,434	8,992	10,425
1967/68	1,685	9,094	10,779
1968/69	1,972	9,278	11,250
1969/70	2,646	9,303	11,949
1970/71	3,247	9,156	12,403
1971/72	4,750	9,243	13,993
1972/73	5,699	9,140	14,839
1973/74	7,616	9,140	16,756
1974/75	8,624	9,140	17,764
1975/76	9,227	9,140	18,367

N.B.: The figures above have been rounded off to the nearest whole number

SOURCE: Tanzania Tea Authority, Statistical Report 1974 (Dar es Salaam: The Authority, 1975).

Tea Board in collaboration with the then Ministry of Agriculture, Forestry and Cooperatives.

Establishment of the Tanzania Tea Authority

On March 14, 1969, the Tanzania Tea Authority (TTA) was established as a central organization, a para-statal body corporate, responsible for matters previously carried out by the Board including planning, implementing, and coordinating smallholder tea development activities in the country (see Appendix B).[1] The constitution of the Authority was made more democratic by including elected tea grower representatives on its Board of Directors. Nevertheless, the Authority remains an all-powerful organization, being the only legal source of planting material and a controller of the flow of tea loans. Its position is again reinforced by the fact that it has control of the extension system for the smallholder tea growers. Furthermore, through farmers' cooperative societies in various tea schemes, TTA keeps individual farmer records on the amount of planting materials (either stumps or vegetative propagated plants) bought each year, the price paid for them, total credit advanced, monthly production figures, the amount paid to the farmer and his outstanding debt.

The first development programme carried out by the TTA was financed by the National Development Credit Agency (NDCA) an institution which at that time handled a major part of Tanzania's agricultural credit. Such funds were passed through the regional cooperative unions to farmers' cooperative societies in tea growing areas. During the 1968/69, 1969/70 and 1970/71 planting periods, TTA attracted 8,571 new small growers who

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[1] For organizational details see: World Bank (IBRD), Appraisal of Smallholder Tea Development Project, Tanzania (November 1971) Annex 4.

planted a total of about 1,600 ha, and this was far above the target area.

Inception of Smallholder Tea Development Project by the World Bank

As the response of rural people to tea growing as a cash crop was encouraging, the TTA made more ambitious plans and sought international financing required for an expansion programme of about 9,500 ha from 1971 to 1974. Of this total, 8,300 ha were part of the project. The project took place in four widely scattered tea districts-- Rungwe and Njombe (Lupembe) in the southern highlands, Bukoba on Lake Victoria in the northwest and West Usambara in the northeast of the country (see Map 1). Most tea holdings were established either on growers' existing holdings or on individually owned composite blocks of unutilized land. Other tea holdings were established on communally owned and operated "Ujamaa"[1] village blocks. Tea had to be planted in accordance with a pre-planned schedule (Table 2.3). At maturity, ten years after planting, the project was expected to produce about 9,500 tons[2] of made tea.

Each grower was expected to plant 0.2 ha in the first year, then, depending on his performance, he could have planted a further 0.2 ha in each succeeding year until he had planted 0.6 ha in total. Current data, however, show that the average size of smallholder tea gardens was about 0.3 ha (see Table 2.4). A tea grower's annual net cash income at full development was expected to be between Tsh 1,780/= and Tsh 2,300/= (U.S. $250 to $320), depending on the area in which the farmer lived. By 1971 the Appraisal Report said: "the increase in income was more than a family

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[1] A Swahili word meaning communal endeavour.

[2] The achievement is likely to be short of the target because the yearly performance of certain schemes were sometimes below target.

TABLE 2.3

COMPARISON OF TARGETS WITH ACHIEVEMENT SINCE THE INAUGURATION OF THE WORLD BANK PROJECT

Tea Scheme	1971/72			1972/73			1973/74			Cumulative Total to June 30, 1974			Cumulative Total to June 30, 1975		
	Target	Actual	Per-cent	Target	Actual	Per-cent	Target	Actual	Per-cent	Target	Actual	Per-cent	Target	Actual	Per-cent
	(ha)	(ha)		(ha)	(ha)		(ha)	(ha)		(ha)	(ha)		(ha)	(ha)	
Rungwe	1,339	818	61	1,132	438	39	1,232	766	62	3,703	2,022	55	3,703	2,593	70
Lupembe	835	72	8	798	58	7	630	221	35	2,263	351	15	2,263	514	23
Bukoba	542	208	38	554	228	41	524	305	58	1,620	741	46	1,620	775	48
Usambara	313	386	123	208	398	191	186	274	147	707	1,058	150	707	1,236	175
Project Cumulative Total	3,029	1,484	40	5,721	2,606	45	8,293	4,172	50	8,293	4,172	50	8,293	5,118	62
Planted Prior to June 1971	--	3,337	--	--	3,337	--	--	3,337	--	--	3,337	--	--	3,337	--
Grand Total		4,821	--	--	5,943	--	--	7,509	--	--	7,509	--	--	8,455	--

N.B.: The 1972/73 planting season was supposed to be the end of the first phase of the World Bank project but it was extended for two more years.

Source: World Bank (IBRD) and International Development Association Report (IDA). Tanzania Smallholder Tea Development Supervision Report, (Annex 6, Appendix 1, May, 1976).

TABLE 2.4

EXPECTED AVERAGE SIZE OF A SMALLHOLDER'S TEA GARDEN

Planting Period	No. of Smallholders		Adjustment Procedure			Adjusted Cumulative No. of Tea Growers	Land Under Tea Cumulative (ha)	Av. Expected Size of Tea Garden (ha)
	Recruited	Cumulative	(t-2)	$(t-1)^{2/3}$	$t^{1/3}$			
1961/62	366	366	0	0.0	122.0	122.0	61	0.49
1962/63	441	807	0	244.0	147.0	391.0	148	0.38
1963/64	805	1,672	366	294.0	268.3	928.3	370	0.40
1964/65	500	2,172	807	536.7	166.3	1,510.3	645	0.43
1965/66	1,100	3,272	1,672	333.3	366.3	2,372.0	1,028	0.43
1966/67	780	4,052	2,172	733.3	260.0	3,165.3	1,434	0.45
1967/68	197	4,249	3,272	520.0	65.7	3,857.7	1,685	0.44
1968/69	589	4,838	4,052	131.3	196.3	4,379.7	1,972	0.45
1969/70	2,106	6,944	4,249	392.7	702.0	5,343.7	2,646	0.49
1970/71	5,876	12,820	4,838	1404.0	1,958.7	8,200.7	3,247	0.40
1971/72	4,445	17,265	6,944	3,917.3	1,481.7	12,343.0	4,750	0.38
1972/73	4,467	21,732	12,820	2,963.3	1,489.0	17,272.3	5,699	0.33
1973/74	--	21,732	17,265	2,978.0	--	20,243.0	7,616	0.37
1974/75	--	21,732	21,732	--	--	21,732.0	8,624	0.39
1975/76	6,952	28,684	21,732	--	2,317.3	24,049.3	9,227	0.38
1976/77	2,837	31,521	21,732	4,635.0	946.0	27,313.0	9,268	0.34

SOURCE: Data for 1961/62 to 1972/73 - Tanzania Tea Authority, Statistical Report 1974 (Dar es Salaam: The Authority, 1975).

Data for 1973/74 to 1976/77 - Ministry of Agriculture, Price Policy Recommendations for the 1977/78 Agricultural Price Review, Vol. III, p. 44.

could receive by having the head of the family working full time in agriculture at a legal minimum wage of Tsh 3.85 per day".[1]

In July 1971, the project was estimated to cost about Tsh 115,000,000.00 (about U.S. $16.10 million). Financing arrangements were made with the International Development Association (IDA) and the Government of Norway. Approximately Tsh 13.3 million were financed by Norway, Tsh 75.0 million were financed by IDA and Tsh 26.5 million were contributed by the Government of Tanzania. The estimates included the continuation of TTA's previous activities on top of financing the new programme. A newly created rural development credit institution, Tanzania Rural Development Bank (TRDB), was used to channel the above loans to TTA and the cooperatives. The TRDB received project funds at an interest rate of 4 percent per annum for a term of 28 years including 8 years of grace. The TRDB loaned the funds to the cooperatives and to the Tea Authority at an interest rate of 8.5 percent per annum.[2]

The funds which were availed to TTA had to cover the purchase of processing equipment for tea factories, tea factory buildings, vehicles and spare parts for green leaf collection, office equipment for the head office, establishing tea nurseries, marketing and exporting of made tea, and constructing and improving tea roads. The TTA had to provide adequate extension services and administer all programmes with the help of international technical assistance in some departments. Cooperatives extended loans to project growers for buying planting material and

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[1] World Bank (IBRD), Apprasial of Smallholder Tea Development Project in Tanzania (November 16, 1971), p. 20. Today the legal minimum wage is estimated to be Tsh 4.40 per day.

[2] Ibid., p.9.

fertilizer during the first two to three years until the bushes came into bearing. Seasonal credit for annual fertilizer requirements thereafter had to be provided through the farmers' cooperatives until such time that the tea growers could liquidate their loans and be in the position of buying fertilizer and other variable inputs in straight cash.

All small growers had to become cooperative members. They pay back their loan by having a cess of about 22 percent deducted from the proceeds of green leaf brought to processing factories. The cess is remitted to the TRDB by the TTA which notifies the cooperative society concerned. Farmers were given a grace period of three to five years during which the interest rate was capitalized because of insufficient income.

Although the TTA has had difficulties in meeting its planting targets, the rapid expansion of the Tanzania tea industry as a whole since the Authority started its operations is a measure of its success. By June, 1976, the number of smallholders had reached 28,684 with a total of 9,227 ha planted (excluding Mufindi Pilot Scheme with 234 ha which does not come under the World Bank project). The national production of made tea has increased steadily from 3,721,939 kgs in 1960/61 to 13,872,667 kgs in 1974/75 (Table 2.5). During 1974/75, Tsh 60.00 million were realized from tea exports. Tea ranked sixth in the list of crops as foreign exchange earners as compared to 1960 when its export value as almost negligible.[1]

Tea Research

The Tanzanian tea development programme is supported by scientific investigation. This dates back to 1949 when scientific attempts by neigh-

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[1] Daily News (Tanzania), Tuesday, July 6, 1976.

TABLE 2.5

NATIONAL PRODUCTION OF MADE TEA

Year	Small Growers	Estates	National
	(Kilograms)		
1960	--	2,414,879	3,721,939
1961	--	4,458,771	4,458,771
1962	--	4,310,420	4,310,420
1963	--	5,018,527	5,018,527
1964	3,397	4,808,854	4,812,251
1965	41,716	5,640,094	5,681,810
1966	105,173	6,694,690	6,799,863
1967	234,440	6,923,157	7,157,597
1968	361,477	7,561,753	7,923,230
1969	580,696	8,196,780	8,777,476
1970	725,059	7,767,160	8,492,219
1970/71	830,707	8,351,244	9,181,951
1971/72	1,184,679	10,428,010	11,612,689
1972/73	1,679,720	11,683,716	13,363,446
1973/74	1,732,218	10,562,098	12,258,316
1974/75	2,033,219	11,839,448	13,872,667
1975/76	2,158,793	10,690,205	13,040,998

SOURCE: Tanzania Tea Authority, Statistical Report 1974 (Dar es Salaam: The Authority, 1975).

bouring tea estates in Kenya were made to improve tea production in East Africa. The demand for further and more detailed investigation grew until the Tea Research Institute of East Africa (TRI) was established at Kericho, Kenya, in 1958. The institution is financed by three East African countries (Kenya, Tanzania and Uganda) in proportion to the amount of tea produced by each country. It is an institution of international repute, and the main source of technical advice to the tea industry of East Africa.

The TRI has a substation in Tanzania at Marikitanda, Amani, in Usambara and carries out irrigation trials on tea at Mufindi in the south. Apart from the research work carried out by the TRI, the TTA conducts field trials at Maruku in Bukoba, Kiwira in Rungwe and in various sub-scheme areas.

In Tanzania there have been no serious diseases or pests of tea which could have been a major drawback to the tea development programme. The only occasional disease is Armillaria mellea (Honey mushroom), a fungus of world-wide distribution that lives on the dead roots of forest trees. It is usually serious on tea that has been newly planted on poorly cleared and tilled forest areas. The only remedy is to dig a big hole around a dead tea bush, remove all the roots, burn them and leave the hole uncovered for about three to five months before replanting.

Tea Production Practices

For a better understanding of the next chapters a brief description of field and factory operations is in order, particularly for those readers who are not familiar with what takes place prior to getting the leaves in the bags we use for our tea brew.

Cultural Practice

Traditionally, tea plants are given their start in life in nurseries with seeds selected from superior parent plants It is important that the seedlings are raised with all the care and refinement of a horticultural operation. After two to three years in nursery beds, the seedlings are pulled up and pruned to about 10 cm from ground level, then transplanted into the field. Field planting for each stump should be 1.0 to 1.5 cm lower than nursery level so as to protect the base of the stem from scorch and at the same time increasing the disposable area for emerging buds. Today, however, there is an increasing use of Vegetatively Propagated (V.P.) plants instead of seedlings. This involves taking cuttings from carefully chosen mother bushes (or clones) that are above average in performance as regards both vigour of growth and manufacturable quality of the leaf. These cuttings are rooted in polythene sleeves which are filled with simple ingredients for propagation. They are kept in a simple shed for about nine months before they are planted in the field. It is essential that in the course of nursery germination the shade be reduced and a month before planting out to the field the cuttings be kept free of shelter, a process which is referred to as "hardening". Through this method the TRI has been able to produce clones that are capable of yields two to three times higher than the seedling tea bushes.[1] The planting material which TTA used for the tea project were raised by both methods, but the V.P. cuttings were collected from the TRI, Kericho, Kenya.[2]

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[1] World Bank (IBRD), Report on the World Tea Economy, (Report EC-178, Washington, June, 1971), p.2.

[2] One of the costly operations with respect to transport and overtime payments to staff.

Before being issued stumps (or clonal plants if V.P.), growers have to make sure that their land is cleared and cultivated in order to eradicate all weeds, especially obnoxious couch-grass with stoloniferous roots. Moreover, all underground dead roots have to be removed before successful tea planting can be carried out. This operation is demanding, particularly in the West Usambara Mountains and Bukoba where heavy forest clearing and couch-grass, respectively, are major problems in land preparation. Under such conditions a farmer might not be able to establish more than 0.1 ha per annum. After proper land preparation planting holes about 60 cm deep and 25 cm wide are prepared at the recommended spacing of 1.2 meters by 0.9 meters along the contour, giving a plant population of 8,872 per ha. Planting is carried out during the rainy season from December to April. Before issuing planting material to tea growers, the fields are inspected by TTA staff for satisfactory soil conservation measures and correct spacing. The time between holing and planting is kept as short as possible except in situations where the soil puddles in the process of making holes. A decision on this point calls for knowledge of local conditions.

During planting, ~~a few ounces~~ of Sulphate of ~~Ammonia and Triple~~ Super Phosphate are mixed with the soil which is rammed into a planting hole to anchor the young plant. Because stumps are pruned before distribution to growers, it is necessary to shade each stump after field planting--this is usually accomplished with three or four bracken fronds. Then the field is lightly mulched until the plants themselves provide sufficient leaf cover, usually by the fourth year. Unless the above procedure is carefully carried out, one is tempted to do a less than thorough job.

Since high yields throughout the life of a tea bush depend largely

on the formation of a strong spreading frame of lower branches, it is necessary to establish a strong plant in the early years after planting. Tanzanian tea development schemes use two systems of bringing bushes into bearing-- pruning[1] and pegging. Both were developed by the Tea Research Institute.

Pruning

After about one year's growth in the field, stump plants are pruned at 20 cm (8") from the ground when most shoots are 1 cm thick at the point of pruning. A second pruning is carried out at 40 cm (16") after two years in the field. Thereafter, tipping-in[2] is carried out for about three rounds at a height of 60 cm (24"). This involves removing out all shoots as soon as they have developed three leaves and a bud above the height of 60 cm, thus establishing a plucking table.[3]

Sleeved clonal plants tend to form a strong main stem which should be checked at an early stage. This is done by pruning only the main stem back to 15 cm above the ground when the plants are about 30 cm high. Next, all shoots are pruned at 28 cm when most shoots are 1 cm thick at that height. A second pruning is subsequently carried out at 40 cm before tipping in at 60 cm as in stump plants.

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[1] It is a technically demanding task and incorrect pruning in the early years is difficult to rectify.

[2] A form of light pruning designed to form a plucking-table parallel to the slope of the ground.

[3] The flat, raised surface of the tea field is usually referred to as the plucking table, and the act of harvesting tea is aptly called "plucking".

Pegging

When shoots have reached a height of between 45 cm and 60 cm, they are pegged down to the ground using wood or wire pegs. The shoots to be pegged should be distributed evenly around the main stem. Usually, three to five pegged shoots are enough and their terminal leaf and a bud are removed from each pegged shoot. Later on, the whole tea bush is tipped in at a height of about 45 cm for at least five rounds before beginning actual plucking. The advantage of this method is that the pegged bushes can be plucked considerably earlier than pruned bushes.[1]

When tea bushes are exposed to plucking for a period of three years or so, there is usually a decline in production per hectare. This tendency calls for pruning all bushes every three to four years, which is referred to as a pruning-cycle. The objectives of this type of pruning are:

1. To maintain the plant permanently in the vegetative phase.[2]

2. To stimulate new growth and maximize yields from increased young shoots that constitute the cropped portion of the bush.[3]

3. To bring the plucking-table down to a manageable height.

4. To allow correction of an uneven plucking table by giving a fresh start.

5. To remove unproductive or diseased wood.

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[1] "Pegging" is a new technique for bringing tea bushes into bearing in two years, but it is time consuming with respect to collection of pegs and the slowness of the procedure.

[2] T. Eden, Tea, p. 48.

[3] Tea Research Institute, Tea Estate Practice 1966 (Nairobi: Tea Boards of Kenya, Tanganyika and Uganda, 1966), p. 42.

Under Tanzanian conditions, it is desirable to prune back to about 5 cm above the last prune every three years. This procedure continues until the table becomes too high for comfortable plucking; then, a major pruning back to 45 cm above ground is carried out, and a new pruning cycle is commenced. All prunings are placed down as mulch.

Fertilizers

Formerly, artifical fertilizers were not considered important in tea growing. New fields were rehabilitated for two years by planting leguminous cover plants such as Mana or Guatemala grass prior to tea planting. Some months after planting, either Crotalaria or Tephrosia candida, leguminous plants, had to be established between rows of young tea plants to serve as wind shelter, to add natural nitrogen to the soil, and to provide shade and mulch.[1] Nowadays, however, the use of chemical fertilizers, N.P.K. formulations in particular, has become more important than ever because tea bushes have proven to have a very positive response to nitrogenous fertilizers. Moreover, research has shown that planting tea bushes closer together increases yield per ha; therefore, under modern cultural practices, there is little room for interplanting the tea with shade trees or leguminous plants.[2]

Smallholders in Tanzania have been using compound fertilizers since 1968 and TTA has continued to encourage the practice. The fertilizers that tea growers use are of two categories. The former application rates

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[1] H. Marby, Tea in Ceylon (Colombo, Sri Lanka: Geographical Research, Vol. 1 (Germany: Franz Steiner Verlag Wiesbaden, 1972), pp. 163-177.

[2] T. Eden, Tea, p. 95.

were as shown below.[1]

1. Planting fertilizers:

   (a) Sulphate of Ammonia, 250 kg per ha.

   (b) Triple Super Phosphate, 250 kg per ha.

2. Annual Application fertilizer.

   (a) N.P.K. (25-5-5) for all schemes except Rungwe;[2] the rate varies according to the age of tea bushes.

One year old	180 kg/ha
Two years old	270 kg/ha
Three years old	360 kg/ha
Four years old and thereafter	460 kg/ha

   (b) Rungwe Scheme:

	N.P.K. (20-10-10) kg/ha	Sulphate of Ammonia kg/ha
One year old	220	260
Two years old	275	325
Three years old	400	500
Four years old and thereafter	700	800

In May, 1976 the recommended annual application rates were lowered to:

   (a) All schemes except Rungwe:

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[1] Recently the application rates have been adjusted to suit the nitrogen requirements of tea bushes at current prices.

[2] Rungwe area has a deficiency in soil copper levels in its volcanic ash soils.

	Nitrogen Required kg/ha	N.P.K. (25-5-5) kg/ha
One year old	45.0	180
Two years old	67.5	270
Three years old and thereafter	90.0	360

(b) Rungwe Scheme:

	Nitrogen Required kg/ha	N.P.K. (20-10-10) kg/ha	Sulphate of Ammonia kg/ha
One year old	45.0	90	135
Two years old	67.5	135	203
Three years old and thereafter	90.0	100	270

Plucking and Green Leaf Quality Control

Plucking is a skilled task in which only young shoots appearing above the plucking table are taken as the saleable product. This involves selection by the "pluckers" of young leaves and unopened buds which are easily broken off between thumb and forefinger and placed in a traditional basket usually carried on the plucker's back.[1] When plucking is going on, it is important that dormant shoots (called "banjhi") are broken off and rejected. The breaking back of the banjhi buds is essential in order to stimulate new flush. Tea plucking does not only call for manual dexterity

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[1] Most of the world's tea is plucked by hand and this will probably continue. Mechanical tea plucking has been used for a number of years in the U.S.S.R., Japan and Assam but it does not produce high quality tea. For more details, see: Tocklai Experimental Station, Annual Report (Assam, India, 1959), p. 278.

but also considerable skill.[1] Mismanagement in field practices is common in plucking.

Quality control is more important for tea than it is for most field crops grown in the tropics. "Good quality tea starts in the field" is an ancient slogan which all tea planters keep at the tips of their tongues. Most of the world's black tea is made from fine plucking.[2] The fineness and coarseness of plucking depend upon the number of leaves taken and the time new leaves are allowed to grow between plucking rounds.[3] The TTA recommends the plucking of not more than two tender leaves and a terminal bud; however, more often than not soft banjhi leaves are accepted by factory managements. In contrast, some managers of private tea estates follow a flexible plucking system. Their plucking practices vary between fine and coarse depending on the prevailing market conditions, factory capacity and magnitude of flush.

All in all, tea plucking is generally a demanding operation requiring careful handling and promptness. Green leaf is usually handled in

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[1] D.M. Etherington, Smallholder Tea Production in Kenya: An Econometric Study (Dar es Salaam: East African Literature Bureau, 1973), p. 13.

[2] Fine plucking usually means taking two top leaves and its accompanying bud. If the quality of the factory manufacture is good, this practice improves quality and appearance of made tea.

Medium plucking means taking two top leaves and a bud plus the soft portion of the third leaf (the lower end and stalk being discarded).

Coarse plucking means taking three or more leaves including stalk and the bud. The practice increases yields per hectare but results in lower quality and prices and thus it impairs profitability.

[3] A plucking round is the action of plucking all one's tea. In Tanzania plucking continues throughout the year. Nevertheless, there are periods of high and low productivity. During flush periods, "plucking rounds" are 5 days apart; increasing to 12 days at other times.

ventilated jute bags. It must be delivered to processing factories within four to six hours of picking because quality declines as the leaf heats up. If a tea grower intends to take longer than six hours on plucking, he should spread the plucked leaf over a shaded jute platform to keep air circulating through the leaf. Such a practice, however, has a limit because it is impossible to maintain the quality of plucked leaf for more than eight hours under tropical conditions.

After plucking, tea growers take their green leaf to buying centres which are located along the main scheme roads. Generally, a farmer will be within a mile of the nearest buying centre. Once a farmer's leaf is checked for quality and weighed by a Cooperative Society representative in the presence of TTA's Leaf Officers, he receives a receipt for his leaf and his responsibility for the crop ends. The leaf is then transported to a processing factory. When transporting green leaf to factory, great care is taken not to bruise or damage the leaves. The jute bags should never be placed on top of each other, therefore the use of special TTA vehicles for the job is a must.

Individual growers' records are kept at a nearby Farmers' Cooperative Society office. Payments are made once a month. By August, 1974, tea growers were being paid a gross of Tsh .80 per kg[1] but were receiving a net of Tsh .58 per kg because of the Tsh .02 cess as a Cooperative Union levy and Tsh .20 as a payment towards their tea loan with the Tanzania Rural Development Bank.

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[1] Currently, tea growers are paid a gross of Tsh .90 per kg of green leaf and contribute Tsh 0.20 per kg towards their loan repayment plan.

Factory Production

Usually green leaf arrive at the factory with about 75 to 82 percent moisture content. The leaf is spread on withering troughs to a depth of about 30 cm; then dry air from outside and warm air from driers is combined at about 32°C and blown through the leaves for about 14 to 18 hours until the leaves are reduced to 45 to 65 percent of their moisture content. This process is known as withering, the first stage of tea manufacture. Withering is supposed to be carried out with great care because in addition to the plucking of good quality leaf from the field, a perfect withering is necessary in making good quality tea. When the leaf can be bent without breaking, it is ready for the second manufacturing stage, rolling.

Rolling imparts a twist to the leaf which is a trade requirement. It also breaks the leaf cells, setting juices free so that chemical constituents in the interior of the cell can mix with enzymes in the cell walls.[1] There are five universal methods of rolling green leaf:

(1) The orthodox manufacture process of subjecting the withered leaf to the wringing action of a rolling machine.

(2) The CTC (Cutting-Tearing-Crushing) process of abrading and fragmenting withered leaf between revolving cutters.

(3) The McTear rotorvane process which operates on the principle of a mincing machine by squeezing and then cutting the leaf.

(4) A combination of the CTC and the McTear methods.

(5) Making use of the Legge tobacco cutter to shred unwithered leaf.

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[1] World Bank (IBRD), Report on the World Tea Economy, (Report EC-178, Washington, June 1971), p.4.

A basic difference exists between the orthodox process and the four alternatives. Although the orthodox manufacture is slow, it is said to be unique in preserving the flavour of the leaf. In the other processes flavour is often lost, but the liquoring qualities are greatly increased. The CTC method has recently gained popularity in East Africa because of its efficiency.

The third stage of manufacture is fermentation. This is an oxidation procedure in which the physical and chemical changes in tea liquors cause changes in the colour and scent of the tea. Usually during the process of fermentation, rolled leaf is stacked in aerated troughs or on open trays at 21° to 30°C for two to three hours, depending on the experience of the tea maker. The fermentation stage is important in tea manufacture because it is the principle determinant of whether the tea will be the black tea of the world tea trade and the other teas of the Orient such as green tea, pickled tea and tablet or brick tea.

At the conclusion of the fermentation stage, the changes that have taken place in the rolled tea are abruptly arrested by passing the tea through driers on slow moving conveyors at about 80°C for 11 to 15 minutes. This is the fourth stage of tea manufacture which is referred to as firing. The tea colour changes from the dark copperly of the fermentation stage to black and it has a moisture content of between 4 to 6 percent. After allowing the tea to cool it is conveyed to a sifting room for grading, the final stage of tea manufacture. Here, the tea passes across several meshes; the stalky material goes through the cutter and the stalk extractor. Smaller grades are eventually put through the blower so that dust particles can be removed. Various grades are distinguished, packed and sealed in foil-lined plywood chests each holding about 45 kg of tea. These are kept

in a storage room ready for delivery to market. Unpacked tea is kept within the factory in airtight compartments known as tea bins. After manufacture tea is called "made tea". About 4.75 kg of green leaf make 1 kg of made tea. The principal grades produced by TTA factories are as follows, in descending order of quality.

BP I	(Broken Pekoe One)	77% to 82%
PF	(Pekoe Fannings)	
PD	(Pekoe Dust)	
BP	(Broken Pekoe)	14% to 17%
Fngs	(Fannings)	
D I	(Dust One)	
BP II	(Broken Pekoe Two)	4% to 6%
Fngs II	(Fannings Two)	
D II	(Dust Two)	

Made tea is hygroscopic, thus it can readily absorb moisture from the air and deteriorate in quality. Factory managers try to maintain proper storage conditions for their tea and they never keep tea in stock for a long time. To complete the story of made tea in its course from factories in Tanzania to international markets and ultimately to consumers, the following comments on export and commodity handling are useful.

Tea Marketing

Tea from factories is transported by lake steamer, road and rail to Dar es Salaam or Tanga ports. From these ports the tea is shipped to markets, particularly Mombasa (Kenya) and London, by TTA and other private exporting agencies in collaboration with the Board of Internal Trade.

Usually an invoice and all relevant documents relating to the original factory, grades, weight and packing is sent to the marketing agents in Mombasa or London before shipment of the tea. On arrival at the nearest sea port to the market place, the tea chests are stored in warehouses and checked for alteration in weight during transit and to substantiate the details given in the documents. The tea is then taken to a central sampling depot which acts for both buying and selling brokers. Samples are made from the teas for distribution to brokers and prospective buyers prior to a tea auction. The samples are reported on by the respective tea testers so that each party in the transaction has an opportunity to value each lot. Meanwhile, selling brokers acting for various producers of different countries, including Tanzania, prepare their catalogue for the sale showing the warehouse location of the tea, the producer's name, country of origin, the number of chests and total weight of each grade, etc. On the basis of this information the selling brokers make tentative orders for the teas in the forthcoming auction.

Two parties are generally involved in tea auctions-- selling and buying brokers. The rules regulating sales are formed by an association[1] consisting of the representatives of sellers, brokers and buyers. Selling brokers participate in auctions as agents for the producers or primary exporters,[2] and they are expected to act in the best interests of their clients. However, they receive instructions from their clients and agents regarding minimum selling prices. Buying brokers buy teas under the

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[1] The Tea Traders' Association.

[2] From the countries of origin as opposed to secondary exporters who export tea after buying it on the World market.

instruction of the buyers who might be blenders[1] or dealers or secondary exporters. The selling brokers sell their teas, starting the auction at a figure near to their own valuation and the lowest increment is a bid to them. The bids are made by buying brokers on behalf of their customers. Buying brokers make their own valuations, buy as cheaply as possible and finally forward the consignments to buyers with selling instructions for guidance. The buying brokers provide credit at their own risk and discretion to the buyers.[2]

After the official transaction has taken place in the market, a monthly phamphlet of average prices fetched by all teas from various countries is published and distributed to all individual estates and other producing agencies. Price levels attained in the market are said to depend on tea quality, briskness, pungency, colour, strength, and a host of other attributes which are known to tea blenders. Of all the attributes used to define tea, "quality" is the most controversial characteristic. It is used to denote the inherent merit of a given tea. The definition of tea quality is, however, elusive because superior tea characteristics do not depend on cultural and manufacturing practices only, but also on physical influences such as soil, climate and elevation. The slower

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[1] A hundred years ago teas were not usually blended. They were sold unmixed just as they came from the factories of producing countries. Nowadays, however, most tea sold at retail is a blend of different grades derived from various estates and sometimes from more than one country of origin. The main purpose of tea blending is to meet consumer demand for a uniform quality at a stable price. For more details, see V.D. Wickizer, Tea Under International Regulation (California: Stanford University Press, 1944), p. 45.

[2] H. Roy, Tea Prices Stablization - The Indian Case (Calcutta: The World Press Private Ltd., 1965), p. 33.

growth and lower yields of teas grown at higher altitudes of Sri Lanka and Assam, for instance, usually result in a finer flavour than that found in teas grown at medium or low altitudes. The latter teas, however, are known to add more colour to a cup of tea. This does not mean that "low" and "medium grown" teas are less desirable on the market than others. After all, most commercial teas are blends. The fact that high grown teas usually fetch a higher price than teas grown at lower elevations is mainly due to the fact that they are in short supply because of lower yields and limitations of growing area.[1]

It is obvious that quality determination is on a relative basis. The common practice is that teas grown in a certain region (East Africa, for example) and at different locations (such as Tanzania) are distinguished by a certain composition of characteristics and they are judged separately from India and Sri Lanka teas. That is why the expression "low quality tea" simply implies a tea with few or none of the characteristics associated with teas of a certain country or elevation; it has nothing to do with poor quality on a competitive basis in the world tea market as a whole.[2]

Summary

Commercial tea planting in Tanzania was started on a conventional

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[1] World Bank (IBRD), Report on the World Tea Economy, (Report EC-178, Washington, April 1970), p. 18.

[2] The tea trade's method of auction price determination evolved out of historical necessity as there were few tea producing countries and many tea drinkers in few nations but with a high demand in relation to supply. Today, however, the system is far from an open market. In fact one is tempted to think that tea price determination is almost a "family matter".

plantation basis as late as 1924. The economics of small scale tea growing was looked upon as an impossible dream because of reputed failures in East Asia in the latter part of the nineteenth century.

Smallholder tea growing in the country is a recent innovation dating back to the early sixties. The structure and pattern of development is designed in a Tanzanian context to meet the country's socio-economic needs. At the start, the tea development programme was faced with many drawbacks pertaining to lack of manpower, lack of enough planting material,[1] etc. Bearing in mind the newness of the crop, the targets so far achieved are indeed encouraging. This success is a result of the combined effort of the TTA and the government backed by the willingness of tea growers to undertake the cultivation of a technically demanding crop that has many rituals.

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[1] I remember the trouble I faced when about 23,000 dried up tea stumps were rejected by tea growers because of long distance transport from Amani to Lushoto, West Usambara, in 1970.

CHAPTER III

LABOUR - THE PRINCIPAL PERSONAL INVESTMENT OF TEA SMALLHOLDERS

Level of Labour Required and the Necessary Operations

Tea planting requires more labour than many other farming activities in the tropics. Labour inputs in tea production can be grouped into those operations relating to establishment (i.e., clearing, digging, staking, holing, planting, pegging, mulching), maintenance (weeding, fertilizer applications, pruning, tipping), and harvesting (plucking and delivery of green leaf to the buying centre). In the early stages of establishment and maintenance, the labour requirement is extremely high. Work done in the early stages can be regarded as a fixed cost which has a strong influence on future output per unit area. As tea matures, the major maintenance operations are reduced to annual fertilizer application and pruning, which is done once every three years on mature tea. Consequently, at maturity the most important labour input is plucking of green leaf and delivery of the leaf to a buying centre. Digging, planting and weeding will tend to disappear over time while plucking and delivery of green leaf to buying centres become increasingly important as shown in Appendix C, Table C.1. Table 3.1 and 3.2 represent annual labour requirements for all tea growing areas in Tanzania,[1] while charts 3.1 and 3.2 shows the trend of labour requirements for tea gardens of various sizes.

Generally, commercial tea estates employ approximately one full-

[1] Tea growing areas have been divided into two major categories because of similarities in cost of establishment and productivity potentials.

TABLE 3.1

ANNUAL LABOUR REQUIREMENT FOR A THREE-LOT, 0.3 HA TEA GARDEN IN CATEGORY A SCHEMES IN TANZANIA
(Adult Equivalent Days)

Years / Age of Tea Garden	Labour Requirement			
	Lot 1	Lot 2	Lot 3	Total
1	77*	--	--	77
2	48	77*	--	125
3	33	48	77*	158
4	28	33	48	109
5	42	28	33	103
6	54	42	28	124
7	55	54	42	151
8	58	55	54	167
9	71	58	55	184
10	61	71	58	190
11	61	61	71	193
12 and over	72	61	61	194

* Requirements may be less in Bukoba because to a large extent tea planting is carried out on "lweya" - grassland.

Source: Appendix C, Table C.1.

CHART 3.1

LABOUR REQUIREMENT FOR TEA GARDENS OF VARIOUS SIZES IN CATEGORY A SCHEMES IN TANZANIA

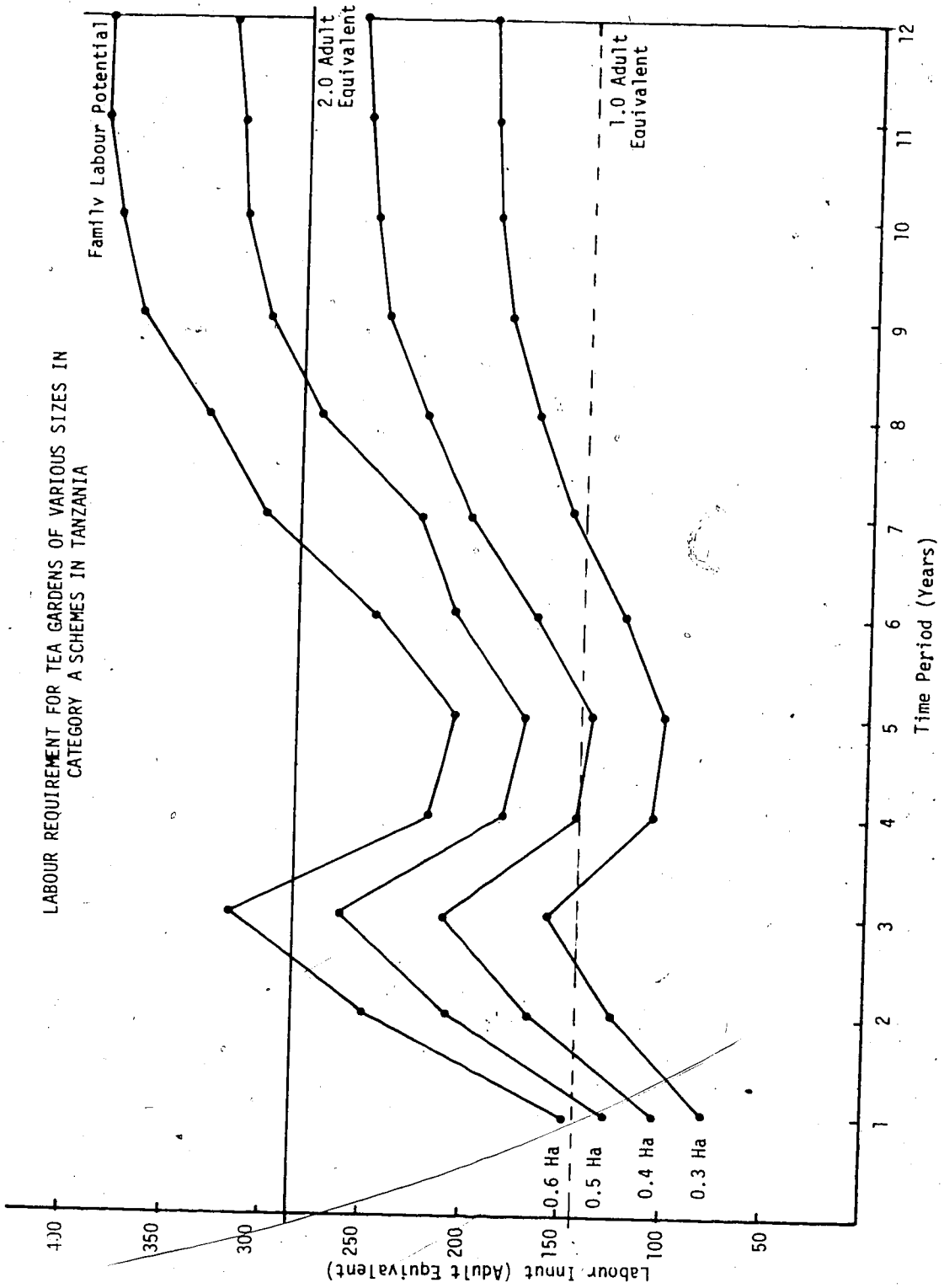


TABLE 3.2

ANNUAL LABOUR REQUIREMENTS FOR A THREE-LOT, 0.3 HA TEA GARDEN IN CATEGORY B SCHEMES OF TANZANIA
(Adult Equivalent Days)

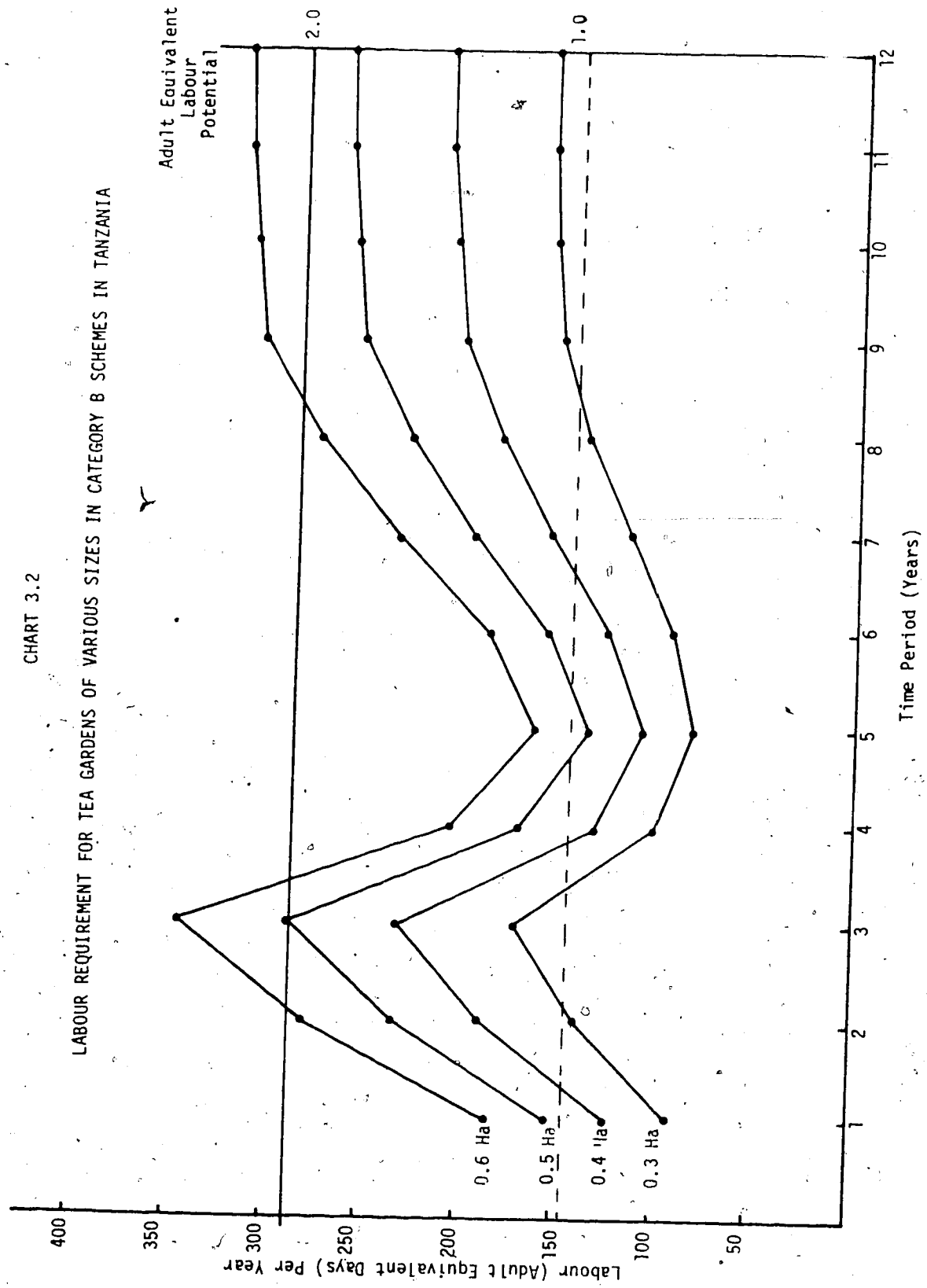
Years / Age of Tea Garden	Labour Requirement			
	Lot 1	Lot 2	Lot 3	Total
1	92*	--	--	92
2	48	92*	--	140
3	33	48	92*	173
4	22	33	48	103
5	27	22	33	82
6	45	27	22	94
7	46	45	27	118
8	47	46	45	138
9	60	47	46	153
10	49	60	47	156
11	49	49	60	158
12 and over	60	49	49	158

* Requirements may be higher where heavy forest stubs have to be cleared, as in Sakare area, West Usambara.

Source: Appendix C, Table C.1.

CHART 3.2

LABOUR REQUIREMENT FOR TEA GARDENS OF VARIOUS SIZES IN CATEGORY B SCHEMES IN TANZANIA



time worker per 0.4 ha (acre) of tea grown per annum.[1] The estimation is based on a work day of 7 to 8 hours for about 300 man days a year. Accordingly, one would expect a farmer with 0.4 ha of tea to devote his full time to his tea garden if it is to be well maintained. The situation is somewhat different for smallholder tea production in which the farm-family is supposed to be the only source of labour. Normally more people are required to work on a similar tea garden because of certain restraints that are inherent in peasant agriculture. Research has shown that a farmer with about 0.2 ha and two adult pluckers would pluck for four hours on one day in one week, and for the same period on two days the next week.[2] Under these circumstances, a farmer with 0.6 ha of mature tea would require three adult pluckers for five to six hours per day for three days each week. Among various limitations, the following are the major reasons which cause smallholders to require more people to work on the tea gardens than their estate counterparts.

(1) Most families do not start work on any farm activity until 8:30 a.m. In the early morning hours they have to cook breakfast, milk cows, prepare children for school as well as complete other household activities.[3] As for commercial tea estates, full time workers may start plucking as early as possible while casual labourers start work at 7:30 a.m.

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[1] N. Ramachandran, Plantation Investment in Ceylon 1889-1958 (Central Bank of Ceylon Research Series, 1963), p. 44.

[2] Dan M. Etherington, Smallholder Tea Production in Kenya: An Econometric Study (Dar es Salaam: East African Literature Bureau, 1973), p.105

[3] J.H. Cleave, African Farmers: Labour Use in the Development of Smallholder Agriculture (New York: Praeger Publishers, 1974), p. 163.

(2) Because of the newness of the crop to peasant farmers, their plucking abilities are limited. Two kilograms of green leaf per hour is regarded as a good rate of plucking in a newly established tea garden. On estates a plucking rate of 2.75 kg per hour is considered normal, and in flush periods some exceptional pluckers attain as much as 4.5 kgs per hour. The cause of this difference in performance is two-fold. First, full time workers on estates have developed specialist skills because of long experience in tea plucking. Secondly, estate pluckers work on mature bushes (most of them being over 20 years old) which allow higher plucking rates because the shoots are closer together as compared to the relatively immature tea bushes of the smallholders.

(3) Plucking on smallholder tea goes on for relatively fewer hours than a similar day's work on a tea estate. A typical farmer has to stop plucking around mid-day. This means the maximum plucking time is about five hours (from 8:00 a.m. to 1:00 p.m.). The reason for working fewer hours is the need to get the green leaf to the buying centre and hence to the factory within six hours of plucking.

(4) Farmers spend an average of one and a half hours per person per delivery of leaf to a buying centre. Three-quarters of an hour is usually spent on the outward journey and the remaining time is spent at the buying centre. The time spent at the buying centre varies greatly depending on the arrival times of other growers and the arrival of the leaf trucks.[1] Normally, after a day's work plucking and delivering tea to the centres the people are too tired to do any other satisfactory work

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[1] Leaf trucks used to get stuck in mud but over time the tea roads in all schemes have been improved by the Ministry of Communication (Comworks) and the Norwegian Road Betterment Units.

on the typical homestead multi-product farm.

Pluckers on tea estates work under different condition. They are virtually assured of an eight hour plucking day because the factory is within close proximity of the plucking fields. This allows as many collections of green leaf as possible.

Supply of Farm Family Labour

Before the structure of the tea project was designed, TTA carried out a general survey on the labour potential of farm families in all tea schemes. The results indicated that a smallholder family had an average of three to six persons working on the farm. It was then deduced that the stock of family labour was adequate to provide the 160 man days[1] of work per annum required for 0.6 ha of tea in addition to operating other activities existing on the farm.[2] Such a conclusion was probably in line with the myth of disguised unemployment,[3] which is alleged to be the characteristic of traditional agriculture in developing countries. The proponents of disguised unemployment claim that (1) labour is idle because of lack of employment opportunity; (2) labour is employed to yield products and services of low value; (3) labour is employed inefficiently; (4) labour

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[1] This was an underestimation of the actual labour requirements for tea especially when all bushes are mature and in full production.

[2] World Bank (IBRD), Appraisal Report for Tanzania Tea Project, 1971, p. 22.

[3] The notion of disguised unemployment implies that there exists plenty of unemployed and under-employed rural family labour which could be withdrawn from subsistence farming and assigned to market oriented activities without reducing the volume of subsistence production. In consequence, the marginal productivity of farm family labour is considered to be zero or almost zero. G.M. Meier, Leading Issues in Economic Development (2nd Edition: London: Oxford University Press, 1970), p. 146.

is unemployed because of illness.[1] The four potential sources of labour are indeed universal and therefore, the tea growing areas of Tanzania could not have been different. However, it appears that the introduction of tea planting which calls for constant attention throughout the year has already drawn considerable amounts of labour which used to be seasonally either unemployed or under-employed.

Household Working Capacity as a Limiting Factor

Before farmers were encouraged to grow tea, a typical peasant family farm in potential tea areas had an average of 1.4 ha of land which was made up of 0.8 ha of homestead with perennial cash and food crops (usually coffee-bananas or cassava and yams) and a small garden. In addition, the family had about 0.6 ha of open grassland some distance from the farm. Apart from working on the homestead farm and taking part in the household chores, each year small plots of arable land had to be cleared and cultivated with maize, beans, potatoes, yams and other crops. The allocation of family labour among the activities depended on each activity's contribution to the well-being and happiness of the family.

In the first few years of tea establishment, scarcity of family labour is not a binding constraint because a farmer can postpone operations such as weeding and pruning for a week or so without any significant effect on future green leaf production. It is only at later stages (during the fifth year and over) that the tea garden becomes more demanding. Postponing plucking for a week causes loss of crop which cannot be

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[1] W.). Jones, "Labour and Leisure in Traditional African Societies," Items, Vol. 22, No. 1 (March, 1968).

recovered. Tea plucking is supposed to be carried on time and it is advantageous for farmers with more than 0.4 ha to adopt an even plucking routine.

The good aspect about smallholder tea production is that it is a supplementary product to other homestead farming activities. The crop has no extreme seasonality and moreover plucking can be concentrated on a few days in a week. Indeed, it was these inherent characteristics of tea operations together with the underestimation of the labour requirements for tea that led TTA to aim at an average of 0.6 ha as a maximum size within the capacity of a family unit without employing labour. The TTA survey results that on average there were three to six people in a rural farm family were misleading because they were not expressed in potential adult-equivalent labour which was then available for farming and working on other household activities.

A survey which was carried out in 1966-68 under the auspices of the Max Planck Nutrition Unit[1] in West Usambara indicated that the average farm family consisted of six members, and that the size of the family increased with the degree of commercialization. An average family numbered only five persons on the subsistence farms of Mulungui Ward, whereas the average went up to 6.9 members per family on the commercialized holdings of Mponde and Soni Wards. The sample of 60 families also revealed that the size of the farm family labour force varied according to the degree of commercialization. For the West Usambara as a whole, the average labour force was 2.3 Adult-Equivalent (AE) per family. In Mulungui Ward, the average was 1.9 AE while in Mponde and Soni Wards it was 2.5 AE per farm

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[1] Hans Ruthenberg, Smallholder Farming and Smallholder Development in Tanzania (London: C. Hurst & Co., 1968), p. 143.

family. A similar survey was carried out in 1964-65 by Friedrich[1] in Bukoba. Results showed that an average farm household was composed of 5.3 persons. Here households had an average labour potential of 1.64 AE per family.

Explanation of these rather controversial results is two-fold. First, probably a good percentage of the rural farm family members are younger children who attend school and whose contribution to farm work is limited. Such members of the family would have considerable difficulty with most tea operations. Second, some adult members of the farm families are probably not full time workers on the homestead farms.

A real problem exists in peasant households as the head of the family has a final say on how the proceeds of the farm are to be spent. Since the householder and his wife have the responsibility of ensuring that their limited farm income covers the purchase of the basic necessities of the family, they allocate little or no money at all to their adolescent and younger children. Thus, some of the older children keep on the lookout for off farm job opportunities from which they can earn direct cash. Adolescent (15-19 years of age) and even child (9-14) members of the typical village household prefer to work as casual labourers in private tea estates instead of working on the family tea gardens.

In general, the farm family labour force keeps changing on a year to year basis. Children are born and grow to working age, grown up daughters get married at the time when they could contribute effectively to the family farm, grown up sons form new families and no longer want to be tied to their father's fortune, well educated sons and daughters get

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[1] Ibid., p. 182.

monthly paid jobs and usually stay far away from their area of domicile, etcetera. Over time, it is only the householder and his spouse who work full time on the homestead and other activities, save for those families with aunts and uncles who can participate on the farm whenever possible.

Another drawback against full utilization of the potential labour force in tea growing areas is the traditional division of labour between men and women. In Bukoba area, for instance, men are usually assigned the heavier tasks of livestock management, keeping household surroundings and buildings in good condition and working on perennial cash and food crops while women become responsible for work on annual food crops and food processing. This practice results in using the available family labour inefficiently. There is, however, sufficient evidence that if tea growing could prove to be rewarding, the cultural practice could change over time.

Amount of Labour a Farm Family Can Afford to Allocate to Tea Work

According to Friedrich (1965), an average farm family in Bukoba had a potential of 578 man-days and yet only 37 percent of the available labour was being used on homestead and arable farming activities.[1] A similar survey by Attems 1966-68 in West Usambara indicated that on an average farm, families had a working capacity of 625 man-days each for agricultural production excluding non-farm employment. Here, only 32 percent of family labour was being used on farming.[2] By giving an allowance of three hours of daylight for house chores (cooking, washing, fire-

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[1] Ibid., p. 197.

[2] Ibid., p. 156.

wood and water collection), the time available for tea work could be determined (Table 3.3). A basic assumption in this case is that farmers prefer tea growing to off-farm activites.

TABLE 3.3

LABOUR CAPACITY AND LABOUR ALLOCATION IN VARIOUS FAMILY ACTIVITIES (Man-Days Per Annum)

Item	Bukoba	West Usambara
Average Labour Potential Per Family	578	625
Labour Used on Homestead and Arable Farming	214	198
Labour Used for Household Chores	120	120
Labour that Could be Used on Tea Work	244	307

Note: Estimates are based on 300 man-days per annum.

From the two estimates given in Table 3.3, an average of 276 man-days per annum could be available for tea work. In general, therefore a smallholder and his wife could at most afford to work on tea for 7.5 hours a day three days a week (about 288 man-days per annum).[1]

At the outset, it is interesting to look into the question of whether a typical farm family with two adults and a few children could manage 0.6 ha of tea without hiring labour. This is an important issue as far as the Tanzanian smallholder tea industry is concerned. Survey results

[1] As discussed earlier, the labour potential from aunts, uncles and children has been excluded because naturally they are not full time people on the farm. However, their contribution is essential to fill the gap at peak periods and when one of the full time farm people falls sick.

in the country might turn out to be misleading because most holdings have immature tea bushes. Nevertheless, close examination of available information should be useful.

A survey which was carried out in the Kisii and Kericho districts in Kenya, revealed that it was an error for the Kenya Tea Development Authority (KTDA) to assume that farmers would not hire labour until they had about 0.4 ha of tea (Table 3.4).[1] Another example from Kenya sheds some light on the labour intensiveness of tea planting. A survey carried out on a random sample of 48 tea gardens averaging 0.47 ha indicated that 60.5 percent of labour input in tea work was hired (Table 3.5). This means that a farmer with about 0.4 ha of tea who could not hire labour for his tea garden would run into a time rationing problem with a resultant effect of neglecting the tea (Table 3.6). Since tea is supposed to be a subsidiary crop, work on food takes priority.

The element of hiring labour for smallholder tea gardens is universal. The author used to see a good number of casual labourers in well maintained tea gardens in Tanzania. Other progressive tea growers with over 0.4 ha who did not hire casual labour were found to have a poor and inadequate food supply base at their farms. Excited by the advent of the new cash crop, they concentrated all their efforts on tea and as a result had to buy their food with the meagre proceeds from the tea. This

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[1] The percentage of hired labour force may be somewhat "upward biased" because the sample of tea growers included some people with some off-farm interests ranging from petty trading in markets, shopkeeping, clerical skills, primary school teaching, high-ranking civil servants, people with elected positions on cooperatives to full time farm people. Implications from the data should not be overlooked because it appears to the author that the above composition of Kenyan tea smallholders is not significantly different from that of Tanzania.

TABLE 3.4

AVERAGE FAMILY SIZE, GREEN LEAF PRODUCTION AND THE PERCENTAGE OF HIRED LABOUR IN KENYA, 1965-1966

	Average Family Size		Average Green Leaf Production (kg)	Mature Hectare Equivalent (ha)	Percentage of Plucking Labour Hired
	Adults	Children			
Nyamira	2.6	7.0	760	0.15	19.4
Konoin	2.2	5.2	885	0.17	23.4
Kitutu	2.6	6.6	1,532	0.30	36.3
Buret	2.5	4.6	1,794	0.36	53.3

SOURCE: Dan Etherington, Smallholder Tea Production in Kenya: An Econometric Study (Dar es Salaam: East African Literature Bureau, 1973), p. 113.

TABLE 3.5

AVERAGE ANNUAL LABOUR INPUT PER .47 HA, TEA, BURET, KERICHO-KENYA, 1965/66

Activity or Enterprise	Adult Equivalent Hours: Family Labour				Hired Labour			Total Average Labour Input (Adult Equivalent)	Total Average Man Days
	Head of Family	Other Men	Women	Children	Men	Women	Children		
Tea	312.6	145.5	276.1	203.9	1,179.0	98.1	23.9	2,125.1	283
Maize	190.6	114.6	160.4	193.9	312.3	20.9	11.8	801.0	107
Millet	21.0	36.8	91.3	26.8	24.9	62.5	0.9	245.7	33
Livestock	146.4	93.3	277.6	774.3	29.2	4.2	63.0	959.4	128
Other Farm Work	135.3	80.0	229.4	109.8	147.5	4.0	3.1	742.1	99
Domestic Chores	55.1	40.7	2,122.0	404.8	33.3	25.8	8.9	2,483.5	331
TOTAL	861.0	511.0	3,156.8	1,713.7	1,627.2	215.5	111.6	7,357.7	981

N.B.: "Adult Equivalent" hours are calculated using the following weights: 1 work hour of man = 1 work hour of a woman = 2 children work hours.

Source: Dan Etherington, Smallholder Tea Production in Kenya: An Econometric Study (Dar es Salaam: East African Literature Bureau, 1973), p. 99.

TABLE 3.6

NEGLECTED TEA GARDENS BY DECEMBER 1976

Scheme	Area (Ha)	Percentage of Total Planted Area
Rungwe	60	1
Bukoba	266	16
Usambara	133	6
Lupembe	271	15

Source: Tanzania Tea Authority, Dar es Salaam.

was a typical phenomenon in Mponde, West Usambara in 1969-1971. Thus, instead of tea being a blessing, it was turning out to be a cruel hoax. The Ministry of Agriculture had to intervene in order to reverse the trend, and tea extension staff were warned not to "preach" on tea only, but also on food and other cash crops.

Since the plucking of green leaf has been identified as the long term demanding operation in tea work, one cannot draw hard and fast rules as to the size of a tea holding to be established by each grower. Apart from the year to year changes in the farm family size, certain families have members who are good at tea plucking. This is particularly true of the Wabena in Njombe, the Wasambaa in Usambara, and the Wanyakyusa in Rungwe. These people are either part-time workers on tea estates or former tea estate workers. A solution to the tea garden size problem would therefore call for thorough knowledge on the part of the extension staff of plucking abilities and labour potentialities of families in their areas of operation. Charts 3.3 and 3.4 can be used as a guide in determining

CHART 3.3

DETERMINATION OF THE SIZE OF A TEA GARDEN
IN CATEGORY A SCHEMES

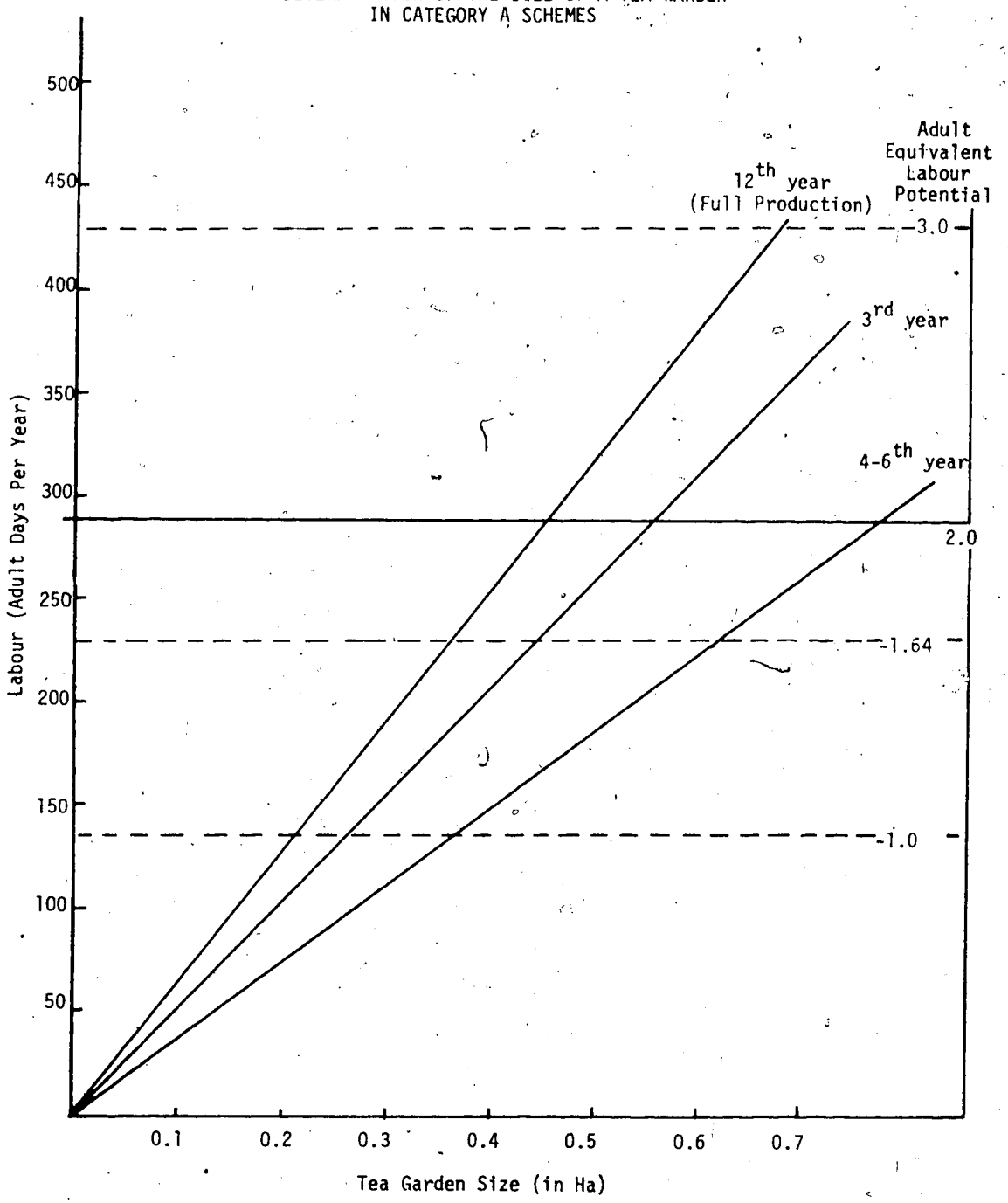
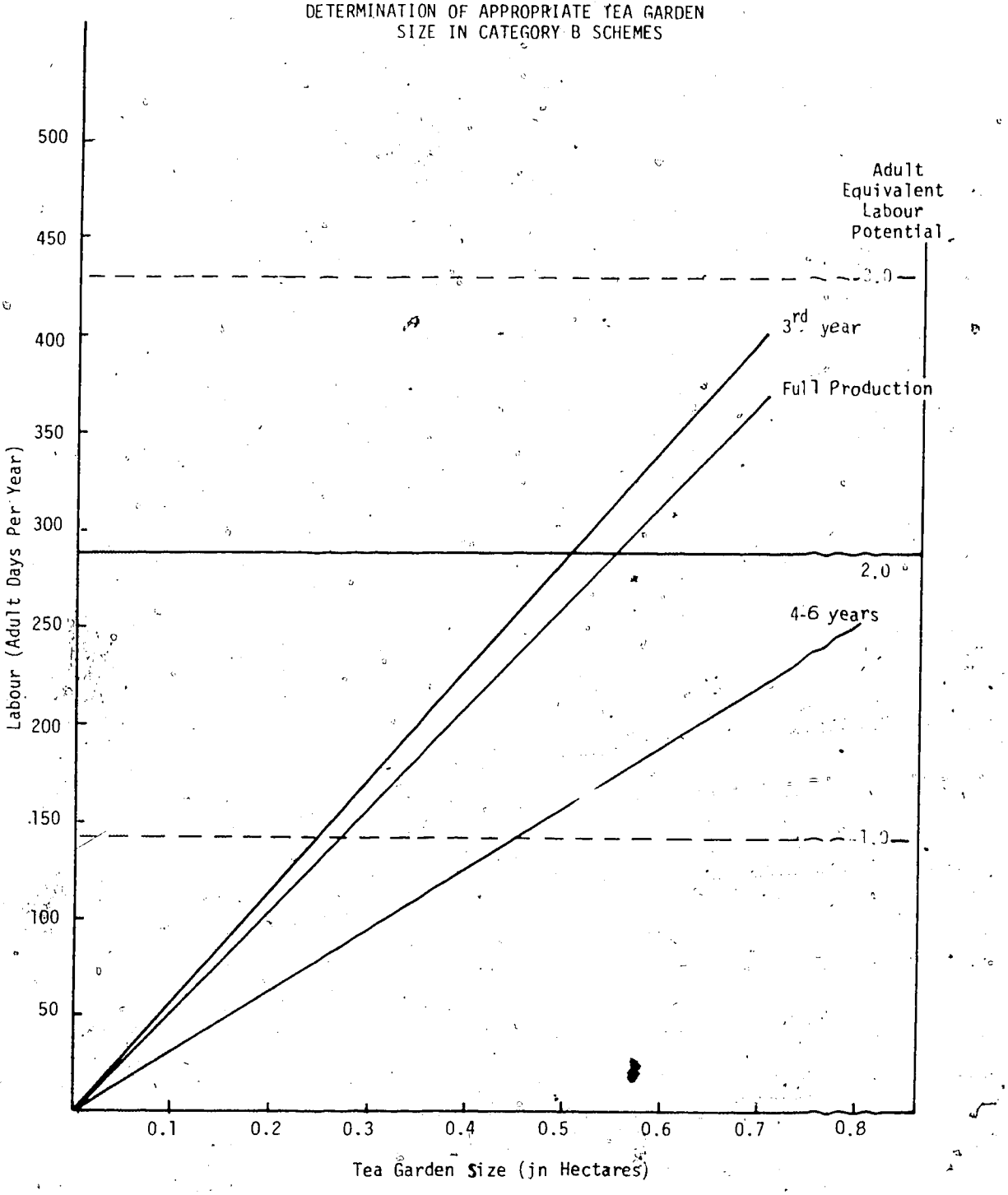


CHART 3.4

DETERMINATION OF APPROPRIATE TEA GARDEN SIZE IN CATEGORY B SCHEMES



the appropriate size of a tea garden on the basis of the two scheme categories.

Summary and Implications

Summary

Tea is undoubtedly a labour intensive crop per unit of output. It calls for constant attention which the average peasant family may not be in a position to give. Work on food crops and other household chores naturally must take priority over work on cash crops because they are essential for survival. On the average, farm families spend about two to three hours of daylight on household chores (such as cooking, collection of water and firewood, etc.), regardless of the size of the family. Release of family labour to grow tea together with other cash crops without deterioration of the food base and the common convenience of house life will take time, improved production methods, and investments by individual householders as well as by communities and the national government.

Implications

1. The question of how much tea a smallholder family can properly tend with "peace of mind" needs immediate attention; otherwise the move towards utilizing "under-employed" rural labour will be defeating its own purpose. It appears to the author that a mature tea garden of greater than 0.3 ha siphons off more of the working capacity of the average farm family than that family can spare. Over time, a family with 0.6 ha of tea has to employ casual labour, in which case tea will tend to be competitive with other homestead activities.

2. Tea growers should be warned not to neglect their food crops

until such time that income from tea gives them the purchasing power needed to buy, instead of to grow, part or all of their food requirements.

3. For planning purposes, it might be wise to assume that all work on tea that cannot be done by the smallholder himself, his wife or relatives in the household will have to be paid for in competitive wages, even if child members of the family do the work.

Among those developing nations having less than twenty years of independence, Tanzania is taking the lead in trying to avail the essential amenities of life to rural people. Nevertheless, it will take a while before all families have running water in their homes. It is therefore unrealistic to consider farming activities in isolation of non-farming duties. These are essentially year round demanding tasks, however unproductive they might be. Encouraging large tea gardens would therefore create a strong local demand for labour which may lead to problems in tea project areas where tea estates already absorb a large part of local labour supply. Since seasonal labour migration is not encouraged by the country's development policy, the system would ultimately inhibit the anticipated development of the smallholder tea sector.

CHAPTER IV

METHODOLOGY OF ANALYSIS

Introduction

As stated in Chapter I, this study will address itself to the analysis of the financial aspect of the smallholder tea development project. Financial analysis of smallholder agricultural projects should consist of two distinct phases.[1]

(1) It must look at the financial results on individual farms to be certain there will be sufficient farm family income and enough incentives for participating farmers. The important incentive for most farmers is the net cash income after repayment of interest and principal which will be available to the farmer if he participates in the project.

(2) The analysis must also look into the results of public entities or commercial organizations such as cooperatives, banks and private input distributors or processing firms. This phase is required in order to focus on how well they would be able to discharge their responsibilities for project implementation.

The principal concern of the financial analysis in this study is to estimate the return on labour and capital for the participants, and to form a judgement as to whether the project is sufficiently profitable or not. With this approach, the timing of costs and returns throughout the life time of a farmer's tea enterprise is very important. This process of analysis is known as the Cash Flow Method.

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[1] J. Price Gittinger, Economic Analysis of Agricultural Projects (Baltimore: The Johns Hopkins University Press, 1972), p. 14.

Cash Flow Analysis

Cash flow analysis provides a framework within which viability of the smallholder tea enterprise can be measured and judged. The concept of cash flow analysis is referred to by Little and Mirrlees[1] as the best measure of viability in project analysis. The procedure for deriving a cash flow of a given firm in a project is as follows. For every year of the life time of a given enterprise, all expected expenditures on goods and services (including capital expenditures) and expected receipts from the enterprise are recorded. Then, for each year, the former is subtracted from the latter. What is left over is a residual which shows how much the firm gains or loses from the enterprise. This residual is known as the net cash flow. During the early years of the project/enterprise, the cash flow might be negative, but this element does not cause trouble as to the definition of cash flow.

There are two major differences in the manner in which derivation of cash flow is carried out for "economic" as opposed to financial analysis. First, in the determination of the social economic benefits of an investment project, income taxes, sales taxes and custom duties are not deducted from the receipt stream because such costs are regarded as transfer payments within the society. In the analysis for private economic benefits (financial analysis), however, taxes are a cost like any other expenditure and therefore must be deducted from the revenue stream before arriving at the amount available for recovering and compensating for the use of capital. The second difference is that in financial analysis of a

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[1] Ian M.D. Little and J.A. Mirrlees, Manual of Industrial Project Analysis in Developing Countries, Vol. II, Paris: D.C.O.E.D., 1968), p. 18.

project, or a firm in a project, it is important to account for capital borrowed from external sources. Thus, when borrowed capital is received it is normally entered into the receipts stream as a kind of benefit received. Then, when a payment of interest or a repayment of principal is made to the outside supplier of capital, it is deducted from the gross returns as a cost in deriving the cash flow. In economic analysis of public projects, the question of interest payment does not arise unless there is foreign capital involved.

The Difference Between Project Analysis and Firm Analysis

A major characteristic of all types of cash flow for project analysis is that they include undifferentiated both the return of capital and the return to capital. This element has caused confusion among project analysts in various fields and professional accountants. In firm analysis, the cash flow is essentially the sum of the profits plus the depreciation allowances, usually after payment of all types of taxes. This definition conforms to accounting terminology. In project analysis, however, instead of an allowance for depreciation on investments, the investment itself is accounted for at the time it is actually made. The interest on any of the capital employed in the project is not explicitly deducted from the gross returns because the analytical technique implicitly either allows for a specified interest charge or determines the internal rate of return of capital in determining the viability of the project.

Discounted Cash Flows

Discounted cash flow is an important tool in financial analysis

because it introduces the cost or time value of money into investment decision making. The process involves discounting the cash flow stream through compound interest worked backwards to the present. The reason behind the translation of cash flow to the present is to give the present worth of the firm's earnings, a useful measure of profitability. Indeed, the need for aggregating future cash flow with decreasing weight cannot be overemphasized because a dollar in hand today is not equal to a dollar to be received in the future. In converting future cash flow back to the present the following formula is used.

$$PV = \frac{R_t}{(1+r)^n} \qquad (4.1)$$

where: PV = Present value,

R_t = Future cash flow; it includes initial investment outlay (The initial investment outlay may occur for more than one year),

r = Discounting factor,

t = 1,2,...,n, time period (Year),

n = Expected life of project in years.

In common practice, there are problems associated with establishing the discount factor and there is little agreement among economists on how to determine it.[1] However, most economists agree that the discount rate attached to future returns by society is lower than that of private firms because society has a longer time horizon. Consequently, the rate

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[1] D.A. Nichols, "The Public Discount Rate" (Unpublished Report, University of Wisconsin, Madison, June 1974), p. 1.

of discount is simply a rule of thumb[1] although many public and private agencies put it between 8 and 15 percent. As for the tea smallholder enterprise, three discount rates will be used to evaluate the profitability of its investments. The first is a zero percent, reflecting the assumption that tea growers are completely indifferent as to the timing of the receipts because future receipts will benefit their own sons. While this may not be a realistic assumption, the zero rate of discount provides a basis from which to assess the importance of other rates' assumptions. The second rate, 3.5 percent, is the rate of interest paid by commercial banks in Tanzania for savings accounts. The third will be 8.5 percent, the rate at which loan funds are extended to the farmers by the Tanzania Rural Development Bank. The 8.5 percent discount rate should be assumed to be a social discount rate. Individual growers discount rates are indeterminate because entrepreneurs discount the future quite significantly.[2]

Discounted Cash Flow Measures of Project Viability

Apart from the benefit/cost ratio, which is used almost exclusively for social economic analysis, there are two important discounted cash flow measures which apply in both social economic and financial analysis of projects.

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[1] The rate of discount chosen may reflect the actual cost of loaned funds, the opportunity cost of withholding funds from alternate use, or subjective time preference and risk aversion.

[2] Farmers (entrepreneurs) are usually not only concerned with money but also uncertainty and risk involved.

Net Present Value at Minimum Acceptable Rate of Return

This is the present worth of the expected net cash flows of an investment, discounted at the cost of capital and subtracted from it the initial cost outlay for the project. The mathematical statement for the net present value is given in the following formula.

$$NPV = \frac{R_1}{(1+r)^1} + \frac{R_2}{(1+r)^2} + \ldots\ldots + \frac{R_n}{(1+r)^n} \qquad (4.2)$$

$$= \sum_{t=1}^{n} \frac{R_t}{(1+r)^t} \qquad (4.3)$$

where:

NPV = Net present value,

$R_1, R_2, \ldots, R_n$ = Net cash flow for each year,

t = 1,2,...,n, time period (Year),

n = Expected life of project in years,

r = Marginal cost of capital (interest rate).

The formal criteria for selection among projects is to accept all projects with a positive net present value when discounted at the social discount rate of capital (however chosen). It is a useful analytical measure when there are alternative ways of carrying out a project. The alternative with the greatest positive net present value would be the most attractive (ignoring intangibles).[1]

A drawback in the practical use of the net present value measure

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[1] C.G. Edge, A Practical Manual on the Appraisal of Capital Expenditure (Toronto: The Ryerson Press, 1964), p. 32.

of project worth is that it does not allow the ranking of acceptable alternative projects.[1] It is therefore an absolute, and not a relative, measure. Consequently, it is an unreliable indicator when for any reason, one has to choose between two or more acceptable projects or enterprises. The source of trouble lies in its formal criteria that for maximizing net returns, all projects with a positive NPV that have been discounted at the opportunity cost of capital should be undertaken. In the real world, however, entrepreneurs are faced with scarce resources to an extent that they sometimes cannot handle all acceptable projects at the same time.

Despite the above mentioned weakness of the discounted net cash flow measure of project worth, it is the tool which will play a major role in determining the profitability of the smallholder tea enterprise. The study is dealing with a single project which has more or less limited alternatives in being carried out.

The Internal Rate of Return

The internal rate of return is defined as the rate of discount which would make the net present value of a given project equal to zero. The discount rate represents the average earning power of the money used in the project over the project life. Its formal mathematical presentation is as follows:

$$0 = \frac{R_1}{(1+i)^1} + \frac{R_2}{(1+i)^2} + \ldots\ldots + \frac{R_n}{(1+i)^n} \qquad (4.4)$$

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[1] J. Price Gittinger, Economic Analysis of Agricultural Projects, p. 144.

where:

$R_1, R_2, \ldots, R_n$ = Net cash flow for each year,

$t = 1,2,\ldots,n$, time period (Year),

n = Expected life of project in years,

i = Internal rate of return (unknown).

The selection criterion is to accept all projects with an internal rate of return value above the opportunity cost of capital. If the projects are entirely independent, the internal rate of return provides the means to rank projects in terms of their relative earning power.

The analytical measure has generally gained wide acceptance among economists and businessmen because entrepreneurs and other investors are more used to judging investments by their yields. Indeed, the internal rate of return is the most efficient selection criterion where capital is the only limiting factor. It is only in cases of mutually exclusive or interdependent projects that the internal rate of return has proved to be an inefficient tool in ranking various projects with respect to their economic and financial viability. In such circumstances, it is better to use the net present value criteria.[1]

A practical problem with the internal rate of return is that there is no direct formula for finding the interest rate that will convert discounted cash flow of a given project to zero. Therefore, one must resort to a trial and error proach. A popular method is to begin with a quick guess of a discount rate which might be in the neighbourhood of the true value. Then, by interpolation one can estimate the right discount rate.

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[1] J.F. Weston, et al., Management Finance (5th Edition: Hinsdale, Illinois: The Dryden Press, 1975), p. 274.

The method used for interpolating the value of the internal rate of return which lies between a discount rate which is too high on one side, and too low on the other is given by:

$$\text{Internal Rate of Return} = \text{Lower Discount Rate} + \text{Difference Between the Discount Rates} \left[\frac{\text{Present Value of Cash Flow at the Lower Discount Rate}}{\text{Absolute Difference Between the Present Value of the Cash Flow at the Two Discount Rates}} \right] \quad (4.5)$$

Though the internal rate of return is widely accepted as a measure of investment projects, it will not be used in this study because of the special characteristics of the tea enterprise, which are:

(1) Apart from capital requirements, the value of the other two factors of production (land and labour) are not assigned any rental cost. Thus, before determining the internal rate of return of the tea enterprise, more assumptions on land rent and cost of family labour would have to be incorporated in the analysis. The author feels that such an approach would result in an unrealistic figure for the internal rate of return. Assumptions on land rent and cost of labour used in smallholder tea growing are explained in details in Chapter V.

(2) There is no need to use the internal rate of return because the analysis is for only one enterprise and therefore the net present value method can as well give reliable basis for the viability of the project.

Computing Techniques of Discounted Cash Flow Measures That will be Used in the Analysis of the Tea Enterprise

A smallholder tea garden would consist of three lots, established in three consecutive years. Maximum green leaf production would occur in the thirteenth year and is expected to remain on the same level for the rest of the project's life. Once plucking begins, a certain fixed cess is charged to meet the loan repayment plan. The average life time of the tea garden that will be used in the budget is sixty years.[1]

Cumulative Net Cash Flow

Cumulative Net Cash Flow at zero rate of return is given by:

$$\sum_{t=1}^{12} (N_t) + 48(N_{13}) = PV_0 \qquad (4.6)$$

where:

N_t = Net cash flow in year t,

PV_0 = Present value at zero rate of return,

N_{13} = Net cash flow in each of year 13-60.

Net Present Value

Present value of the project to a householder at a specified rate of return (discount rate), r, is given by the following mathematical statement.

$$PV_r = \sum_{t=1}^{12} (P_t) + \frac{N_{13}}{r} \left[1 - \frac{1}{(1+r)^{48}} \right] (1+r)^{-12} \qquad (4.7)$$

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[1] For a detailed account see Chapter V.

where:

$$P_t = \frac{N_{tr}}{(1+r)^t} = N_{tr} \cdot (1+r)^{-t}, \text{ for } t = 1,2,\ldots,12 \qquad (4.8)$$

Alternatively, in natural log, $P_{tr} = N_{tr}.e^{-\delta t}$ (4.9)

where: $\delta = \ln(1+r)$;

$e = 2.7183$ (basis of natural logarithms)

Also, $$PV_{r(48)} = \frac{N_{13}}{r}\left[1-e^{-\delta 48}\right]\left[\quad^{-\delta 12}\right] \qquad (4.10)$$

Thus,

$$PV_{r(60)} = \sum_{t=1}^{12} N_{tr}e^{-t\delta} + \frac{N_{13}}{r}\left[e^{-12\delta}e^{-60\delta}\right] \qquad (4.11)$$

In determining the net present value of the cash flow of the two discount rates (3.5 percent and 8.5 percent), the discounting factors ($e^{-t\delta}$) of Table 4.1 were used. From year thirteen to sixty (48 years) annual cash earnings from the investment is estimated to be equal. In computing the net present value of a given investment, two different financial positions may occur.

Case A

At one point in time during the 48 years, the loan plus interest might be fully covered. This period would have to be determined in order to calculate additional cash flow after the loan term. The formula for determining the time, t, for loan retirement can be worked out as follows:

TABLE 4.1

DISCOUNTING FACTORS TO BE USED IN DETERMINING THE NET PRESENT VALUE OF THE CASH FLOW

Time t	3.5 Percent Discount Rate	8.5 Percent Discount Rate
1	0.9662	0.9217
2	0.9335	0.8495
3	0.9019	0.7829
4	0.8714	0.7216
5	0.8420	0.6650
6	0.8135	0.6129
7	0.7860	0.5649
8	0.7594	0.5207
9	0.7337	0.4799
10	0.7089	0.4423
11	0.6849	0.4076
12	0.6618	0.3757
13-60*	15.5470	4.5134

* The discount factors for the 13^{th} to 60^{th} year have been determined from the formula:

$$\frac{1}{r}\left[e^{-12\delta} - e^{-60\delta}\right] \quad \text{. (Refer Equation 4.11).}$$

Let $$PV = \frac{R}{i}\left[1 - \frac{1}{(1+i)^t}\right] = \frac{R}{i}\left[1-(1+i)^t\right] \quad (4.12)$$

where:

PV = Present value,

R = Amortization cess minus current year loan services, i.e., cost of maintenance fertilizer plus interest on same.

i = Loan interest rate,

t = Time of loan retirement after the twelfth year.

Alternatively,

$$PV = \frac{R}{\delta}\left(1-e^{-\delta t}\right) \quad (4.13)$$

Thus,

$$e^{-\delta t} = 1 - \frac{\delta PV}{R} \quad (4.14)$$

and

$$t = \frac{\ln\left(1-\frac{\delta PV}{R}\right)}{\delta} \quad (4.$$

Equivalent ("Average") Annual Net Cash Flow (E_r):

i) At $r = 0$, $E_0 = \frac{PV_0}{t}$

ii) At $r > 0$, $E_r = PV \cdot r \frac{1}{(1+r)^t - 1}$ (4.16)

where:

E_r = Equivalent annual net cash flow at r discount rate.

PV = Present value of a future sum of net cash flow.

t = Number of years of project life.

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[1] Cissell and Cissell, Mathmematics of Finance (Boston: Houghton-Mifflin Company, 1973), p. 138, 144.

Alternatively, by taking $\frac{PV_0}{t} = A$

$$PV_r = A.\frac{1}{r}\left[1-(1+r)^{-t}\right] \qquad (4.17)$$

In natural logarithms,

$$PV_r = Ar^{-1}(1-e^{-\delta t}) \qquad (4.18)$$

Equivalent Cash Flow per Adult Equivalent Day (AED):

This will be determined from the following ratio:

$$AED = \frac{A}{AD} \qquad (4.19)$$

where:

A = Equivalent annual net flow,

AD = Average annual adult equivalent days.

Case B

This would be a situation in which the loan cannot be retired within the life time of the project. In case this happens, the total amount of loan at the end of 60 years would be determined.

The gross amount of the loan increases every year by a factor (1+i). At the end of the project life it equals:

$$GLA_{60} = A_{12}\,(1+i)^{48} \qquad (4.20)$$

where:

GLA_{60} = Gross loan accumulation,

A_{12} = Amount of outstanding loan at the end of the twelfth year,

i = Loan interest rate.

The annual repayment amounts to:

$$N_{13} = C_{13} - Cl_{13} \tag{4.21}$$

where:

C_{13} = Fixed annual cess payable,

Cl_{13} = Current loan.

The amount of these payments cumulated to age 60 is:

$$PA_{60} = \frac{N_{13}}{i}\left[(1+i)^{48}-1\right] \tag{4.22}$$

Thus, the net amount of the loan at the end of the project will be:

$$LA_{60} = GLA_{60} - PA_{60}$$

The present value of the loan, LA_{60}, unpaid at sixty years is:

$$LP = LA_{60}(1+i)^{-60} \tag{4.23}$$

To find out how much additional cess (AC) that should be paid each year to retire the loan in 60 years is given by the fomula:

$$AC = \frac{LP.i}{(1-e^{-\delta t})} \tag{4.24}$$

The additional unit cess (AUC) in Tsh/kg of green leaf can be estimated approximately by dividing into life time tea output (LTP):

$$AUC = \frac{60AC}{LPT} \tag{4.25}$$

On a workday basis, this additional load amounts to:

$$\frac{AC}{AD} = (Tsh/AED) \tag{4.26}$$

where: $AC = \frac{LP.i}{1-e^{-\delta t}}$

AD = Average annual adult equivalent days.

Sensitivity Analysis

The viability of a project is likely to be affected by changes in the value of some of its basic parameters. The method by which one measures the expected impact of changes in the value of basic parameters on the project performance is known as sensitivity analysis. To carry out a sensitivity analysis is to vary the value of each of the sensitive parameters by some fixed percentage so as to determine which one is likely to have a greater impact on the profitability of a project under a certain range instead of a unique value.

There are five major kinds of basic parameters which can be considered for agricultural projects. These include future yields, unit prices, unit costs, demand estimates and lags in the construction and development phase. According to Edge,[1] the return on investment is more sensitive to changes in some factors than others. A 10 percent change in selling price would normally have a greater impact on the viability of a project than a 10 percent change in the unit cost. This element is illustrated by Table 4.2

As far as the smallholder tea enterprise is concerned, sensitivity analysis will be carried out for changes in green leaf yields, in the price of green leaf, the price of fertilizer and the rate of cess to be deducted from the gross proceeds of green leaf sales.

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[1] C.G. Edge, A Practical Manual of Appraisal on Capital Expenditure (Toronto: The Ryerson Press, 1964), p. 133.

TABLE 4.2

CHANGES IN A FIRM'S SENSITIVE PARAMETERS AND THEIR IMPACT ON THE RETURN ON INVESTMENT

Factor	Percentage Change in the Factor	Percent Point Change on the Return on Investment
Expenditure on Plant and Equipment	10	2.1
Sale Volume (Yield)	10	4.9
Selling Price	10	7.0
Raw Material (Unit) Cost	10	2.3

Source: C.G. Edge, A Practical Manual of Appraisal on Capital Expenditure (Toronto: The Ryerson Press, 1964), p. 134.

Limitations of Discounted Cash Flow Methods in Investment Evaluation

Though discounted cash flow methods provide measures of both economic and financial worthiness of projects, they are not an [illegible]n themselves. They cannot reflect the non-monetary objectives of a given project. This drawback is particularly true for the analysis of this study because the smallholder tea project in Tanzania has other non-pecuniary objectives which must be justified (see Chapter I).

Another limitation of the use of discounted cash flow methods is that many projects start with large negative effects on earnings in the initial period, but expect compensation through favourable cash flow earnings in later periods. This is common for projects with a long gestation period such as tea. In a world of imperfect knowledge the basis of the future cash flow projections can easily be questioned. Since the future

is truly uncertain, the individual grower may feel that he might discount the future more heavily than strict opportunity cost would indicate.

CHAPTER V

COMPUTATION AND EMPIRICAL RESULTS

Assumptions in the Analysis of this Study

1. Though each farmer participating in the project is entitled to receive enough planting material to establish up to 0.6 ha, the budgets in this report assume annual plantings of 0.1 ha (0.25 acres) and a total tea acreage of 0.3 ha. Data for other acreages may be obtained by expanding the estimates with the appropriate factor of proportionality.

2. There is no rental charge for land used for tea production. Many tea holdings were established either on unutilized land of the subsistence multi-product farms or on communally owned and operated "Ujamaa" village blocks. In tea scheme areas where land is scarce, specified forests and grasslands are provided freely by the government. Refer to Appendix-D on land tenure system in Tanzania.

3. Tea growers would rely on both their personal labour as well as their family's labour for establishing and maintaining their tea holdings.

4. Apart from miscellaneous expenses on hoes, plucking baskets, pruning knives, etc., which a tea grower has to meet out of his own pocket, the expenditure on planting material and fertilizer is met by receiving a loan. Tea loans are available only through cooperative societies and TTA who use the existing credit facilities of the Tanzania Rural Development Bank.

5. No trading is permitted among recipients of planting material and fertilizer.

6. Labour requirements for harvesting will vary linearly with the

amount of green leaf available in a tea garden.

Data Specification

Expenditure on Various Items

As stated earlier, each farmer in the project obtains a loan for establishing and maintaining his tea garden. The expenditure and cost estimates at current prices are shown in Table 5.1.

Cost of Capital

Tea growers are charged an interest rate of 8.5 percent per annum on the loan. The loan repayment plan is on an amortized basis. The interest is added to the loan account yearly and therefore it is a "true"[1] cost to a tea grower.

Expenses to a Tea Grower

Cost of miscellaneous inputs such as hoes, plucking baskets, pruning knives have been estimated throughout the project life, and a contigency allowance has been made for changes in future prices.

Returns to a Tea Grower

Green Leaf Yields

Apart from maintaining a required level of crop husbandry, the crucial inputs in tea production are those used during the first three years of field planting. This means that the number of tea stumps planted, the care taken at planting time and the care taken in bringing the

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[1] Basically it is a variable cost, but at the sametime it is a fixed cost because even if a tea grower could decide to abandon the holding, his tea loan would increase yearly by the amount of the interest.

TABLE 5.1

A SMALLHOLDER'S EXPENDITURE ITEMS FOR ESTABLISHING AND MAINTAINING 0.1 HA TEA GARDEN

Item			Per Unit Cost (Tsh)	Total Cost (Tsh/0.1 ha)
i) Supply Purchase of Planting Material				
1st year planting, 888 stumps or VP plants			0.35/plant	130.60
2nd year planting, 888 stumps plus 15% (in fills) for 1st year planting			0.35/ "	357.20
3rd year planting, 888 stumps plus 15% (in fills) for 2nd year planting			0.35/ "	357.20
Infills (133 stumps or VP plants) = 15% of 3rd year planting			0.35/ "	46.60
ii) Supply Purchase of Fertilizer				
(a) Planting Fertilizer-- All Schemes				
1st year planting - Triple Super Phosphate (TSP) + Sulphate of Ammonia (SA) 10 gm/hole			1.40/kg	12.40
2nd year planting -	(")		1.40/kg	12.40
3rd year planting -	(")		1.40/kg	12.40
(b) Maintenance Fertilizer				
(i) All Schemes except Rungwe Scheme				
One year old tea	18 kg NPK (25-5-5)		1.40/kg	25.20
Two year old tea	27 kg "		1.40/kg	37.80
Three year old tea and over	36 kg "		1.40/kg	50.40
(ii) Rungwe Scheme	NPK (20-10-10)	Sulphate of Ammonia		
One year old tea	9 kg	13.5 kg	1.40/kg	31.50
Two year old tea	13.5 kg	20.3 kg	1.40/kg	47.32
Three year old tea	18.0 kg	28.0 kg	1.40/kg	63.00

Source: TTA H.Q., Dar es Salaam, Tanzania, 1976.

bushes into bearing affect the future stream of output greatly. Up to this time, not all structural parameters of the smallholder tea production function are known with certainty for any tea growing area in the country. However, it is known that it takes nine to ten years for a tea garden to attain maximum green leaf production.

Yield data (Table 5.2) were adopted[1] from the development programme statistics used by the World Bank Appraisal Mission in 1971. The estimates were based on smallholder tea garden output in Kenya and Uganda where similar projects were started much earlier. However, since tea growing is new to the majority of smallholders in Tanzania, there is a wide range in the degree to which the total package of tea growing techniques is conformed to. Some farmers tend to overlook the essential crop husbandry practices and hence end up with comparatively lower green leaf output per unit area.

Cash Receipts

All calculations are made on price of Tsh 0.90/kg of green leaf sold, with a cess payment of 0.20 Tsh/kg for repayment of the loan plus interest as set by the Board of Governors of the TTA for 1976.

Computational Results and Interpretation

Category A Schemes

Results of Cash Flow Projections

Results of most likely cash flow projections and budget analysis

[1] Yields in Bukoba and Rungwe, and Lupembe and Usambara, respectively, are expected to be rather similar and are combined into High-Yielding (Category A) and Medium-Yielding (Category B) groups. Yield estimates have been rounded off.

TABLE 5.2

EXPECTED GREEN LEAF YIELDS FOR SMALLHOLDER TEA SCHEMES IN TANZANIA

Age of Garden (Years)	Category A[1] Schemes kg/ha	Category B[2] Schemes kg/ha
1	0	0
2	600	600
3	1,400	900
4	2,600	1,600
5	3,200	2,500
6	4,000	3,300
7	4,800	3,900
8	5,300	4,400
9	5,700	4,600
10 and thereafter	6,000	4,800

[1] High Yielding Schemes, Bukoba and Rungwe.

[2] Medium Yielding Schemes, Lupembe and Usambara.

N.B.: Average conversion rate is that 4.8 kg of green leaf is equivalent to 1.0 kg made tea.

Source: World Bank (IBRD), Appraisal of Smallholder Tea Development Project--Tanzania, Annex 1, Table 2.

for Bukoba and Rungwe schemes are contained in Table 5.3. The important result of the budget analysis is that the total amount of outstanding loan and interest is at maximum between the tenth and eleventh year, and thereafter they begin to decline. This is a useful observation. It follows that only in the tenth year will cess from green leaf sales be sufficient to begin reducing the development loan.

Determining the Time for Loan Retirement

From equation (4.14), let $\frac{1-\delta PV}{R} = A$.

Therefore, $A = 1 - \left(\frac{0.08158PV}{R}\right)$

where: PV = Amount of outstanding loan at the beginning of the 13th year = Tsh 1,956.59.

R = 360.00 - (153.30 + 13.03) = 193.67

Thus, $A = 1 - \frac{(0.08158 \times 1956.59)}{193.67} = 0.175824$

Taking logarithms of equation (4.15), $t = \frac{\ln A}{\delta} = \frac{-1.73827}{0.08158}$

$= 21.3$

Time of loan retirement, $t \approx 21$ years after the twelfth year. Therefore, it will take (12+21) 33 years for a tea grower in a category A scheme to retire the loan.

Cumulative Present Value

Initial discounting factors used to convert cash flow projections into the present value have been shown in Table 4.1 in Chapter IV. If a certain percentage of total annual cess payment is reimbursed to tea growers once the initial loan is repaid, they would receive an additional cash flow from year thirty-three to year sixty.

TABLE 5.3

ESTIMATED FLOW OF FUNDS STATEMENT FOR 0.3 HECTARE (AVERAGE) TEA GARDEN IN CATEGORY "A" SCHEMES

Item	Time Period In Years Since Work Started on a Tea Garden*												
	1	2	3	4	5	6	7	8	9	10	11	12	13 (and over)
A CASH													
1. Receipts: Green Leaf Sales			54.00	180.00	414.00	648.00	882.00	1,080.00	1,269.00	1,422.00	1,530.00	1,593.00	1,620.00
2. Less: Loan Repayment Cess			12.00	40.00	92.00	144.00	196.00	240.00	282.00	316.00	340.00	354.00	360.00
3. Net Cash Receipts			42.00	140.00	322.00	504.00	686.00	840.00	987.00	1,106.00	1,190.00	1,239.00	1,260.00
Expenditure													
4. Miscellaneous Inputs (Hoes, Panga, Axes, Pruning Knives, Baskets, etc).	50.00	50.00	75.00	75.00	100.00	100.00	120.00	(and over)					
5. Net Cash Flow	-50.00	-50.00	-33.00	65.00	222.00	404.00	566.00	720.00	867.00	986.00	1,070.00	1,119.00	1,140.00
6. Net Cash Flow/Adult Equivalent Days	-0.65	-0.40	-0.21	.60	2.15	3.25	3.75	4.30	4.70	5.20	5.54	5.77	5.88
B. LOAN FUNDS													
7. Debit: Planting Material	310.60	357.20	357.20	46.60									
Planting Fertilizer	12.40	12.40	12.40										
Maintenance Fertilizer		25.65	64.15	115.25	140.70	153.30	(and over)						
8. Sub Total	323.00	395.25	433.75	161.85	140.70	153.30	153.00	153.00	153.00	153.00	153.00	153.00	153.00
9. Interest		27.45	63.40	104.72	123.57	138.50	151.10	160.30	166.53	169.75	170.35	168.95	166.25
10. Total Loan Funds Received	323.00	422.70	497.15	266.57	264.57	291.80	304.40	315.60	319.83	323.05	323.66	322.25	319.55
11. Loan Funds Repaid (Cess)	-	-	12.00	40.00	92.00	144.00	196.00	240.00	282.00	316.00	340.00	354.00	360.00
12. Net Flow on Loan Account (10-11)	323.00	422.70	485.15	226.57	172.57	147.80	108.40	73.60	37.83	7.05	(-16.35)	(-31.75)	(-40.45)
13. Amount of Loan Outstanding ($\sum_{i=1}^{n}$ 10-11)	323.00	745.70	1,230.85	1,457.42	1,630.99	1,777.80	1,886.20	1,959.80	1,997.63	2,004.68	1,988.34	1,956.59	1,916.14
14. Net Flow of Funds (12+5) (Cash + Loan)	-373.00	-472.20	-518.15	-161.57	49.43	256.20	457.60	646.40	829.17	978.95	1,086.35	1,150.75	1,180.45

SUMMARY OF ESTIMATED ANNUAL INCOME STATEMENT

Revenue													
Green Leaf Sales (1)			54.00	180.00	414.00	648.00	882.00	1,080.00	1,269.00	1,422.00	1,530.00	1,593.00	1,620.00
Expense													
Cash (4)	50.00	50.00	75.00	75.00	100.00	100.00	120.00	(and over)					
Loaned Production Expenses (10) (Total Loan Funds + Interest)	323.00	422.70	497.15	266.57	291.80	291.80	304.40	313.60	319.83	323.05	323.66	322.25	319.55
15. Total Expenses	373.00	472.70	572.15	341.57	364.57	391.80	424.40	433.60	439.83	443.05	443.66	440.25	439.55
16. Realized Tea Income (1) Less (15)	-373.00	-472.70	-518.15	-161.57	49.43	256.20	457.60	646.40	829.11	978.95	1,086.35	1,152.75	1,180.45

* (Reference: World Bank Appraisal Group Book).

The present value of this additional cash flow, FC, is;

$$FC = E/\delta\left[e^{-33\delta} - e^{-60\delta}\right] \quad \text{, equation 4.11.}$$

The present value factors, FC/E, are 5.6512 for the 3.5 percent discount rate, 0.7380 for 8.5 percent, and 27 for a zero discount rate. Thus, the cumulative net present value figures at various rates of return were determined in three stages as shown in Appendix E, Table E.1.

Equivalent Annual Net Cash Flow

(a) At zero rate of return,

$$E_0 = \frac{PV_0}{t} = \frac{65,835.10}{60} = 10,097.25$$

(b) At $r > 0$, Equation (4.18)

(i) For 3.5 percent rate of return,

$PV_r = 23,065.91$ (Appendix E, r = 3.5).

I. Since $t = 60$, and $r = 0.035$

$$\delta = \ln(1+r) = 0.0344$$

$$e^{-\delta t} = 0.1269$$

$$1-e^{-\delta t} = 0.8731$$

$$r^{-1}\left(1-e^{-\delta t}\right) = 24.9457$$

Thus, $A(=E_{3.5}) = \frac{23,065.91}{24.9457} = 924.64$

(ii) For 8.5 percent rate of return,

$PV_r = 8,019.25$ (Appendix E, r = 8.5).

II. Since $t = 60$, and $r = 0.085$

$$\delta = \ln(1+r) = 0.0816$$

$$e^{-\delta t} = 0.0075$$