AN ECONOMIC ANALYSIS OF STATE OWNED LARGE SCALE MECHANISED WHEAT FARMS. A CASE STUDY OF SETCHET WHEAT FARM IN ARUSHA, TANZANIA.

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ABSTRACT

This study describes and analyses the economics of large scale wheat production at Setchet Wheat Farm in Arusha, Tanzania. The objectives of study are to : (a) determine benefits and costs of wheat production at Setchet Farm and examine the farm's cost effectiveness, (b) examine efficiency and profitability of the farm and (c) investigate the constraining factor(s) limiting the farm to achieve its potential yields.

The study requires extensive use of secondary data. However primary data were collected to supplement recorded data. Analysis applied involved use of descriptive analyses, such as the benefit-cost ratio (supplemented by net present value and internal rate of return), efficiency ratios and cost comparative analysis.

Survey results reveal that, the farm is operating below its potential compared to wheat research trials done at Hanang Wheat complex. Efficiency ratio analysis shows that although the farm has been able to meet its production costs, meagre farm margins in some years have made the farm not able to meet its investment and depreciation costs.

Economic analysis demonstrates that the current average farm performance is economical, while financial tests reveal that the farm is commercially unviable at 1.8 tons/ha. The economic analysis gives a benefit-cost ratio of 1.15. But financial analysis at the same management level, gives a

benefit-cost ratio of 0.96. On the other hand, cost comparative test reveals that conventional tillage method is cheaper than reduced tillage method currently applied at the farm.

From the study it is recommended that, the farm should do advance preparation of farm machinery before field operations, while seed multiplication has to be carried on separate blocks. On the other hand, the farm should apply conventional tillage method during land preparation. Finally the study recommends further restructuring of NAFCO so as to allow autonomy and flexibility of the farm management.

DECLARATION

I, STANSLAUS MASAGA BERNARD do hereby declare to the Senate of Sokoine University of Agriculture that, the work presented here is my own, and has not been submitted for a higher degree in any other University.

Signature.....

Date...21/10/1993.....

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CHAPTER I

INTRODUCTION

1.1 Background

Tanzania is a large and diverse country with an area of 945000 km^2. About 20 - 30% of the area is arable area, of which only about a fifth is presently under cultivation (World Bank, 1992 ; Kaplan, 1978).

The country is predominantly agricultural, with a population of about 24.5 million people, rapidly increasing at an estimated rate of 3.1% per annum and per capita income of US $ 110 (World Bank, 1992). Approximately 70% of Tanzania's Population lives in rural areas. Agricultural production is its primary economic activity and source of livelihood. The agricultural sector contributes about 59% of the Gross Domestic Product (GDP) and approximately 84% of the total export earnings (World Bank, 1992).

Tanzania has a rainfall growing period of less than 120 days for over one quarter of her territory. For most parts of the country rainfall period is shorter and erratic thus limiting production of annual crops to only one crop season. Much of her rainfall is lost because it occurs in storms of high intensity and is unreliable, and unevenly distributed. Food production in Tanzania has been fluctuating over a long period resulting in periodic heavy import bills particularly of the country's preferred food

staples, namely, maize, rice and wheat. Faced with negative trends in agriculture, the Government of Tanzania has tried to encourage investment in large scale farming in the form of state farms as one of the possible ways to feed her growing population. The government policy on agriculture as formulated in the Tanzania National food strategy of 1984 and the agricultural policy of Tanzania of 1983 outlines a set of goals and strategies for increasing food production. These include the production of three main cereal crops namely, maize, rice and wheat in specified regions. It also stresses on the rehabilitation and consolidation of the existing large scale farming schemes.

Arusha is one of the few regions that has given emphasis in wheat production (Ministry of agriculture 1984). Wheat in particular has become an important crop in Tanzania and in most tropical countries (Saunders 1991).

Increase in Tanzania's wheat production though now sound, appears to have stemmed from increased acreage by state farms rather than yield improvements. An estimated area of over 26000 hectare of large scale wheat farms had by 1990 been developed by the government of Tanzania with a great foreign assistance (Amani et al 1991, unpublished report). The introduction of large scale wheat scheme to Tanzanian conditions has suffered technical, economic, institutional and social problems (Loewen-Rudgers 1988). On the other hand while benefits of the foreign assisted large scale farming scheme have been recognised, it is difficult

to quantify and attribute these benefits to any one factor. In fact the interactive effects of a number of factors such as technology, capital, complimentary inputs, land and labour are likely to contribute to the observed low performance of the wheat production process in the country as a whole.

This study reviews and analyses the present state of one of Tanzania's large scale wheat farming schemes, the Setchet wheat farm in Hanang District. The farm grows viri common, Tausi, Mbayuwayu and viri medium wheat varieties which have grain yield potential of over 4 tons/ha. Despite this potential wheat yield at setchet like in other large scale wheat schemes are generally low (Amani et al. 1991). As stated above this poor performance has been attributed to a number of factors whose effects on the scheme deserve to be investigated so as to assist in developing plans that will improve the farm's production efficiency.

1.2 Importance of wheat in the Tanzania economy.

Wheat provides about one percent of the national calorie intake, thus is certainly the least important of the staple cereals of the country (Marketing Development Bureau (MDB), 1989). Wheat is considered as one of three important cereals in Tanzania, (others being maize and rice) because of its high status and demand among residents of urban centres as well as the substantial investment in wheat production by state farms (MDB, 1989). It is

estimated that wheat consumption in Tanzania stands at 120,000 tons, of which 80,000 tons are locally produced, and 40,000 tons are imported. It is also estimated that urban consumption of wheat is 100,000 tons while rural consumption is 20,000 tons (Mlay et al. 1989, unpublished report). Although the given production and consumption statistics would seem to suggest that, wheat occupies an insignificant position in Tanzania's food security equation, its importance in supported by the following reasons:

a. The significant contribution by wheat imports to total wheat supply; In the face of serious foreign exchange scarcity and deficit in the balance of payments, options that would lead to reduction in wheat imports will be attractive.

b. Given that significant share of wheat consumption takes place in urban centres, the demand for wheat is bound to grow commensurate to the urban population growth rate which is about 8%.

c. Given substantial investment in wheat production by state farms and given that only 15% of the area suitable for wheat is currently exploited, serious consideration of measures that would increase the contribution of wheat to the country's food security and to the economy as a whole is necessary.

1.3 Wheat production potential and trends in Tanzania

1.3.1 Wheat production potential

Wheat, Maize and Rice form the most preferred cereals in Tanzania, (MDB, 1989) and are generally characterised by high income elasticities (Shayo 1987, unpublished report). However Tanzania's potential for wheat production is not fully exploited. It is said that the Northern highlands of Tanzania has a potential area of over 200,000 hectare suitable for wheat production of which only 45000 hectare is currently under wheat production. The Southern highlands is estimated to have a potential wheat area of 100,000 hectare, of which only about 20,000 is currently under cultivation (Loewen-Rudgers 1988). These areas offer opportunities to expand both small and large scale wheat farms. Currently wheat is mainly grown under rainfed conditions.

Regions where wheat is grown and areas where it is concentrated are as follows:

Region	Area
Arusha	Arumeru, Babati, Hanang and Mbulu districts
Kilimanjaro	West Kilimanjaro and Pare Mountains
Tanga	Usambara Mountains,in Lushoto district
Morogoro	Uluguru and Mahenge Mountains
Iringa	Njombe district
Mbeya	Mbeya district
Rukwa	Nkasi district
Ruvuma	Mbinga district

Large scale commercial farming, is mainly limited to NAFCO and few companies like Tanzania Wattle Company at Njombe, and Kilimanjaro Natives Cooperative Union (KNCU) in West Kilimanjaro as shown in Table 1. Todate wheat produced by NAFCO farms in Norther Tanzania accounts for 53% of total national wheat production (Saunders 1991).

Table 1. Tanzania: Wheat areas cultivated in 1989 and 1990 by large and medium scale producers (in ha).

Item	1989	1990
Large scale producers:		
Hanang wheat complex (NAFCO)	25253	26299
West kilimanjaro (NAFCO)	222	268
Tanwat	534	378
Rotian Seed	500	500
Pop Vriend	500	61
Sub-total	27009	27506
Medium scale producers:		
Magamba (NAFCO)	50	50
Gararagua (KNCU)	61	20
Sub-total	111	70
Grand total	27120	27576

Source: Adopted from Amani et al. (1991).

1.3.2 Wheat production trend

An examination of wheat production trend in Tanzania reveals that total production continued rising from 22,000 tons in 1969 to 80,000 tons in 1988, as shown in appendix 1. Despite this rise in production wheat imports continued

to fluctuate from year to year without a clear trend. For example in 1982 total production was 95000 tons, and imports were 82,000 tons. Whereas in 1988 production stood at 80,000 tons, and imports at 33700 tons. These fluctuations have mostly been caused by the unpredictable inflow of wheat into Tanzania under food aid program. Wheat imports help to throw light on the extent of production and demand in the country. The figures show that, consumption has increased far above production. The demand for wheat in the country has increased because of the general dietary shift from other products to wheat, which could itself be stemming from a shift in consumer taste, and a general rise in income and population especially in the urban areas.

1.4 Production systems

Wheat production in Tanzania is carried out under two distinct production systems. Large scale mechanised production system mainly in the northern highlands in Arusha and Kilimanjaro regions, and small holder production system in the Southern highlands. Smallholder production system is organised under intercropping production system and is characterised by having low level application of technology ie little or no use of fertilizers and agrochemicals, with minimum foreign exchange component. Unlike the smallholder system, large scale wheat production is capital intensive characterised by having high level of mechanisation and intensive use of inputs that have large

foreign exchange component. Experience from several recent studies by Byrlee and Longmire (1987), Longmire and Lugogo (1987) suggest that, technology used in the production process is an important factor that influences the comparative advantage of domestic wheat production. They argue that, use of capital intensive technologies such as tractors and combine harvesters, reduces the foreign exchange saving of domestic wheat production and also its comparative advantage if less capital intensive alternatives exist.

With the adoption of economic recovery programme in Tanzania, the shilling has substantially been devalued and crawling peg has been adopted. Similarly interest rates have been raised significantly with the longterm goal of achieving positive real interest rates. Devaluation of the shilling has a depressing effect on the demand of wheat import, and at the same time increases production costs for large scale mechanised wheat production. High interest rate also increases cost of borrowing and hence production costs. The two measures adopted, tend to encourage movement of resources away from production sectors that have high foreign exchange component to those that dependent on mobilisation of funds from local lending institutions. Therefore if large scale wheat production in state farms is to be sustained then the increased cost must be reflected in the selling price. Records have shown that,agrochemicals is the single most expensive production input in NAFCO

wheat farms (Table 2). However furthermore studies have also revealed that it is possible to produce wheat under the current system of large scale farms (Schumacher et al 1989). This calls for a need of looking into the more cost effective ways that will further reduce cost without reducing yield per ha in these farms.

Table 2. Tanzania: Variable costs by type for large scale wheat farms.

Item	Costs in million (shs)	Percent
Labour	1.5	4.5
Fuel and Lubricants	7.3	22.0
Agro-chemicals	8.9	26.9
Machinery - Repair, Hire and Insurance	5.6	17.0
Seed	8.8	26.0
Others	1.2	3.6

Source: Based on 1987/88 Accounts for Basotu, Setchet Gidagamowd and Gawal Wheat Companies.

1.5 Importance of large scale mechanised farming in grain production

Constrained with capital and technology in agricultural production, some least developed countries, including Tanzania have seen large scale mechanised farms as a means towards food self sufficiency and also as a source of foreign exchange earning through agricultural export (Beamish et al. 1968, unpublished report). With improvement in farm mechanisation technology, plus advances in plant breeding, crop protection and agronomic package, there have been some improvements in productivity and profitability. Large scale farming is also justified by the fact that the degree of control over plant growth, increases crop quantity and reduces per unit cost of operation.

Large scale farming may also enable governments to apply effective extension services (Livingstone and Ord 1980). The mentioned importance of large scale farms are well appreciated by governments and donor agencies, which regard them as a solution to the lagging food production. But large scale farms have their own weaknesses. This is due to the fact that, they require very expensive investments and in fact the government has often supplemented the already costly large scale state farms with expensive production, marketing and social support services (Msambichaka et.al 1983). It is also important to note that, most of large scale farms are financed by

foreign institutions (The Canadian government for the case of wheat farms in Tanzania).

With such a high foreign exchange component, high yields are needed to pay for the investments. This calls for the need of the government to apply methods that will maximise return from existing large farms. Tanzania's large scale wheat farms however, have been expanding. An estimated 26617 hectares of modern operated wheat farms, had by 1989/90 season been developed by the Tanzanian government, with the assistance from the Canadian government. This has been a strategy of the government aimed at increasing output. However, large scale farms may not be the most effective way of increasing agricultural output in general, but for specific crops like wheat, it has played a significant role in Tanzania. Of the total estimated annual wheat production in Tanzania (ie 80,000 tons), state farms accounts for between 40,000 and 50,000 tons (Loewen Rudgers, 1988). The farms are also major suppliers of wheat sold through the official channel. National Milling Corporation's total procurement of wheat from state farms, rose from 62% in 1980/81 season to 88% in 1987/88 season (Appendix 2).

Therefore there is a need of examining the effects of past investment in state farms, from which one may identify various ways likely to be most appropriate for improved future wheat production.

1.6 Justification of study.

Large scale farms play an important role in the Tanzania economy, not only for producing cash crops like sisal and sugar cane, but also in increasing the output of food crops such as wheat, rice and maize. The main objectives of establishing wheat state farms in Tanzania in the early 1970s' included among other things; expanding wheat production based on modern technology, increasing production per hectare and reducing production costs to the level which would be competitive in the world market (Beamish, et al. 1968).

Since the early 1970s, attempts to increase production of wheat in state farms, encountered many difficulties both, natural ones such as climatic factors, soil fertility and salinity, and economic problems such as high operational costs and demand for working capital (Loewen-Rudgers 1988). High operation costs in these farms, could be attributed to a number of factors whose effects on the farms and the nation as a whole deserve to be investigated.

The national grain strategic reserve of the Ministry of Agriculture and Livestock Development, estimated that, in the 1991/92 season domestic wheat production would be at a tune of 75,700 metric tons, of which about 70% was to be produced by the state farms (Mzalendo news paper of September 8, 1991, unpublished report). Therefore unless deliberate measures are taken to counter major economic constraints faced by state farms, wheat deficit from

domestic sources are likely to increase in the future because demand still outstrip supply.

Cultivation of wheat in these farms is completely dependent on the weather. In that case only one crop is grown in a crop year. This system inhibits the economic exploitation of resources such as land, tractors and other farm machinery (Rukuni and Bernsten 1987) in two ways:

(a) Low output per hectare which makes this type of production too expensive.

(b) Under utilisation of available capacity and consequently a further increase of costs per unit handled.

This calls for the need of examining the current cropping pattern and resource use, because in order to achieve potential benefits from farm investments, it is necessary to have an efficient machinery management system and use of other resources, particularly land, labour and working capital. Efficiency in the use of these inputs, therefore, need to be examined.

In his study of the traditional land management practices of the Barabaigs, (a semi - nomadic pastoralist group in Tanzania) and the impact that a large scale agricultural development project has had on them, Lane (1990) argues that, large scale state wheat farms in the Hanang plains have displaced the Barabaigs, made their traditional ways of life untenable. They have also caused

soil erosion and have eliminated from the area the types of local grasses used for grazing purposes. He further claims that, the costs of these farms include imported inputs which require the expenditure of foreign exchange which are considerably subsidised. These costs, when the opportunity costs of expenditure of foreign aids are taken into consideration, considerably out weigh the benefits of the farms. This calls for a need of assessing in broad terms the benefits and costs of introducing this technique of production in Tanzania. It is also argued that, foreign exchange costs of producing wheat under large scale in Tanzania is by far higher than that of importing wheat. Consequently, up to the end of 1989 imported wheat flour was sold at a price based on that of locally produced wheat grain, so as to protect wheat production in state farms (MDB,1989). The current food policy of non-protection of domestic wheat producers, calls for the need of determining the cost effective ways of producing wheat in state farms so as to increase benefits and commercial sustainability for these Farms in the future.

1.7 Location and description of study area

1.7.1 Location

Hanang District where the study was based is one of the 8 Districts of Arusha Region. Others are Arumeru, Arusha, Babati, Kiteto, Monduli, Mbulu and Ngorongoro. Hanang District lies in the South West part of Arusha town

(figure 1). The study area (Setchet wheat farm) is located between Latitudes 4 16' and 4 31' South of Equator, and between Longitudes 35 09 and 35 25' East of Greenwich Meridian. It is within the Hanang wheat complex to the West of mountain Hanang and the main Gregorian Rift valley, at altitudes ranging from 1570 to 1800 metres above sea level (figures 2). Setchet itself is a small traditional village which stands at about 280 kilometres South of Arusha, the capital town of the region.

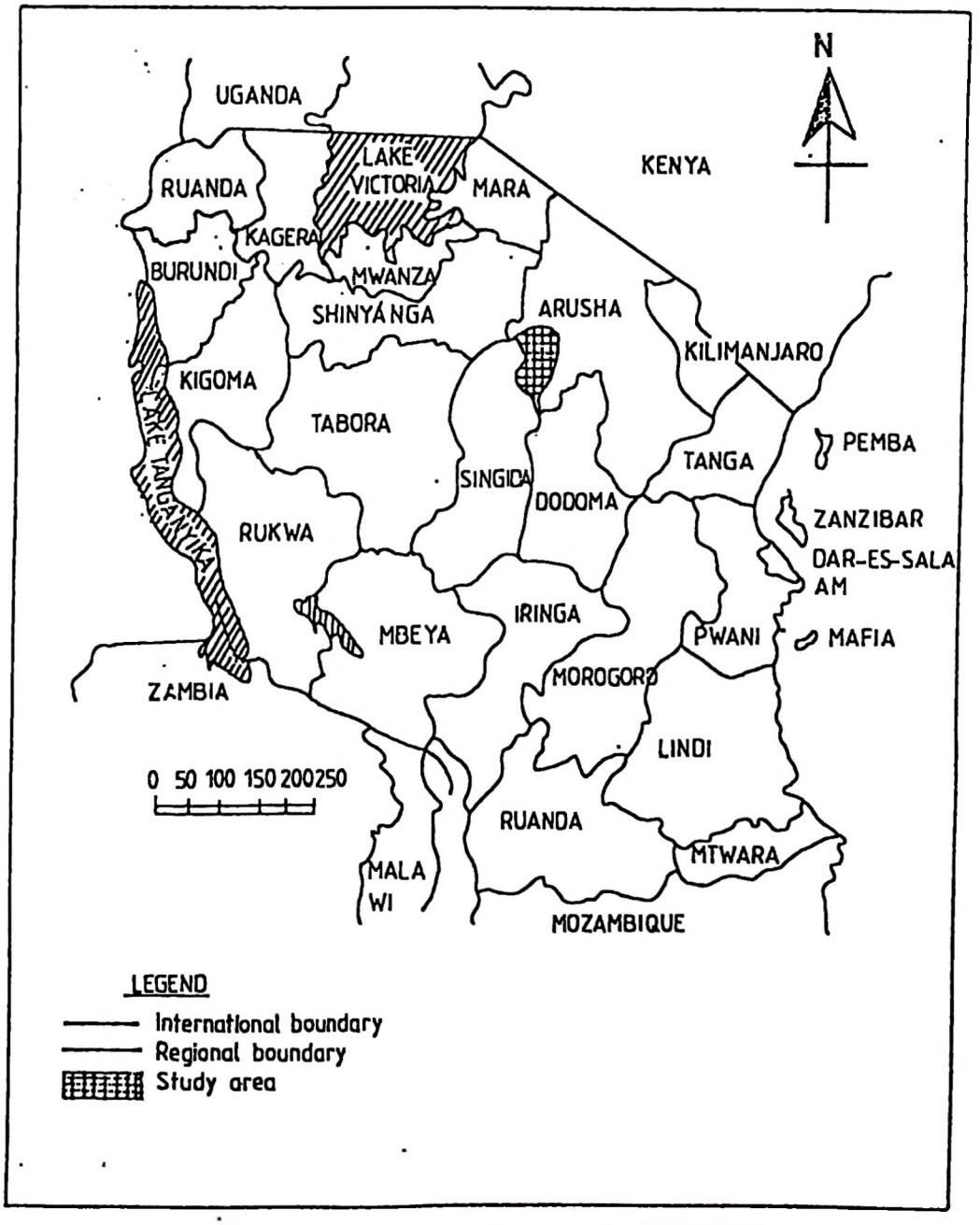

Figure 1. Tanzania: Location of Hanang District

Source : Adopted from Balirwa (1990)

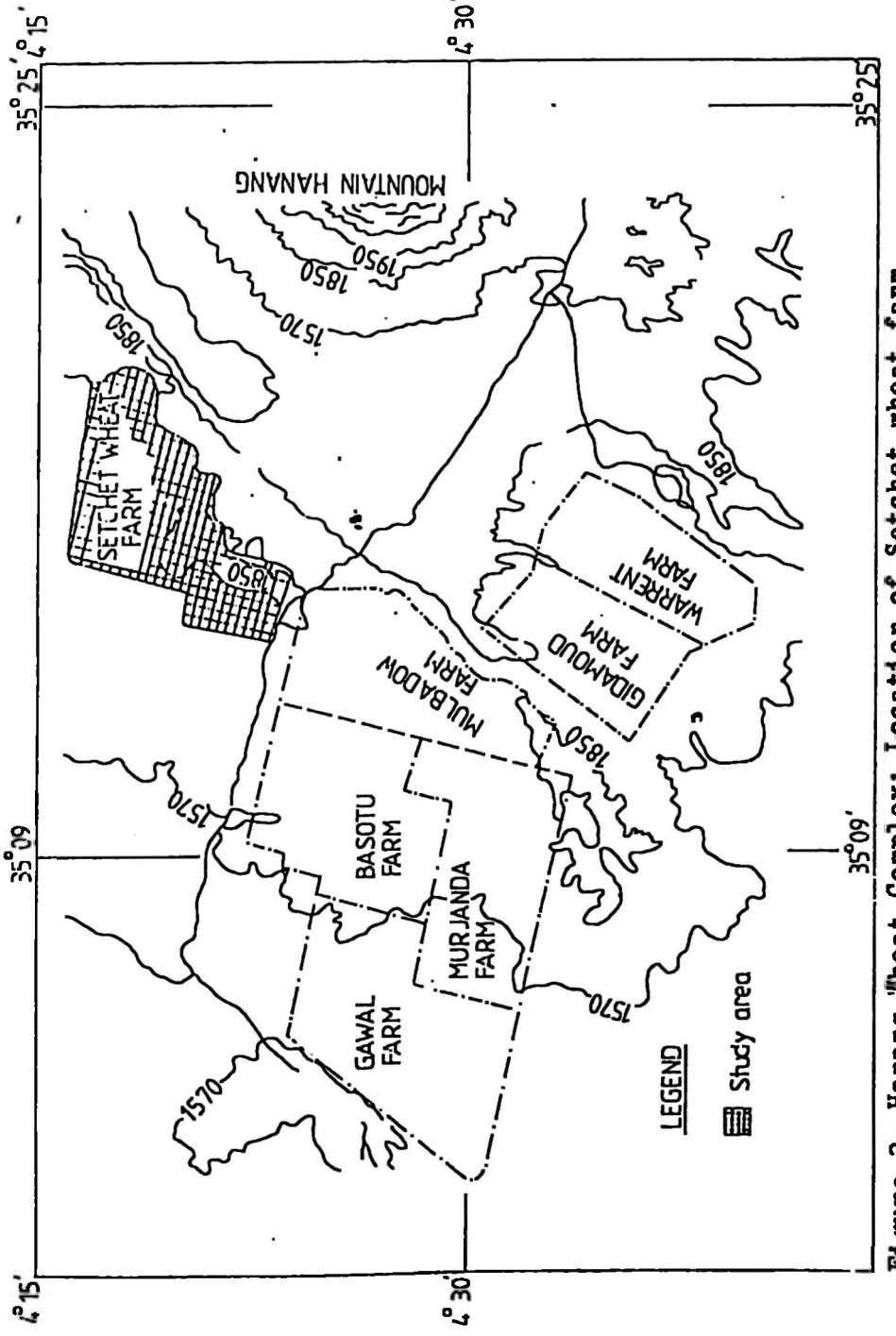

Figure 2. Hanang Wheat Complex: Location of Setchet wheat farm

Source: Schumacher (1990)

1.7.2 Project background and organisation

The project is executed by the National Agricultural and Food Corporation (NAFCO), a parastatal organization responsible for operating the nationally owned food producing farms. In addition to Setchet, NAFCO owns other large scale wheat farms of the Hanang Wheat complex namely Basotu, Gawal, Gidagamowd, Mulbadow, Murjanda and Warret.

Setchet wheat project involved the establishment of over 4000 hectare. The project activities included land development, purchase of agricultural machinery and equipments, purchase of motor vehicles and construction of buildings. Financial and technical assistance were provided by the government of Canada, in form of a grant. Survey and preliminary work were carried out by Tanzania and Canadian wheat experts before 1975. Project activities started in 1975 after land acquisition from individuals in the surveyed area. Wheat growing started in 1976. The project was expected to be fully operational after the completion of phase 1 of the Tanzania-Canada Wheat Project (TCWP) in 1979, but it was later extended to phase 2 and 3 which covered the periods from year 1979-1987 and from 1987-1991 respectively. Total investment costs were shs 104 million. A breakdown of investment cost is indicated on table 3.

Table 3. Arusha: Setchet wheat farm, investment (construction) costs in million shs.

Item	Foreign cost component in Local currency	Local costs	Total costs
Land development	5.10	18.90	24.00
Farm machinery	22.00	0.00	22.00
Motor vehicles	20.00	0.00	20.00
Tools and Equipments	5.70	4.30	10.00
Water Scheme	0.00	4.00	4.00
Building and Housing	2.00	11.75	13.75
Training	5.00	0.00	5.00
Technical assistance	0.00	6.00	6.00
Total	59.80	44.95	104.95

Sources: NAFCO Head quarters, CIDA and Setchet Farm Records.

One of the serious set backs of the farm had been area expansion through land clearance and design of farm layouts. At the time of its establishment, the typical Canadian Prairie Survey pattern was adopted with little concern for topography, soils or rainfall characteristics. It was only subsequently recognised that this layout exposed the land to unacceptably high soil erosion and

that, it was totally inappropriate. Unfortunately problems still persist as a result of this defective original layout despite the very considerable efforts subsequently made to institute erosion control measure.

Other problems include acute shortage of foreign exchange, high cost of imported machinery, agrochemicals, fuels and spare parts which has been exacerbated by higher manufacturer costs as well as the effects of inflation and devaluation that occurred in the country. It is estimated that the present day replacement cost of equivalent machinery and parts, would cost 10 times what it did in 1977 (Schumacher et al. 1990).

Setchet wheat farm like any of NAFCO's farms is an autonomous profit centre and a subsidiary company. The NAFCO head office performs a supervisory role and provides planning, management and technical assistance. The manager of Setchet Farm is responsible for all the farm's activities and is answerable to the NAFCO management and Farm's board of directors. There are three departments under the farm manager, each department is headed by a senior officer who is assisted by junior staff as shown in figure 3.

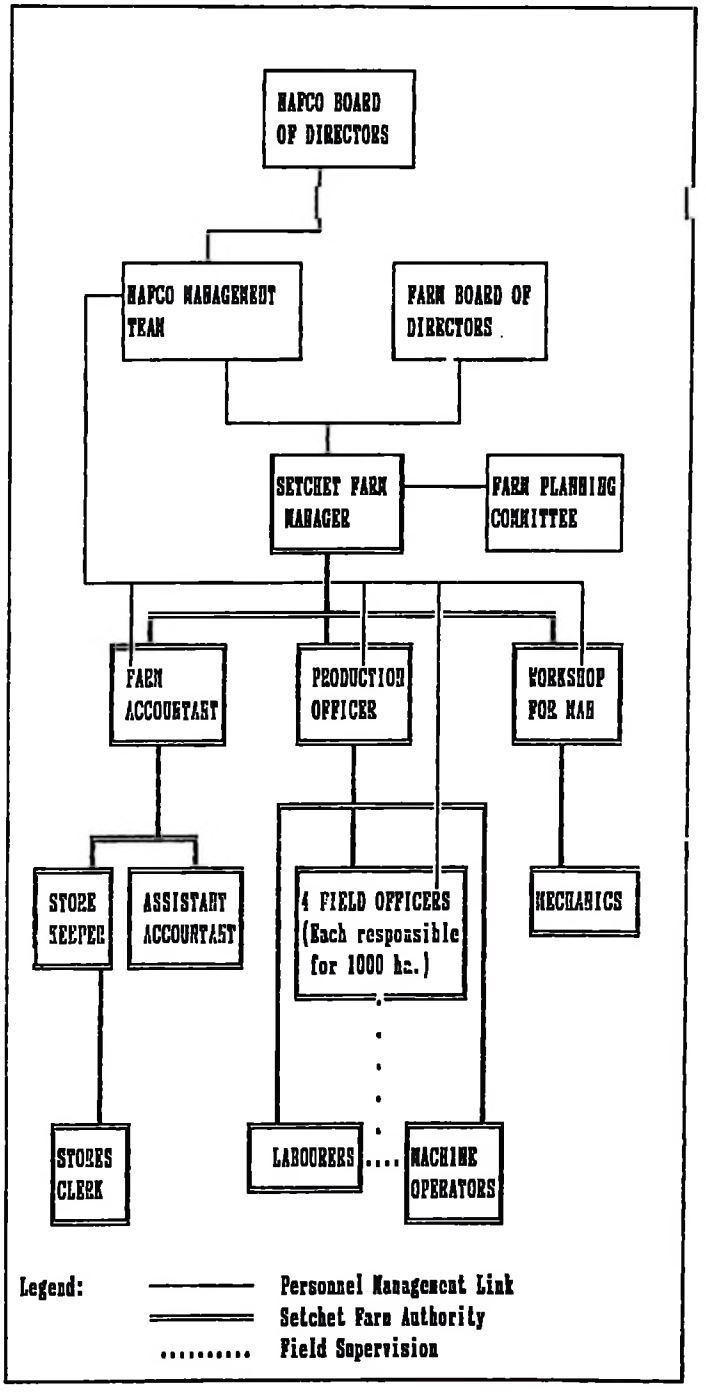

Figure 3. HAFCO: Organisational structure and its link to Setchet farm authority

Source: HAFCO head office records.

1.7.3 Climatic conditions

Setchet wheat farm like any other area in the Hanang district experiences variations in soil moisture content which is directly linked to yield levels. However, soil moisture content depends on the amount of rainfall an area receives and its distribution pattern. For example studies done by Mckeague (1989, unpublished report) in northern Tanzania revealed that an average of 300 mm of rainfall, which is well distributed could support a good wheat crop. Usually rainfall in the wheat growing areas of Tanzania is above this average but it is not always well distributed (Msemwa 1979). Considered over a period of 16 years the rainfall pattern for Setchet Wheat Farm is of bimodal character (figure 4). Setchet on average receives an annual rainfall of above 570 mm. The rains are unevenly distributed through the months of October to mid June. Records show that Setchet receives its long rains between January and June. The long rains have their peak in January. The rest of the months between June and October receive no rains at all. Short rains of the months of October to December are unreliable making it difficult to schedule farm activities. Temperature ranges from 18 to 22 degree centigrade during the year. Mean temperature during growing season is around 20 degree centigrade. This is sufficient for wheat cultivation in the warm tropical regions (Klatt 1985).

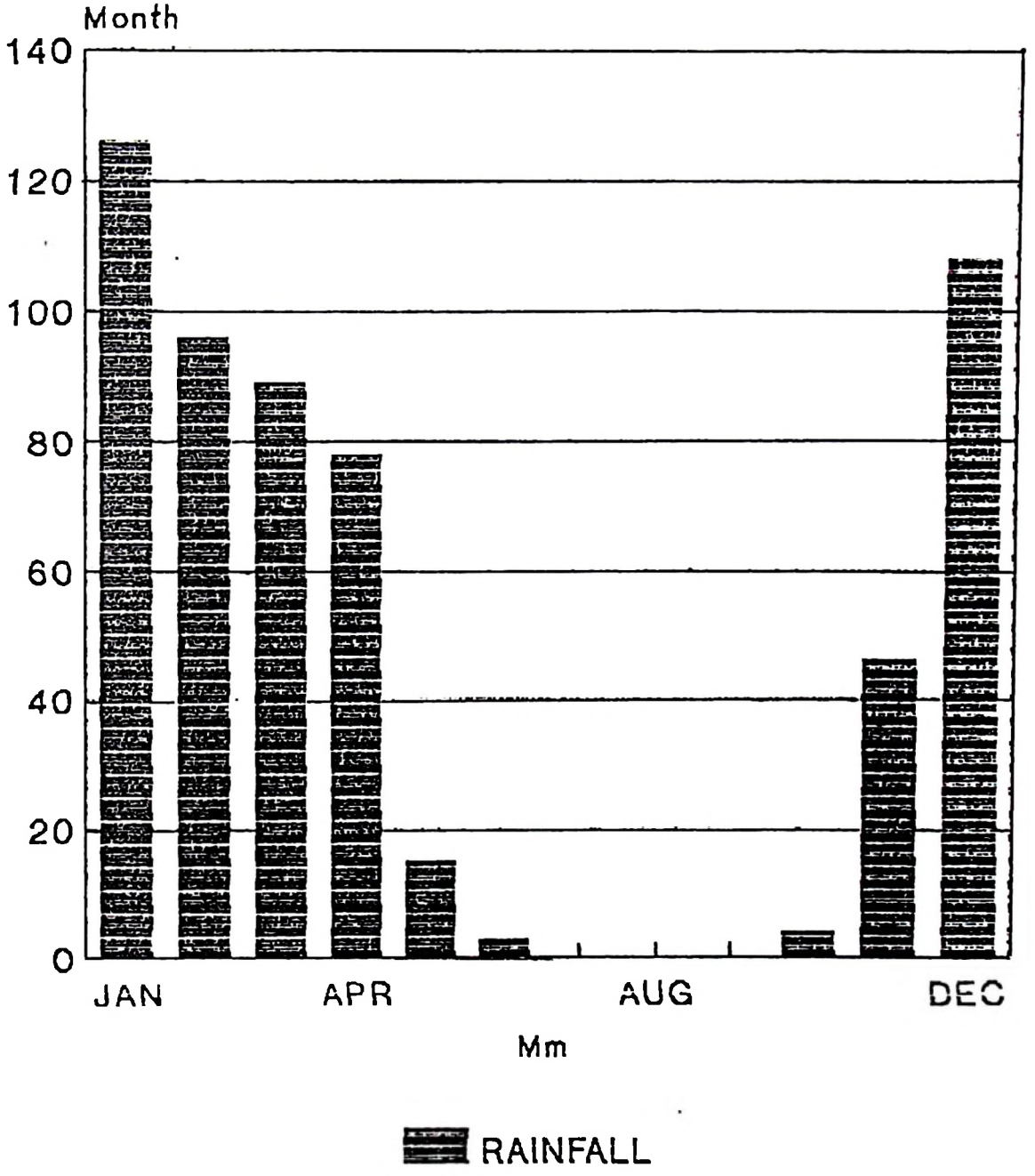

Figure 4. Setchet: Mean Monthly rainfall in mm.
1975 - 1990

Source: Derived from appendix 6.

1.7.4 Soils and topography

The soils here like any where in the Hanang wheat complex are derived from three major parent material types-calcareous volcanic tufts, granites and hornblende schists (Beamish et al. 1968). Soil genesis has been further modified by the physiographic position in the landscape on which these soils have developed and by the climate.

In general the commonly found soils in the project area are Vertisols, Mollisols, Alfisols and Inceptisol which are fertile without major problems, and able to support a good crop without nitrogen and phosphorous fertilizers, except for the 800 ha of red soils North East of the farm where application of 125 kg of TSP per ha increased wheat yield by an average of 0.4 tons per ha (Majanga and Shekuwe, 1989). In general the project area has land with uniformly gentle slope very suitable for mechanisation.

1.7.5 Land use.

The area in which this study concentrates (Setchet farm and associated village) has a population of about 3000 people. Most of them are cattle headers and they do some arable farming mainly of Maize, Sorghum and Wheat. The area is sparsely populated with concentration along the fringes of the alluvial plains. Total project area is

over 4000 ha for both cultivation and buildings, but only about 3800 ha is currently used for cultivation. The other area was abandoned due to having shallow soils and gulley problems. The highest hectarage cropped in one season was 4550 ha. This was in 1983. Todate this acreage has never been cultivated again and the farm grows only wheat for commercial purpose.

1.8 Objectives

The main objective of this research is to study and analyze the current wheat production system in a national mechanised wheat scheme, in order to find out whether the objectives of the scheme have been attained or not.

1.8.1. Specific objectives include:

a. To determine the benefits and costs of Setchet wheat production scheme (a state wheat farm) and to examine the cost effectiveness of the scheme.

b. To examine efficiency and profitability in a national mechanised wheat scheme.

c. To investigate the constraining factor(s) limiting the farm to achieve its potential yields.

CHAPTER II

LITERATURE REVIEW.

2.1. Introduction

Though however, there is a possibility of incurring losses, small family operated farm business are flexible, innovative and often they are adaptable to weather diversity than large scale operations which have fixed overheads and payrolls which must be met (Schumacher et al 1990). A number of studies related to efficiency and economy of size have been conducted in various places where it has been proven that, while economic efficiency is related to size, diseconomies are also encountered when a farm business expands past a certain stage (Livingstone and Ord 1980). The reasons for these are rooted in the inefficiencies which arise through overhead cost of administration, as more tasks require delegation and supervision of works, and also perhaps because of high requirement of inputs with high foreign exchange components.

This chapter reviews relevant studies, carried out by different scholars on farm operational efficiency (efficiency ratios) and benefit-cost analysis. First it starts with operational efficiency of mechanised farms (particularly the cost ratio analysis) in Saudi Arabia and Tanzania, and secondly it gives literature review on general benefit-cost analysis, in which the advantages

and disadvantages of the benefit-cost method are discussed, followed by a literature survey on benefit-cost analysis done for large scale and small scale schemes in the world , Africa and Tanzania in particular. Finally, the chapter concludes with a brief summary of the main observations.

2.2. Efficiency ratios

Al-Suhaibani (1989), used operating ratio to study costs of using farm machinery for wheat production on 41 farms in the mid region of Saudi Arabia. Analysis was done on individual operations as well as on the total of each farm. He observed that, the average total cost was Saudi Arabia Riyal (SR) 1152 per ha, while ownership and operating costs (excluding timeliness) was SR 1047.2 per ha. Fixed costs comprised of 68% of total costs and variable costs was 32%. Repair and maintenance costs was low (ie 3%) due to government subsidy. The graphical distribution of per ha costs for chiselling, mould-board ploughing, planting, harvesting and the total per ha costs for each farm size was discussed and presented. The total cost distribution pattern displayed no relationship with farm size, but variable costs showed more rising trend than fixed costs. He finally concluded that, production costs for most of the farms, could be reduced by optimizing the use of available machinery on the farm, selling or renting surplus equipment

(especially tractors and combines) if further farm expansion is not feasible.

Balirwa (1990) studied operational efficiency of a large scale irrigation scheme at Dakawa in Morogoro, using efficiency ratios (particularly the cost ratio analysis). All costs were converted to real prices based on 1977 constant prices, using the National Consumer Price Index (NCPI). Results showed that the farm was making big losses as indicated by high cost ratios. It was observed that, although the farm was capable in meeting its direct operating expenses, fixed and gross expenses could not be met for years, ie from 1979 to 1986. It was further observed that variable resources were more efficiently used than fixed resources, particularly in 1984 and 1985 when fixed ratios were greater than one. Lastly it was concluded that, high cost ratios were caused by high input prices, disappropotionate overhead, low output and large irrigation assets other than farm machinery such as pump station and rice mill which were operated below capacity.

Robert Boerre (1972) studied Mbarali and Kilangali state farms and found that, cost of paddy production at Mbarali rice farms was much higher than cost of production of smallholder. Average cost per ton was found to be shs. 1416.00, of which about 25% consisted of foreign exchange component, while in smallholder, production was carried out at practically no foreign

exchange costs. For Kilangali rice farm cost of production was lower than at Mbarali rice farm but it was above that of smallholder. It was also observed that foreign exchange cost for Kilangali rice farm reached about 30% of the total production costs. He concluded that, high production costs in large scale mechanised state farms was only a temporary feature, and that it would decrease as the farms had reached full maturity. He further argued that, unit cost of production would be reduced more effectively by increasing yield per hectare, rather than economising on inputs and that, consideration in the analysis should also be put on the revenue side, so as to address the profitability of these projects rather than concentrating on the cost side alone. But the analysis was later criticised for lack of sufficient data, and that, assumption made on the life of the farm machinery, directly affected the costs of production. Rates used in Tanzania appear to be very low but are nevertheless adopted because they could be achieved if serious efforts are made.

2.3. The benefit-cost ratio

According to Gittinger (1982), this is the present worth of the benefit stream divided by the present worth of the cost stream. It is one of the popular criteria used in project appraisal and evaluation, especially for economic analysis. Some important items one is supposed

to know in benefit-cost analysis include the following:

a. Discount rate

b. Identification of benefits and costs to be included

c. Valuation of benefits and costs

i. Advantages, of B/C ratio.

The benefit-costs ratio gives an immediate indication of degree of desirability. Any ratio above 1 at the opportunity cost of capital, is said to be economically justifiable. This implies that the project will yield direct benefits than it will cost, given that the discount rate used truly reflects the risk involved in the project. A ratio of exact 1 implies that the project is marginal.

Ciriacy-Wantrup (1964) said that, benefit-cost analysis, necessitates quantification both in physical and economic terms, consequently it stimulates scientific understanding of the physical and social problems involved in public resource development.

ii Disadvantages

One of the shortcomings of the benefit-cost ratio analysis is that, it discriminates against projects with relatively high gross return and high operating costs, when though these may be shown to have greater worth generating capacity than alternative projects which have higher benefit-cost ratios. For the case of mutually

exclusive projects, the benefit-cost ratio may lead to an erroneous investment choice (Mkcean 1958).

Charan (1973) made a detailed study of the benefits and costs of West Banas Irrigation project in Rajasthan India. The study was based on considerable field investigations designed to obtain a detailed farm cost and return data from the project area.

The analysis of the data suggests that gross farm output was significantly higher in canal irrigated areas as compared to rain fed areas. After meeting the cost of cultivation which was also comparatively higher, the project farmers had greater net surplus with them. On the basis of the above results, direct primary benefit-cost ratio of the project was calculated. When the project was sanctioned, the anticipated productivity rate was reckoned at 4.1%. In the course of time the estimates of the costs had to be revised. However as the revised estimates of the costs were high, the project proved to be financially unsound. Hence it was likely that, had the original estimates been made on the basis of the revised figures, the project would not have been sanctioned on the financial grounds.

Researchers in the same field have been criticizing Charan's study on the ground that the analysis appears to be handicapped by two basic shortcomings. In the first place, while the benefits as well as the associated costs of farming are estimated at 1968-69 prices, the capital

costs of the project which was completed by 1962-63, is in actual pre 1963 values. Secondly, for the benefit-cost, Charan departs from the accepted practice of deducting the associated costs from the value increased due to irrigation, in order to estimate the net benefit. He calculates net benefits gross of associated costs, and costs include both project and associated costs of farming. This is not justifiable. While correction for the later would increase the benefit- cost ratio, benefit as well as the costs would reduce it quite significantly.

Benefit - cost calculations also were applied for Mwera irrigation scheme in the Republic of Kenya, by Chambers and Morris (1973). By tracing operation of the scheme for 20 years they found that, the scheme had a present value of 386,000 in 1955, and therefore at that date the project was justifiable in terms of benefit - cost criteria. But further studies have indicated that the results could nevertheless be sensitive to given assumptions if for instance one used the market price of labour (sh. 3.31 Kenyan shilling per man day at that time) in the calculations, instead of lower value based on an estimate of real social value, the project would not have been justifiable in 1955 unless one assumed that return to capital in Kenya was very low. The discount rate is also an important element to be considered in this study, because rates as low as 5% which were considered appropriate in 1955, can no longer be

generally acceptable. Although return to capital in private enterprise in Kenya, of only 10% was fairly common in the 1950s', the opinion of economists about minimum acceptable rates at the time of the researcher's results and even now appears to be edging upwards. Therefore the project could not be justifiable at a discount rate of 15%, given several combinations of other assumptions.

Balirwa (1990) used benefit-cost analysis to evaluate performance of a large scale irrigation rice farm at Dakawa, in Morogoro. Net present value (NPV), and internal rate of return (IRR) were incorporated in order to supplement the main (B/C) analysis. Results showed that, at the yield level of 3.8 tons/ha (which was the average production performance of Dakawa Rice Farm) NPV was shs -38 million when discounted at 20% interest rate, while the IRR was 3%, which was far below the opportunity cost of capital which was assumed to be 12%. Finally the B/C ratio was computed and found to be less than one in both two cases ie 0.83 and 0.75 for financial and economic analysis respectively. She finally concluded that, given bank lending rate of 20% and yield level of 3.8 tons/ha, the farm was operating inefficiently and thus, financially unjustifiable. Similarly at the same level of output the farm was economically unjustifiable given opportunity cost of capital at 12%. Poor performance was said to be caused by poor irrigation

design, which resulted in operating problems such as weed infestation, silt accumulation, water logging and inadequate on-farm water management. Other constraints were said to be high input costs and inadequate machinery and equipments. However she noted in her conclusion that the farm would be financially and economically justifiable if the output was to be raised up to a level of 6.7 tones/ha. At this level of output, the NPV , IRR and the B/C ratio would be shs 108.17 million, 15% and 1.30 respectively. Raising output from 3.8 tons/ha to 6.7 tons/ha was considered to be possible as this would involve the mobilisation of the available resources at the farm.

Summary

In this chapter it has been observed that, the measuring of benefits, costs, and efficiency of a project, is a very complicated exercise. Many scholars have contributed on how to measure projects' benefits, costs and their operational efficiency. Benefits and the associated costs of a project are in particular difficult to measure because the project benefits not only people who are directly linked or associated to it, but also tend to improve the infrastructure of the region in which it operates and thus benefits the rest of the community members who are not directly linked to it. So in the case of an agricultural project one has to distinguish between

business or financial (micro) goal and economic or developmental (macro) goal. Furthermore, measuring of benefits and costs of the project needs appropriate decision as to what prices and discount factors to be used in the computation for financial and economic analyses. In general benefits, costs and efficiency of an agricultural project can be estimated by evaluating performance in relation to objectives and goals of the project itself, and the nation as a whole. In Tanzania many agricultural projects have been unable to fulfil their roles, due to various reasons which need to be investigated in order to come up with appropriate solutions.

CHAPTER III

CONCEPTUAL FRAMEWORK AND METHODOLOGY

3.1 Introduction

This chapter gives a brief discussion on the method employed in analysing the data collected. It begins with a brief conceptual frame work of the analysis, followed by the type of data needed, and their sources and then technique of analysis used, which includes a brief presentation of formulas, specification of variables and interpretation of results and ends with data limitation. The analytical tools used include the benefit-cost ratio, operating ratios and cost comparative analysis. These analytical tools are aimed at studying the benefits and costs of the national wheat scheme, its cost effectiveness in the production process and its business operational efficiency as a whole.

3.2 Conceptual framework

In this study an attempt has been made to assess key efficiency indicators of the Setchet wheat farm such as; benefits and costs, cost effectiveness and operational efficiency. Operational efficiency of the farm has been assessed by operating and income ratios, while cost effectiveness and benefits and costs, have been assessed using cost comparative analysis and the benefit-cost ratio respectively.

However one must be interested to know whether a defacto analysis of benefits and costs is possible, considering differences in periods, conditions, assumptions, objectives and goals of the farm. Of course analytical comparison of flow of benefits and the associated costs of an organisation can be done provided that the variable factors under consideration are similar, ie provided there is a common base. In this study, the main issues considered are objectives and level of operation for the specific farm under study. Although it would be appropriate to assess operational efficiency of all seven national wheat farms (schemes) of the Hanang complex, resource limitation made the researcher unable to study operations of all seven farms. Consequently, this research was limited to the area of operation of Setchet farm.

The collected data capture the effects of endogenous and exogenous factors that influence operational efficiency over time. The exogenous factors associated with inflation are assumed to be constant as the nominal figures are deflated by means of the constant NCPI. The evolution of trends of the constant figures of the time series data are then observed and computed to compare benefits and costs.

3.3 Types of data needed

The nature of the study requires mostly secondary data as it is an evaluation of the performance of the farm. However primary data were collected to supplement recorded data when they were not sufficient. The data collected covered all basic data on production costs and inputs both local and foreign inputs used in the production process, agricultural machinery and implement utilization on the farm, yield per hectare, prices of wheat output for a period of 15 years, types of services rendered by the farm to the nearby community, field operation and husbandry technique, farm history and farm assets, rainfall data, cropping pattern, investments costs and sources of funds, current bank's lending rate for agricultural projects and the current opportunity cost of capital rate.

3.4 Sources of data collected

Most of the data were obtained from farm's production files, audited reports and other farm record documents. Other sources of data were NAFCO headquarters, Bank of Tanzania, Ministry of agriculture and livestock development, Selian agricultural research station in Arusha, Planning commission's office in Dar es Salaam and the Canadian international development agency (CIDA).

3.5 Methodology (technique of analysis)

In order to get appropriate answers to the given objectives, the study employed several methods of analysis. Physical production efficiency and financial position of the farm were examined using efficiency ratios for specified years of production, while cost comparative analysis was used to examine cost effectiveness of the farm. Finally the project or farm's worthiness was assessed using B/C ratio togather with other two discounted criteria namely net present value and the internal rate of return.

However the commonly used conventional investment criteria for project appraisal or evaluation include the benefit - cost (B/C) ratio, net - benefit investment ratio, pay back period, net present worth or net present value (NPV) and internal rate of return (IRR). A project's worthiness can be assessed by one or a combination of these criteria. Except the payback period criterion, the other four criteria are based on the discounted principle commonly applied to agricultural projects. Using payback period criterion in project evaluation would therefore entail the use of a rough means of judging profitability of an investment. Payback period also disregards project earnings after the break even period. By so doing it tends to favour quick yielding projects without taking into account of their over all rate of return (Gittinger 1982). Due to these

weaknesses the payback period criterion was not considered in this study.

Projects that last for several years which have different shapes of future cost and benefit streams are usually evaluated through discounting. Discounting method reduces the future benefit and cost streams to their present worth. The calculations, limitations and interpretations of discounted measures are the same regardless whether they are used for economic or financial analysis. The difference occurs only when given technique is applied to financial or economic value respectively. However Gittinger (1984) noted that there is no one best technique for estimating project worthiness, although some are better than others. For that reasons this study considered the benefit - cost (B/C) ratio as its main tool of analysis of the Setchet Wheat farm. Two more discounted criteria namely the net present value (NPV) and internal rate of return (IRR) were chosen to supplement the main criterion ie B/C ratio.

3.5.1 Concepts and computation of data.

3.5.1.1 Concepts

(i) Benefit-cost analysis

This is a ratio of project benefits to project cost. The ratio is one of the most widely used criteria in project appraisal and evaluation especially for economic

analysis. The parameter thus, provides some indication of the economic merits of a project. It has much popular appeal since it gives an immediate indication of the degree of desirability of the project (Kuiper 1971). Any ratio above unit at the opportunity cost of capital is considered economically justified, ie the project will yield greater direct benefits than it will cost, provided the discount rate used truly reflects the risks involved in the project. A ratio of exactly one indicates that the project is marginal. The absolute value of the benefit - cost ratio varies depending on the discount rate chosen. The higher the discount rate the smaller is the resulting benefit - cost ratio, and if a high enough discount rate is used on a project, the ratio is likely to be driven down to less than one in which case the investor cannot recover the investment. The weakness of this criterion is that, it discriminates against project with relatively high gross returns and high operating costs even though these may be shown to have greater wealth generating capacity than alternative projects which have higher benefit-cost ratios. However if a project is already in existence and was yielding less than the B/C ratio acceptable, then serious consideration should be given to discounting it in order to free funds to an alternative project. Care should be taken however that proper economic principles are used when deciding to abandon a project. If certain funds are already committed, and the

resulting assets are now fixed and have little or no salvage value, then the costs applicable for comparison with returns will be mostly the variable costs. Costs already sunk and which cannot be salvaged have no relevancy any more when consideration is being given to abandoning a project (Gittinger, 1984).

(ii) Net-present value - This refers to discounted cash flow measure of a project worth. It is a present worth of cash flow stream. In economic analysis it is the present worth of the incremental income generated by the investment. The formal selection criterion for the NPV is to accept all projects with zero or grater NPV when discounted at the opportunity cost of capital. One advantage of NPV over other discounted measures is that it makes no difference at all as to what point in the computation process, the netting - out of benefits and costs takes place regardless of whether it is done at the middle or end of the project life. However, since NPV is an absolute and not a relative measure it imposes a serious drawback because no ranking of acceptable alternative project or management level is possible using this criterion. A small highly attractive project may have a smaller NPV than a large marginally acceptable project. Another limitation is, this measure cannot be applied unless there is a relatively satisfactory estimate of the opportunity cost of capital.

(iii) Internal rate of return (IRR) - This measures the earning capacity or rate of a project. It is a measure of maximum interest that a project could pay for the resources used if the project is to recover its investment and operating costs and still break even. It is a discount rate which renders the project a benefit - cost ratio of 1 (Kuiper 1971). While in the B/C ratio one assumes a certain discount or interest rate, IRR calculation measure the rate of discount or earning power of the project, and thus is independent of external interest rates.

When IRR is used in financial analysis of projects it is termed internal financial rate of return (IFRR) to distinguish it from internal Economic rate of return (IERR) used in economic analysis. The formal selection criterion for IRR is to accept all independent projects having an IRR equal to or above the opportunity cost of capital. Generally the analysis of Setchet wheat farm involved the following:

-Determination of quantity and value of benefits and costs

-Conversion of figures of different years to a common period basis and

-Comparing the total benefits and costs.

In the computation, only tangible benefits and costs were considered. The benefits considered include the sale of wheat whose basis of valuation was on prices set by

the Tanzania National Milling Corporation, income from sale of fixed assets, and hire of farm machinery and miscellaneous revenue from the farm's shop and guest house. The cost category included investment, replacement and operational (recurrent) costs. NPV and IRR were computed by subtracting costs from benefits year- by-year to arrive at the incremental benefit stream (cash flow) which was then discounted.

3.5.1.2 Computations of data

(i) B/C ratio, NPV, and IRR

To differentiate B/C ratio from a cash flow analysis, benefit and cost streams were discounted separately. There after present worth of the benefit stream was then divided by the present worth of the cost stream. Both the netting-out and gross basis conventions were applied in the calculation of B/C ratio and NPV whereas IRR was calculated on gross basis. Netting out changes the B/C ratio by a small difference while the NPV is not affected by the netting out procedure. Calculation of B/C by netting out is done by having:

Gross benefit minus associated cost, divided by the project economic cost.

Where: the associated cost is the value of goods and services over and above those included in the project cost needed to make the immediate products or services of the project available for use or sale. The project

economic cost is the sum of installation, operation, maintenance, replacement and induced costs. The induced cost is the uncompensated adverse effects caused by the construction and operation of the project. But in the computation induced cost was not considered. The study considered replacement cost of all items whose life span were less than the assumed project life (25 years). The items considered include farm machinery, implements, vehicles and buildings. Their replacement costs were included as investment costs in years during which they were expected to occur.

Choosing of the discount rate: The discount rate for economic analysis should normally be a lower rate than the financial rate, as the economic rate measures the social time preference or social cost of capital. The rates adopted for financial and economic analyses in this study were 26 and 14% respectively.

For financial analysis, the interest or discount rate is usually the marginal cost of money to the farm for which the analysis is being done. This is often the rate at which a private enterprise is able to borrow. Currently Tanzania's bank lending rate to private agricultural projects, lies between 25 and 30% per annum. This study adopted 26% in its financial analysis as the best marginal cost of money to Setchet Wheat Farm. Discount rate for economic analysis is the interest rate, (below which it will be un accepted for IRR to fall) or

the opportunity cost of capital. This is a rate which reflects the choice made by the society as a whole between present and future returns, and thus the amount of total income the society is willing to save. In most developing countries , the rate is assumed to be somewhere between 8 and 15% in real terms (Gittinger 1984). This study adopted 14% as the best opportunity cost of capital for Setchet Wheat Farm. Finally the mathematical formulation for discounted measures of a project worth as it was applied in the study is as follows:

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

$$IRR: \quad r* = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

$$B/C \ ratio = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$

Where: B = Benefits in each year

C = Costs in each year

1/(1+r) = Discount rate by which values expected are brought to a common time basis

t = 1,2,...n.= Number of years

n = Assumed life span of the project

r = interest (discount) rate

r* = Interest (discount) rate at which the NPV equals zero.

(ii) Efficiency ratios

Efficiency ratios provide measurement of asset use and expense control. In this study these ratios were calculated in order to judge about farm's efficiency and its return to key aggregates. This study considered the following ratios as outlined in Gittinger (1982).

a. Operating ratio = Total operating expenses divided by gross farm income

Operating ratio indicates the ability of management to control production costs including selling, general and administrative expenses (Gittinger, 1982). This ratio indicates the proportion of gross farm income required to meet total expenses. If the ratio is greater than 1, the farm cannot be in position to cover the total expense of operation. The ratio is useful when operations of the same enterprise are compared year by year. If the ratio is increasing it may mean that the cost of raw materials is increasing or there is waste in the production process

or when sales decline, expenses have not been trimmed proportionately. If a company has made large investment it must be able to recover it with a high cash flow which can only be accomplished generally through a low operating ratio. An operating ratio, say in the neighbourhood of 90% reflect difficult is making adequate return, while an abnormally low ratio say 50% implies that some costs have likely been omitted or underestimated.

b. Income ratios

This is calculated in order to examine longterm financial viability of the farm's enterprise, and ability of this enterprise to generate funds for re-investment and growth. This study considered the following income ratios:

c. Return on asset ratio = Operating income divided by total assets

This ratio comes closer to the return on all resources engaged. If the farm is operating at normal capacity, the return on assets should exceed the cost of capital in the society as measured by say bank lending interest rate to a similar investment. A reverse condition is evident that the public fund would better be employed in other enterprises.

d. Credit worthiness ratio

The farm's financial position was also tested using one of the credit worthiness ratio which is obtained from:

Current assets divided by current liabilities. Where: current assets = property or claims owned by an enterprise which are expected to be converted into cash within a reasonable short period normally a year, while current liabilities = debts or claims against assets of an enterprise that are falling due within a year. This ratio is an indicator of margin that a company, or enterprise has for its current assets to shrink in value before it faces difficult in meeting its current obligations. A rule of thumb sometimes applied to this ratio is that, it should be around 2 if it drop near 1 then the company will be in a potential unstable position. As with all rules of thumb, however figures derived should be used with caution when drawing conclusions.

(iii) Cost comparative analysis

This was done in order to assess cost of wheat production per hectare, under the prevailing (reduced tillage)[1] method vis a-vis cost of production per hectare, under the conventional[2] method, so as to determine the most economic and sound wheat production method for adoption at the farm. In calculating the cost

of both methods, only two most expensive production inputs at the farm were considered. These were herbicides and fuel, while only one farm activity was considered, ie tillage operation. Specific important items which were taken into consideration included: (a) number of tillage operations in each method, (b) quantity of fuel used up during tillage operation in each method, (c) types of herbicides applied in each method, (d) application rates of types of herbicides applied in each method, (e) unit price of fuel and unit price of each type of herbicide used.

3.6 Data limitation

The data collection exercise encountered several problems. It was difficult to establish the exact number of some assets and their date of purchase. This was especially so with the farm's machinery and implements. Some were declared written off, others grounded although they may have been in proper working conditions. Others were reported to be outside the farm as were borrowed by other wheat farms. Value of assets were taken as per audited reports. In some cases it was not easy to disaggregate costs incurred for specific operation

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[1] Reduced tillage refers to 2-3 tillage operations with the application of pre-emergence and post-emergence herbicides.

[2] Conventional tillage refers to 4-6 tillage operations with application of post-emergence herbicides only.

because inputs particularly fuel and oil were aggregated for all operations.

It was somehow difficult to identify resource use for specific activities of the farm although records were at times recorded on weekly basis. Some data were even contradicting because they had been recorded by more than one person. Therefore these factors reduced the reliability of the data as dividing lines depended heavily on personal experience and those of farm staff consulted.

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents a descriptive analysis of the study and discusses the general characteristics of the farm, in which the agronomic cultural practices and the on farm autonomy issues are discussed. The effects of some of these factors on productivity is not easy to quantify. However there are cases when and where some of them may have played a big role in lowering or restricting the farm's production or potential for productivity.

Moreover, the chapter also looks on cost comparative analysis which was done to assess cost of production per ha. This was done by analysing cost of production under the prevailing reduced tillage method vis a-vis cost of production under the conventional method in order to show the most economic and sound wheat production method or technique for adoption at the farm. On the other hand production performance of the farm was examined using efficiency ratios such as the operating ratio, return to farm investment (return on assets) and credit worthiness ratios which were derived annually for 9 years i.e from 1982 to 1990. Their analyses reflect the farm's physical production efficiency and expenses on its production

elements. Lastly the chapter discusses the main tool of analysis of this study namely, financial and economic analysis which was carried out based on six different management levels. This analysis helps in testing the financial and economic viability of the project and its future prospects.

4.2 Cultural practices of Setchet wheat farm

Wheat cultivation undergoes related operation almost anywhere. These operations are land preparation which include; ploughing, land smoothing(harrowing) and weeding. Land preparation is followed by seeding (planting) and spraying, and finally swathing and harvesting.

4.2.1 Land preparation (tillage)

Cultivation of wheat at Setchet run from December to August. This involves ploughing, harrowing and application of herbicides. These operations are wholly mechanised. First tillage is done during the first three weeks of December, three months after harvesting (June - August) using chisel plough and sweeps, then one more tillage operation is performed in order to effectively control germination of weeds. This is done in late December (last week) and in first 3 weeks of January. This leave a satisfactory fine tilth required by the crop. However it is observed this late tillage after

harvesting does not allow the straw to decompose well. Early tillage after harvest (post harvest tillage) may allow early and complete decomposition of straw thus increase soil fertility potentials as well as yield.

4.2.2 Seeding and spraying

Wheat is sown immediately after the second tillage operation in late January to mid February using press drills and air seeders. Both implements (drill and air seeder) are pulled by tractors. However experience on the field has shown that, due to machinery breakdown and other problems, seeding is done up to the first week of March. Planting after February has proved to be uneconomical (having low yield), because flowering and filling stage of such late planted crop would coincide with the beginning of a dry weather period which in some years start in May. It was also observed that, in most cases sowing is hampered or delayed by heavy rains of December and January, which render difficult to work in heavy soils which cover a large part of Setchet farm.

The common varieties seeded at Setchet Farm are Viri Common, Tausi, Mbayuwayu and Viri medium. The farm doesn't produce pure seeds. After the harvest a certain quantity of wheat is retained as seed for the following season. However, it might be possible that the effects of this continuous use of mixed seed has been the low yields per ha.

Spraying operations start between late February to April, using two categories of herbicides for weed control. The first category involves pre-emergence herbicide with residual activity. These include stomp and Glean which are used for control of grassy and broad leaf weeds respectively. This first category of herbicides (pre-emergence), is applied immediately after planting in late February or early March. Other category involve post - emergence herbicides which include systemic/contact herbicides such as Puma Super and 2,4D mine, which are used for control of grassy and broad leaf weeds respectively. These are applied between late March and April. Application of two categories of herbicides started in 1988 after the adoption of reduced tillage method.

Herbicides constitute the most expensive production input at Setchet farm and experience has shown that, wheat production is not possible at this farm without application of herbicides. The dominant and most problematic weed is the love grass (Setaria Verticillate). This weed matures very early and spreads fast. This is a grassy weed therefore it is killed by grass weed control herbicides. Weeds can reduce yield up to 75% if not intensively managed. About 1300 ha were, in 1990 seriously affected by love grasses. This weed has become more resistant to herbicides, perhaps due to continuous use of these chemicals. Higher doses than the

recommended rates of herbicides and sometimes mixing of different herbicides have been resorted to, to effectively kill it.

However the love grass is not prevalent in the whole cultivated area except in few units of the farm. It is also observed that, the farm applies reduced tillage technique in which two categories of herbicides are applied. In doing so the farm incurs unnecessary cost. This is due to the fact that the areas where weed (love grass) infestation is not serious only one category of herbicides can be applied.

4.2.3 Swathing and harvesting

Swathing starts on late May to mid June depending on the condition of wheat grain. Swathing is done to minimize grain loss due to shatter before harvesting. Harvesting starts in late June and continues up to August using combine harvesters. Wheat is removed from the fields, taken through a cleaner to remove impurities, and then it is taken to store or sold immediately.

4.3 Cost comparative analysis

This is done in order to assess per ha cost of wheat production at the farm under prevailing reduced tillage method Vis cost of production per ha under the conventional method. Only two most expensive production inputs at the farm were considered in the computation.

The inputs are fuel (diesel) and agrochemical (herbicides). Types, quantities and prices applied at the farm in 1991/92 season were used as basis for computations (appendix 3).

In the reduced tillage method weeds are controlled by two tillage operations, followed by the application of two categories of herbicides which include the pre-emergence and post-emergence herbicides. While in the conventional tillage, weeds are controlled by four tillage operations followed by the application of Post-emergence herbicides only.

Results show that, cost of fuel (diesel) per ha under conventional tillage method is shs 1412.80 more than per ha cost of the same item under the reduce tillage method. While per ha cost of herbicides under conventional tillage is shs. 7290.0 less than per ha cost of the same items under reduced tillage. Finally it is observed that per ha cost in terms of fuel and herbicides are shs 5877.20 higher under reduced method than is under conventional method (Table 4).

The difference in costs is mainly caused by a persistent increase in price of herbicides, which is caused by a continuous devaluation of Tanzania shilling, as these chemicals are bought in foreign currencies. Reduced tillage was adopted in 1988 after it was found to be cheaper than the then used method of conventional tillage. But continuous increase of price of herbicides

has altered or reversed the situation. That is reduce tillage method is now more expensive than the conventional tillage method, therefore the farm must adjust itself accordingly. The farm would save more than shs 5877 per ha or over shs 22 million for the total annual cultivated area of 3750 ha, if it abandon the current reduced tillage method in favour of conventional tillage operation.

Table 4. Arusha: Setchet wheat farm, cost comparative analysis between reduced and conventional tillage methods (in shs).

	No.of tillage	Fuel	Herbicides	Total
Reduced tillage	2	1412.80	14091.60	15504.40
Conventional-tillage	4	2825.60	6801.60	9627.20
Cost difference	-	(1412.8)[1]	7290.00	5877.20

Source: Computed from appendix 3.

1] numbers in parentheses refer to negative values.

4.4 Performance analysis of the Setchet wheat farm using efficiency ratios

4.4.1 Operating ratio (efficiency)

The farm's total annual operating expenses were compared with respective income of the farm to get operational results (Table 5). Total expense considered in this calculation included variable or production expenses, selling, general and administrative expenses, repair, maintenance, and depreciation expenses.

Total expenditure per year in some years have been far in excess of the respective incomes of the farm. For example annual expenditure in 1990 was five times as much as annual total farm income. The differences between operating income and expenditure showed substantial losses of shs 1.35 million in 1982; shs 3.24 million in 1983; shs 8.77 million in 1986; Shs 29.86 million in 1989 and shs 73.67 million in 1990. But also profits were realised as shs 5.1 million in 1984; shs 15.69 million in 1985 shs 20.7 million in 1987 and shs 6.00 million in 1988 (Appendix 4). For the period of 9 years considered ie. 1982 to 1990, total loss was shs 69.34 million higher than total profit of shs 47.55 million. From 1988 on wards the results nevertheless show increase in losses and a general tendency of moving away from a break-even point. Operating ratio was excessively high, ie over 100%

in 1982, 1983, 1986, 1989 and 1990 reflecting far less or inadequate returns in those years.

However the ratio was normal ie between 60 and 80 percent in 1984, 1985 and 1987 (table 5), reflecting adequate returns in these years. The main contributing factors to the excessive spending (high operating ratio) included, low productivity especially in 1982, 1987 and 1990 when yields were 0.78, 1.43 and 1.42 tons/ha respectively. High production, marketing and administrative expenses also played a big role in raising total expenditures, hence high operating ratio of the farm. In 1989 selling and distribution expenses alone accounted for 48 and 39% of the total annual revenue and operating expenses respectively. Although in 1988 the farm recorded the highest output level of 2.61 ton/ha, it could not manage to get high profit as the operating expenses were 94% of total annual revenue. High production expenses in 1990 were mainly caused by low productivity and increase in cost of fuel and herbicides. For example fuel expenses increased two folds between 1987 and 1990, while the cost of herbicides rose 5 times during the same period (Appendix 8).

Table 5. Arusha: Setchet wheat farm, comparison of operating expenses and revenue, 1982 to 1990 crop years in percentage.

Operating expenses/Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
	As percentage of revenue[1]								
Production (variable)	41	53	35	21	42	31	32	37	302
Marketing and Distribution	4	1	2	28	49	-	30	48	14
General and Administrative	25	27	19	13	23	22	20	28	113
Repair and maintenance	10	13	6	3	4	4	4	5	49
Depreciation	34	37	13	4	3	8	7	6	45
Operating ratio[2]	114	131	75	69	121	65	93	124	524

Source: Derived from appendix 4.

1] Revenue from wheat sale.

2] Operating ratio = Total operating expenses divided by revenue times 100.

Where : Total operating expenses on the table obove refer to production, marketing and distribution, general and administration, repair, maintenance and depreciation expenses

4.4.2 Return to farm investment (return on assets)

This section discusses the direct economic return to investment at the Setchet wheat farm. Return to farm investment at Setchet for 1982, 1983, 1986, 1989 and 1990 were far below the social costs of capital prevailing in the country (Table 6). The opportunity cost of capital/social lending rate to agricultural investments is about 14%. The statement of accounts revealed losses which led to negative percentage return on assets for these years. Return on assets was above 14% in 1984, 1985 and 1987 suggesting that the project could be economically viable if operated at this level throughout.

Table 6. Arusha: Setchet wheat farm, computation of return to farm investment, 1982 to 1990 in percentage.

	1982	1983	1984	1985	1986	1987	1988	1989	1990
Wheat sales revenue	10.49	10.11	20.65	51.52	42.13	63.83	93.44	126.70	17.42
Less									
Operating expenses	11.84	13.35	15.55	35.36	50.90	41.13	87.38	156.56	91.09
Operating profit (loss)[1]	(1.35)	(3.24)	5.10	15.69	(8.77)	20.70	6.06	(29.89)	(72.67)
Current (net)-assets	11.82	9.95	20.35	52.84	55.01	74.35	90.93	139.71	244.59
Fixed (net) - assets	11.13	10.61	9.28	8.25	9.49	19.88	22.09	21.43	33.51
Total assets	22.95	20.56	30.13	61.09	64.50	94.23	113.02	161.14	278.10
Return to Farm-investment[2]	(5)	(56)	17	26	(14)	22	5	(19)	(26)

Source: Derived from appendix 4 and 5.

1] Figures in parantheses show negative values.

2] Return to farm investment = Operating profit divided by total assets

4.4.3 Current ratio (creditworthiness) of the farm

This is a ratio of the farm's current assets to its current liabilities. The ratio shows the farm's stability and ability to pay its current debts. On the other hand, the difference between current assets and current liabilities show the farm's working capital in a particular period of time.

In this analysis results show that, Setchet Farm's working capital increased from shs 5.08 million in 1984 to shs 63.25 million in 1989 from where it declined to shs 42.8 million in 1990 (table 7). Working capital showed negative values in 1982 and 1983, whereby for every shilling owned by the farm, there were only 80 cents in 1982 and 70 cents in 1983 for payment. With exception of the year 1982 and 1983, the farm could discharge all its current liabilities if claimed by the respective parties during these years. This implies that the farm on the whole was in a stable position. It appears that the farm is commercially sustainable from the perspective of having enough revenue to cover all its recurrent costs. This conclusion assumes that its current supply of equipment and parts do not cause problems.

Table 7. Arusha: Setchet wheat farm, working capital in million shs and the current ratio, 1982 to 1990.

Item\Year	1988	1983	1984	1985	1986	1987	1988	1989	1990
Current assets(c.a)	11.82	9.95	20.85	52.8	55.01	74.35	90.93	139.7	244.6
Current liabilities-(c.l)	15.21	14.77	15.87	33.76	30.19	41.63	54.08	76.46	201.8
Working capital	(3.39)	(4.82)	5.08	19.08	24.82	32.72	36.85	63.25	42.80
Current ratio [1]	0.8	0.7	1.3	1.6	1.8	1.8	1.7	1.8	1.2

Source: Derived from appendix 5.

1) Current ratio = c.a/c.l

4.5. Performance analysis of Setchet wheat farm using B/C ratio, NPV and IRR

4.5.1 Considerations and assumptions in the application of discounted measures

Length of project period - Grittinger (1982) suggests that a convenient way of establishing the period of analysis of a project, is to use technical life of the major investment item. In the Setchet Wheat Farm one alternative would be to take land development as major investment item, and replace agricultural machinery, implements and vehicles when they become old. Land development has a life span of 25 years.

Both benefits and cost were discounted beginning with the first project year. This is to make it

convenient such that project years and discounting periods coincide, ie project year 1 is discounted using the factor for the first period and so on.

Depreciation- was not subtracted as cost. it was automatically taken care of in the computation processes, since the net benefit stream or cash flow is an undifferentiated combination of the return of capital (which include depreciation) and return paid for the use of capital, which is the return to capital or interest rate (Gittinger 1984). Likewise no deduction was done for interest paid on money borrowed.

Salvage value - Most investment items will have been used up by the end of project period since they were assumed to have a life less than 25 years. Items such as godown and a water tank could still have salvage value but this would not make any significant difference in the calculations since after all salvage value is added in the last year of project. No value for land was included in the project financial or economic analysis. The land was assumed to have been idle without the project. It would in effect have produced no economically valuable output at all. Therefore the net value of production foregone was assumed to be zero.

Loan and loan repayment - This item was omitted from the economic accounts as it was regarded as a transfer payment. Loan repayment is an out flow in the financial analysis, where as loans are inflow in (this ie)

financial analysis and therefore add to benefits (squire and Van der Tak, 1975). No value for taxes was entered in the project economic analysis. Payment of tax does not reduce national income. It is a direct transfer payment and not a cost from the stand point of the society as a whole. The payment of taxes and other duties is customarily treated as a cost in the financial accounts. Taxes in the financial analysis for years up 1992 have been at a rate of 45% of the gross profit.

However the government has shown interest of reducing income taxes up to 35% of gross income for all resident companies with effect from 1993 in order to reduce cost of production, and also enable companies to earn more profit which will be reinvested to boost the economy (Daily news June 1992, unpublished report). Therefore both the current income tax rate of 45%, and the proposed rate of 35% have been used in this study.

Subsidies - were omitted in economic analysis. In reporting results, the benefit-cost ratio obtained on gross basis, while net present values (NPV) are reported on both gross and netting out basis. The internal rates of return are computed specifically on netting out. Netting-out is meant to change figures only slightly (Gittinger, 1984).

4.5.2 Background to Setchet farm management levels.

Setchet wheat Farm has had varying yields from year to year. Annual yields of as low as 0.78 ton/ha and as high as 2.6 tons/ha have been recorded. With such a diversity, calculations on benefit - cost ratio, NPV and internal rates of return have been based on some average or representative yield. The representative yield level enables the researcher to suggest possible management levels which can make the farm both financially and economically viable. It also enables estimation of management level at which to expect a possibility of project costs recovery and further reinvestment. The representative yield level for the farm has been taken to be 1.8 tons/ha. This was the average production performance for 8 reviewed years (1983 - 1990). Yield for 1991 was not included because the crop was still in the field at the time of the study and the operational costs had not yet been compiled. (However the cultivated area in that year was 3750 ha. Output for the year 1991 therefore, was based on the assumed yield for each management level, times the cultivated area)'. As for wheat price the official (NMC) prices were used in the computation for years from 1975 to 1990. These prices were converted to real prices based on 1989 prices by using National consumer price index (NPCI). Real prices were determined by using the formula as follows:

Real price = Current price divided by NCPI/100

Where: NCPI = National Consumer Price Index.

In July 1990 the government decontrolled the marketing and distribution of wheat grain and wheat flour, thus the agricultural pricing policy changed towards fixing indicative producer price and leaving consumer price open (Amani et al). Producers are now allowed to sell in the open market by negotiating the selling price with buyers. Therefore as for the rest of years ie 1991 - 1999, the ruling market price of 1991 as converted to constant price of 1989, was used for forecasting of revenue in those years, assuming a project life of 25 years from the first year of wheat production in 1975.

Other management levels were as follows:- A management level at 2.0 tons/ha; This was the average yield attained in the last 3 years ie 1988 - 1990. It was estimated that the farm could break - even with this management level. Change in management level in 1988 showed that, a yield of 2.5 ton/ha was attainable as during the same year the yield was around 2.6 ton/ha. Cultivable area however can be maintained at 3750 from 1991 on wards, as expansion of area is limited by the current land pressure in the area. Present machinery capacity allows cultivation up to 4000 ha.

Potential yield of 4 tons/ha is not likely to be reached within short time due to farm's underlying problems as discussed in section 4.2.2. Due to

uncertainties the study considered the highest management level to be 3.0 tons/ha with maximum cultivable area of 3750 ha.

4.5.3 Financial analysis of Setchet wheat farm.

When the current income tax rate of 45% was included in the computation, the internal financial rate of return (IFRR) becomes 22% which is far below the bank lending rate of 26%. The net present value (NPV) become shs -2.93 million, while the benefit - cost ratio is 0.96. This implies that with inclusion of income tax at the rate 45% of gross profit, and at the current 1.8 tons/ha yield level, investments and other costs into this scheme cannot be recovered in the project's life of 25 years. Even after this period, the project will remain with a loss of over shs 2.93 million, when computed at 1989 constant prices (Appendix 8). But when the proposed new rate of 35% income tax was used, losses are reduced by 35%, giving an NPV of shs - 2.08 million. The B/C ratio was found to be 0.98. Which was still less than 1. The IFRR was 24% which is far less than the ruling bank lending rent of 26% (appendix 9). Therefore the farm will still not be financially viable at 1.8 tons/ha yield level even if income tax is reduced by 10%, ie from 45% to 35%.

However, yield records for the years 1988, to 1990 showed that yield levels can be raised by 11% to reach

2.0 tons per ha. At this yield level, the 35% income tax rate gives an IFFR of 26.4% which was more or less equal to the ruling bank lending rate of 26%. At this level the B/C ratio is 0.99. This implies that at 2.0 ton/ha yield level the farm will be very near to its break-even point (Appendix 10).

But since it is for the national interest to see the farm generates enough profit at the end of its life time, then it is not advisable to produce at this level as very little profit will be generated at the end of the assumed life time of the project(ie NPV = shs. 0.27 million only). The current average production performance of 1.8 tons/ha was found to be caused by a number of factors such as land preparation, lack of high yield varieties, late planting and weeds particularly the love grass. These factors may reduce potential yield by 55% or more. However the farm is capable of solving these problems without extra resources. If successful this will enable it to raise the current 1.8 tons/ha by 67% to a level of 3.0 tons/ha.

At 3.0 tons/ha, with income tax rate of 35%, the farm gets a net present value (NPV) of sh. 6.45 million and IFRR of 30% which is by far greater than the ruling bank rate of 26%. B/C ratio is 1.14 which implies that cost would have to rise by 14% before the B/C ratio is driven down to 1 (when computed at constant prices of 1989), (appendix 11).

4.5.4 Economic analysis of Setchet wheat farm

4.5.4.1 Consideration in the application of economic analysis

This analysis followed the same management levels as the financial analysis, except that financial prices of some items were changed into economic values. The open market price of wheat grain was used as an estimate of its economic value, in each respective year. These prices were 20% higher than the official (NMC) prices.

Adjustment for costs of various items were as follows. A foreign exchange premium of 50% was used to determine the economic value of all items whose purchase involved a foreign exchange component. These items included fuel, oils, lubricants, Agrochemicals, spares for vehicles and 57% of the capital investment (Appendix 14). Casual labour was shadow priced at 60%. Price of other items like seeds operators meals etc. were not adjusted as these items were being purchased at open - market price from the start of the project.

4.5.4.2 Interpretation of economic analysis results

After discounting net benefit at 14, the analysis showed that at the current performance of 1.8 tons/ha the farm is economically viable. A benefit cost ratio of 1.15 and IERR of 22% were obtained indicating that, in the economic sense investment and other project costs were recoverable at this level of output (appendix 12). But since the farm needs to operate profitably in both

aspects (financially and economically), it is still not advisable to operate at this level as the IFRR was found to be 24% which is far less than the ruling bank lending rate of 26% (Appendix 9). At output level of 2.0 tons/ha, the B/C ratio was found to be 1.22, while the IERR was 23% and NPV was shs. 56.48 million. These results proved to be economically viable at this level. However at the same management level, the farm was operating near its break-even on financial accounts, as the IFRR was 26% which is equal to the existing bank lending rate. Therefore for a profit seeking enterprise, it is not advisable to operate at this level as profit will be negligible (Appendix 10).

Raising yield levels to 3.0 tons/ha would put the project on sound economic and financial footing. The B/C ratio computed in this analysis was 1.53, IERR was 28% and the highest NPV of shs 151.48 million was obtained. At this level also the farm was found to be financially justifiable after, having NPV of shs 6.45 million when tax rate of 35% was applied in the computation. This implies that at opportunity cost of capital of 14%, given level of output of 3.0 ton/ha, a high positive NPV of shs over shs 151 million will be obtained. In economic terms all capital borrowed at 14% interest rate could be repaid while leaving management with a net balance of over shs 151 million in terms of present value of future income (Appendix 13).

4.6 Impact of the farm on the surrounding community

4.6.1 Introduction

This section reviews the main issues and opportunities for community development both near the farm and the districts as a whole.

4.6.2 Positive impact

The farm operates with modern technology having very little integration with surrounding villages. It has independent input channels and sells all its produce far from the surrounding area. However there are economic spill-overs to the surrounding villages though in a limited state. Records indicates that 303 ha in five villages were cultivated using hired machinery and implements of the farm in two seasons as shown in table 8.

Table 8. Arusha: Setchet wheat farm, area cultivated by the nearby five villages using farm machinery and implements in 1988/89 and 1989/90 seasons.

Name of village	1988/89 season (area in ha)	1989/90 season (area in ha)
Ufana	65	86
Setcheda	27	37
Luxmanda	20	20
Orbesh	-	4
Madungu	30	20
Total	142	161

Source: Production record of Setchet Wheat Farm.

Other spill-overs are in the field of labour, health transport water and electricity. It was observed that out of 50 full time labour force which is composed of 10 different ethnic groups, only few come from the surrounding community which is mainly made up of Iraqwe and Barabaig groups. Poor level of education (trained persons) and lack of interest to work in the field were said to be the reasons for the situation. The number of casual labourer is estimated at between 100 and 150 person per year. This would involve a large number of

individuals who by large are drawn from the surrounding villages which have a population of over 3000 people. No exact information was provided on gender composition of the causal labour force but most of them are said to be men.

The farm operates dispensary which is staffed by a medical assistant, a nurse and nurse assistants. The facilities include, consultation and maternity rooms, laboratory, pharmacy, clinic and a waiting room. Both on - farm and off farm community cases are attended, while transport for medical reasons to outside facilities are also provided by the farm to both farm employees and villagers for emergency cases. Cultivation of crops notably maize by farm workers has expanded very fast. The completion of central water system and the arrival of the grid electricity at the farm in 1991 has benefited the surrounding areas, including the district town of Katesh which used not to have electricity. While certain farm facilities such as maize mills are used by nearby residents, the farm pays a substantial amount of local tax to the district council in form of produce levy, which is charged at the rate of shs 0.75 per kg of wheat sold. Generally it can be well argued that in the absence of the farm the government would have to provide such facilities to the area in any event.

4.6.3 Negative impact

However the loss of grazing land caused by establishment of the farm is of course a negative impact on the pastoral population. lack of recognized access to grave sites, is a cultural loss which can be remedied, or at least minimized if a full and frank dialogue between the farm and the community could be established and agreed upon.

4.7 NAFCO Organisational structure and its effects on Setchet farm's authority and operational efficiency.

4.7.1 Introduction

There are several ways of portraying business management function, but management roles tend to be the same. In general, the roles or functions of management are decision making and problem solving to achieve certain goals. Thus effective farm management team requires enough autonomy to set goals, make decision and to act on them. The following section discusses the NAFCO bureaucratic organisation and its effects on Setchet Farm operational efficiency.

4.7.2 Influence of NAFCO organisational structure on the Setchet farm's authority

NAFCO is relatively authoritarian, centralized decision making bureaucracy in relation to its individual

corporation/companies such as the Setchet farm. NAFCO board of directors is responsible for developing over all policy directives. Its office and senior managers (figure 5) are located in Dar es Salaam.

The organisational link between the head office and the farm is through the field coordinator at Arusha and the field director at Hanang wheat farms (including Setchet farm). The field director provides a direct link between NAFCO head office and the farm manager. However, it is still not clearly stated as to how the field director communicates through the field coordinator at Arusha. As a result, substantial overheads are automatically built into the farm's production operating costs. This is illustrated by NAFCO's management charges on the farm which is at a rate of 8 percent of the Farm's gross profit. It is still not clear as to how this charge is spent on behalf of the farm's economic welfare. In addition to this overhead charge, the farm has a sizeable administrative units of its own. These add considerably to the total farms administrative overheads. For example in 1989 total farm's administrative overhead amounted to shs 33.03 million, which was one third of farm's total operating costs (Appendix 8).

Figure 6 shows NAFCO and overall national administration of the Hanang wheat complex which seem to complicate decision making at Setchet farm. Under this system one may note that a number of minor farm

management decisions are required to go through a chain of bureaucratic bodies. Given training and competence of the farm manager and his field officers, this kind of administration of farm operations appears to increase farm administrative expenses while impending fast farm management decision making processes due to too much bureaucracy. Farm operation requires efficient and timely decision making that will enable management to react to changes at short notices. In that case the existing bureaucratic structure does not support the smooth and effective administration of farm operation. The cost to the farm in terms of lost efficiency and slow reaction to new management opportunities, cannot easily be quantified. The monetary costs are obviously high as the NAFCO administrative charges stand at 8% of the farm's gross receipts. In 1989 the farm paid a total of shs 20.93 million as NAFCO fees, added to this was costs of providing transport and per diem allowance to board members, as half of the 15 board members travel from distant places like Arusha, Dar es Salaam and elsewhere. Also during the same year (1989), the farm paid to the government a total of shs 49.1 million as income tax. These two government related expenses (ie NAFCO fees and income tax) alone amounted to 55% of the farm's total revenue in that year (Table 9)

Table 9. Arusha: NAFCO service fees and income tax paid by Setchet wheat farm, 1985 to 1989 as percentage of total farm revenue.

Description/Year	1985	1986	1987	1988	1989
NAFCO service fees paid as % of total farm revenue	5	6	9	8	16
Income tax paid as % total farm revenue	30	18	30	30	39
NAFCO service fees and income tax paid as % of total farm revenue	35	24	39	38	55

Source: Computed from appendix 8 and farm's audited reports.

From the above discussion it can be said that, NAFCO organisational or administrative structure, may be one of factors that have caused excessive overhead and administrative costs at the farm making it unable to clearly demonstrate commercial viability (Appendix 8), and thus failing to retain enough profit for replacement of capital assets when they wear out. Currently, capital assets replacement is effected as outright grant from the government of Canada through its overseas agency ie CIDA.

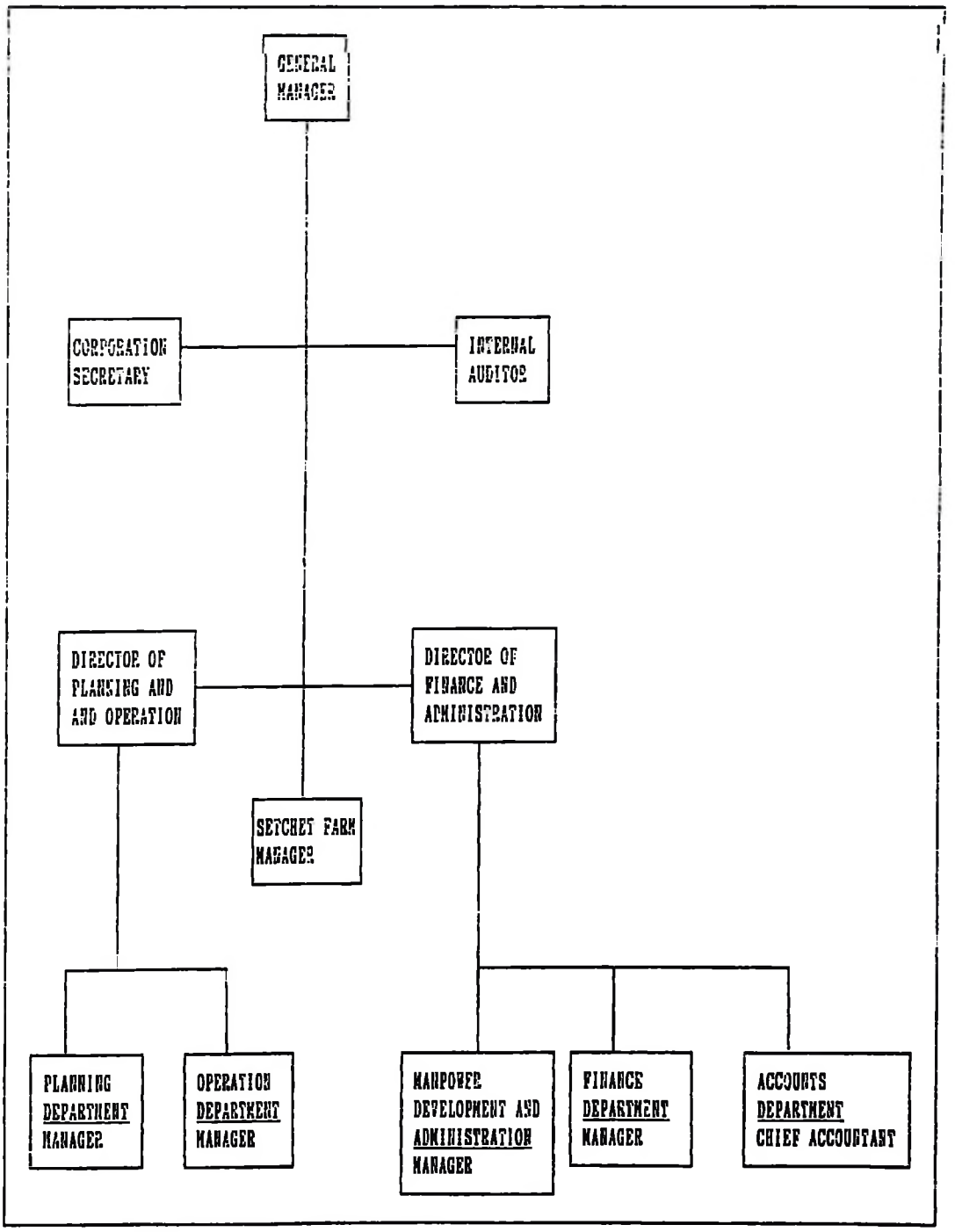

Figure 5. Tanzania: HAFCO management team.

Source: Adopted from Schumacher et al. (1990).

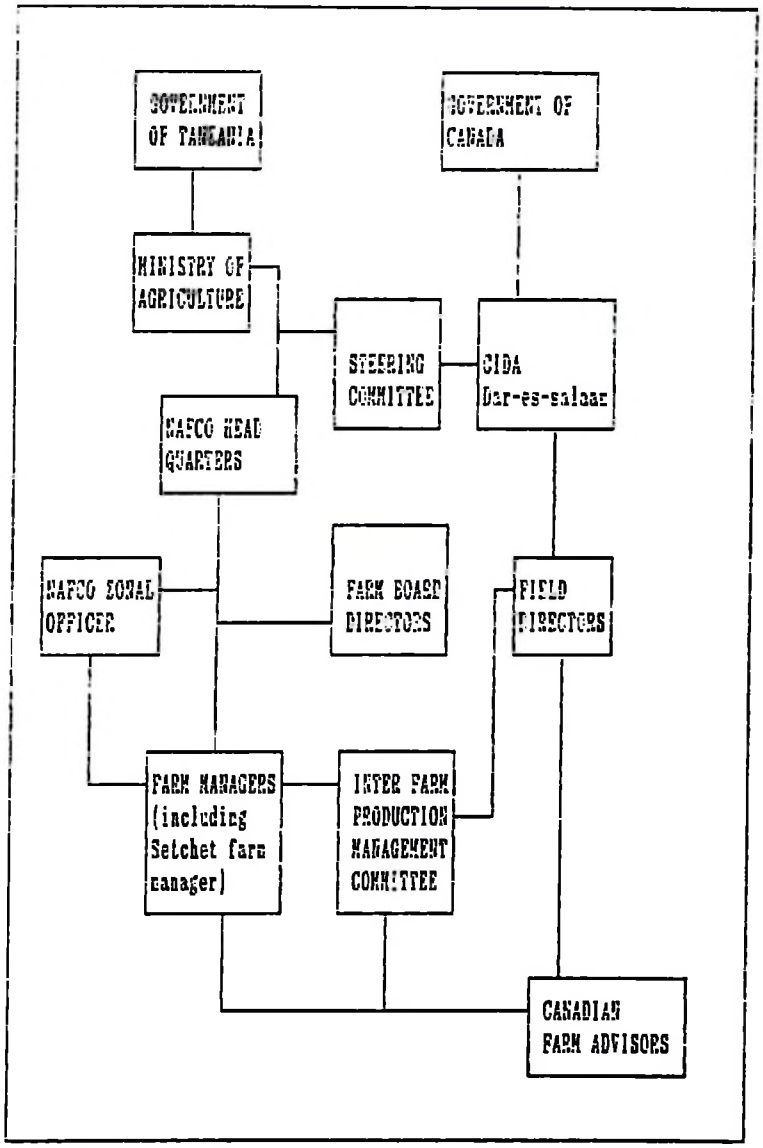

Figure 6. NAFCO and overall national administration of the Hanang wheat complex (Setchet farm included)

Source: Adopted from Schumacher et al. (1990)

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In the preceding chapters, discussions have been concerned directly with organisational and the economics of a large scale mechanised state farm of the Setchet wheat production farm. Literatures on related studies have been reviewed, while the methodological issues concerned the study have been discussed.

This chapter then, summarises the findings of the study as related to the stated objectives, and makes possible recommendations for future development and sustainability of the farm. The initial objectives of the farm, were to cultivate wheat successfully and profitably so that, together with its sister companies (the other six national wheat schemes) would make the country self sufficient in wheat production, and improve the lagged agricultural production technology particularly of the surrounding area (Beamish, et al 1968).

The objectives of this research is to test the farm's financial and economic viability and assess its cost effectiveness, to examine operational efficiency and profitability of the farm, and to identify constraining factors limiting the farm to achieve its potential output. Financial and economic viability of the farm is

tested using values of three quantitative indicators, namely, benefit-cost ratio , net present value and internal rate of return, while cost effectiveness of wheat production at the farm is assessed by cost comparative analysis whereby, wheat production cost per ha under the currently applied reduced tillage method, is computed and compared to cost per ha under the conventional tillage method. The farm's physical production efficiency are examined using financial ratios, which include the operating ratio, creditworthiness and return to assets ratios. On other hand constraining factors limiting potential yields are identified with main focus on cultural practices, weather conditions, organisational structure of NAFCO and its effects on management of Setchet farm.

5.2. Conclusion

5.2.1. General economic performance of the farm

Results from the analysis show that, Setchet farm's key problem in the struggle for productivity and profitability, appears to be a combination of high production cost and low yields due to inappropriate cultural practice and adverse weather. The field survey results have revealed that, the farm is operating below its potential. In addition to that, a variation of yields from year to year have been observed whereby yields as low as 0.78 tons/ha in 1982 and as high as 2.61 tons/ha

in 1988 were recorded. Moreover an eight crop years (1983-1990) average production of only 1.8 tons/ha, renders the farm to be financially (commercially) unsound as it does not cover the average variable costs.

The gap between average annual output (assuming an average of 3750 ha under crop annually) and potential annual production (considering yield of 4 tons/ha) is estimated at 8250 tons, of wheat. This is worth shs 39.6 million per annum[3]. Causes of poor performance and variation in yields between 0.78 and 2.61 tons/ha in 1982 and 1988 crop years respectively, were poor timing of farm operations, bad weather (unreliable rainfall), weed infestation, improper agronomic practice, lack of high yield seeds. These factors are assumed to be responsible for reduction of potential yield (4 tons/ha) by 55%. However all of these problems except weather could be solved with the existing NAFCO resources.

5.2.2 Production efficiency (as indicated by efficiency ratios)

The farm had been chronically short of working capital from its on set in 1975 to 1984. Afterwards the situation improved, and the farm has been able to cover all its current financial obligation. This has been indicated by positive working capital for the period

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3 The figure was computed at the 1991 market price of shs 48.00 per Kg of wheat grain.

from 1985 to 1990 showing its potentials and sustainability in some years to come (assuming there is no problems with the supply of parts, machinery and equipment). However in general the farm has been operating efficiently given its environmental (weather), organisational and operational constraints, although meagre farm margins in some years had been insufficient to allow the management to pay back the investment cost and meet depreciation costs. This has been shown by the high operating ratio in the years 1982, 1983, 1986, 1989 and 1990. Moreover the performance of the farm seems to be affected by the huge overhead costs caused by high administrative expenses ever increasing prices of production inputs which have foreign currency component, and a huge income tax charge which currently accounts for 45% of the farm's profit. Other limitation include a delayed foreign exchange allocation for purchase of herbicides which often ends the farm in last minute undertaking of its activities. However there are still hopes for the farm to recover from its previous financial burdens, as the government has announced a reduction of income tax charges from 45 to 35% for resident companies, and abolishment of import duties for agricultural inputs with effect from 1992/93 crop season. Also as from 1989/90 season the government ceased to set and control price for wheat grain and flour. Wheat now is sold at open market where by a producer is free to negotiate for

a better price depending on market forces. The reduction in income tax, abolishment of import duties and decontrolled producer prices may enable the farm retain a substantial part of its gross profit. Also the yield level of 2.61 tons/ha achieved in 1988 nevertheless shows some hope that the wide gap between average annual output yield level (1.8 tons/ha) and the potential level (4 tons/ha), can be reduced if the farm is to adhere to the proper agronomic practices, including timeliness of operations and use of improved high yield varieties.

5.2.3 Financial and economic analysis.

The current production performance of 1.8 tons/ha at Setchet Farm is uneconomical farming practised. Unless this performance is improved, it would be financially unsound (though economically viable) to continue investing in this farm. This is because, financial analysis at this yield level is 24% which is far less than the on going bank lending rate of 26%. The net present value showed a negative value of shs 2.08 million while the benefit - cost ratio is 0.98 which is less than 1. Low producer prices, huge income tax charges, huge administrative overhead, high production costs and low yields per hectare are the main factors contributing to this unsound financial state of affairs. Although the economic test at this level (1.8 tons/ha) indicates the farm to be economically justifiable, it is not advisable

to produce at this level as the farm is required to be both financially and economically sound. However it is not advisable to close down the farm, not only because some costs that have been incurred are sunk, but also because currently the farm is able to meet all its current financial obligations.

In the financial analysis yields at 2.0 tons/ha enable the farm to break even. At this level of output the farm will be at margin making a meagre profit and a b/c ratio slightly less than one ie (0.99). Thus it is still not advisable to produce at this level. The yield level of 2.6 tons/ha attained by the farm in 1988 showed that, under proper farm management practice the farm can attain a yield level of 3 tons/ha and so reduce the percentage gap between average annual yield/ha and potential annual yield per hectare by 30% ie from current 55% to 25%. At 3 tons/ha the farm could earn back sufficient revenue to cover all costs expended on it and pay at least 26% interest for the use of borrowed money. The economic rate of return at this level was 28% while the net present value was shs. 151.48 million. The B/C ratio was 1.53 which was far greater than 1.

However results in the cost comparative analysis showed that, per ha cost of production under the reduced tillage method was higher than per ha cost under the conventional tillage method. And that the farm would save more than shs 5877 per ha or over shs 22 million for the

total cultivated area of 3750 ha, if it abandons the current reduced tillage operation in favour of conventional tillage operation.

5.3 Recommendations

For the Setchet Farm to improve production performance so as to become financially and economically viable, management should carry out measures that will increase yields and reduce the unit cost of production. The analysis however suggest that increase in yield and costs reduction per ha could be done within NAFCO resources as follows:-

Low yield - is due to a combination of factors such as whether (unreliable rainfall) and poor wheat husbandry. It is advisable to have a proper preparation of machinery before field operations so as to adhere to calendar of operation. Planting should be done according to rainfall calendar at the farm. This implies that, if December and January rainfall is heavy (more than 200 mm), seeding should be done immediately in late January to early February. Otherwise seeding should be done in early February even if less than 200 mm of rain has fallen. Moreover blocks with heavy soil should be seeded early to avoid delays which may be caused by heavy rains. If early seeding is done, then varieties which take long time to mature (example viri medium) must be seeded first.

The current practice of the farm of retaining a certain quantity of wheat grain as seed from the proceeding season's harvest, must be discouraged because the longterm effect of continuous use of mixed seed under this system has been low yields. In solving this problem, foundation seed has to be certified by the relevant body (TANSEED), while seed multiplication must be done separately either by the farm itself or by elite contract growers. Further research efforts must be directed on varieties with high yield, reasonable plant height and resistance or torelance to adverse weather.

Also after assessing cost effectiveness and operational efficiency of wheat production at the farm, it is then recommended that, weed control using two categories of herbicides should be used where it is necessary only, ie where love grasses are prevalent. Otherwise the current reduced tillage method for weed control must be abandoned in favour of conventional tillage method which is currently relatively cheaper and cost effective. However efforts must be done for seeking alternative cheaper agrochemicals (herbicides) which could effectively control the problematic weeds. On the other hand financial burden or excessive overhead of the farm, steps should be taken with the appropriate support of government and the TCWP team, to work toward restructuring of NAFCO - Farm relationship which allows more autonomy and flexibility for the Setchet farm

management team. This can be easily done under the current nationalwide parastatal organisational restructure. Also the present 8 percent NAFCO management fee should be examined to see if it can be reduced substantially or eliminated, alternatively the farm board of directors' meeting expenses be covered by NAFCO out of the 8 percent management charge, if the charge is to remain inforce.

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APPENDICES

Appendix 1. Tanzania: Wheat production and imports in 000' tons.

Year	Production (in 000' tons)	Imports (in 000' tons)
1968	22	55
1970	42	11.6
1971	47	19
1972	60	-
1973	88	-
1974	85	-
1975	82	-
1976	69	60.2
1977	64	33.6
1978	55	60.2
1979	70	61.3
1980	87	32.5
1981	90	48.7
1982	95	82.0
1983	58	11.4
1984	74	46.3
1985	83	33.4
1986	72	21.8
1987	72	53.5
1988	80	33.7
1989	100	-

Source: Adopted from Saunders 1991.

Appendix 2. Tanzania: domestic sources of wheat marketed to the National Milling Corporation (NMC), 1980 to 1988 in 000' tons and percentage

Year	NMC Procurement Amount			Percentage		
	From State farms	From Hired farms	Total	From State farms	From Hired farms	Total
1981	16.7	10.2	26.9	62	38	100
1982	15.9	7.2	23.1	69	31	100
1983	20.4	10.8	31.2	65	35	100
1984	21.4	6.9	28.3	76	24	100
1985	30.2	3.0	33.2	91	9	100
1986	41.3	9.0	50.3	82	18	100
1987	27.5	6.0	33.5	82	18	100
1988	37.1	4.9	42.0	88	12	100

Source: Tanzania-Canada wheat project, literature review of wheat production in Tanzania, October 1988.

Appendix 3. Arusha: Setchet farm, production costs per ha in terms of fuel and herbicides as in 1991 (in shs).

Fuel

Diesel:

Total area cultivated in hectare = 3750
Quantity of diesel used up in a single tillage operation = 3000 litres

Quantity of diesel per ha = $\frac{30,000}{3750}$ = 8 litres
Unit price of diesel (price per litre) = shs 88.30
Single tillage operation costs per ha in terms of fuel
(diesel) = 88.30 x 8 = shs 706.40

Herbicides

Pre-emergence herbicides:

Stomp/Glean Mixture:

Stomp:

Application rates = 2 litres/hectare
Unit price(stomp) = shs 1582.50 per litre
Cost per ha = shs 1582.5 x 2 = shs 3165.0

Glean:

Application rate = 25 gm/hectare
Unit price = shs 165000 per kg
Cost per hectare = shs $\frac{165000}{1000}$ x 25 = shs 4125.0
Total cost of pre-emergence herbicides per ha (Stomp/Glean mixture)
= (3165 + 4125.0) = shs 7290.0

Post-emergence herbicides:

Puma super/2, 4D Amine Mixture:

Puma Super:

Application rate = 1 litre/hectare
Unit price = shs 5942/litre
Cost per hectare = shs 5942.0

Appendix 3 (cont.)

2,4D Amine:

Application rate = 1.2 litre/hectare
Unit price = 716.30/litre
Cost per hectare = 716.30 x 1.2 = 859.60
Total cost of Post - emergence herbicides per ha (Puma Super/2,4D
Amine Mixture) = (5942 + 859.60) = Shs 6801.60

Source: Setchet farm production record files

Appendix 4. Arusha: Setchet wheat farm, operational results of the enterprises 1982 - 1990 (in million shs).

year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Items:									
Wheat Sales	10.49	10.11	20.65	51.52	42.13	63.53	93.44	126.70	3.32
Less: Cost of sales (excluding maint. and depr. expenses)	4.25	5.38	7.31	11.05	17.71	19.68	30.30	47.02	52.53
Gross profit	6.24	4.73	13.34	40.47	24.42	44.15	63.14	79.68	(49.21)
Less: Selling and distribution expenses	0.38	0.08	0.25	14.55	20.65	-	27.85	60.50	2.42
Administrative and general expenses	2.60	2.79	3.92	6.49	9.57	13.91	18.59	32.27	19.71
Repair and maintanance expenses	1.03	1.32	1.33	1.66	1.88	2.43	3.67	5.94	5.52
Depreciation expenses	3.58	3.78	2.74	2.08	1.09	5.11	6.97	7.83	7.91
	7.59	7.97	8.24	24.78	33.19	21.45	57.08	109.54	38.91
Operating profit /(loss)[1]	(1.35)	(3.24)	5.10	15.69	(8.77)	22.70	6.06	(29.86)	(73.67)
Add: Non - operating income	0.32	1.51	1.33	16.57	22.72	3.25	8.48	15.21	15.55
	(1.03)	(1.73)	6.43	32.26	13.95	25.95	14.54	(14.65)	(58.23)
Less: non-operating expenses	0.90	0.54	1.00	1.58	0.80	1.78	1.80	4.23	3.72
Profit/(loss) before income tax	(1.93)	(2.27)	5.43	3.68	13.06	24.17	12.74	(18.88)	(61.95)

Source: Setchet wheat company income statement records

1] Numbers in parentheses imply negative values

Appendix 8. Arusha: Setchet wheat farm, balance sheet as from 1982 to 1990 (in million shs)

Items/Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Assets:Current assets:									
Cash and Bank Balances	2.04	3.05	8.6	31.34	26.43	21.60	28.23	45.46	7.96
Amount due from group companies	0.27	0.29	0.62	0.58	3.42	4.55	2.05	16.35	25.49
Debtors and prepayments	1.42	1.47	1.89	5.32	6.03	17.21	33.51	41.16	4.46
Stocks and stores	8.05	8.11	9.74	18.1	22.13	30.39	26.69	36.74	139.71
Short term loan due from group companies	0	0	0	0	0	0	0	0	6.95
Total current assets	11.82	9.95	20.95	52.84	55.91	74.35	90.93	139.71	244.59
Add:									
Fixed Assets (Net)	11.12	10.61	9.28	9.25	9.49	19.88	22.09	21.43	33.51
Total Assets	22.95	20.56	30.13	61.09	64.5	94.23	113.02	161.14	278.1
LIABILITIES:Current liabilities:									
Sundry creditors, provision and accrued charges	3.04	2.33	3.54	5.45	5.42	7.52	12.50	12.54	55.54
Bank overdraft	0	0.25	0	0	0	2.15	0	0	59.07
Current Maturity of long term loans	1.28	0.44	0.61	1.33	0.99	0.5	0	0	0
Amount due to group companies	8.67	3.03	10.5	3.16	1.01	9.6	20.9	13.84	43.69
Corporation tax Payable	2.22	2.22	2.22	17.21	22.76	21.86	20.69	49.03	28.49
	15.21	14.77	15.87	33.76	30.19	41.63	54.03	76.46	201.79
Add:Long term liabilities									
Longterm loan	4.96	4.44	5.87	4.77	3.77	3.27	3.12	3.12	0
Total liabilities	19.69	19.21	21.74	38.35	33.96	44.9	57.2	79.58	201.79

Sources: Setchet Wheat Farm audited reports, 1982 to 1990.

Appendix 6. Arusha: Setchet wheat farm, comparison of rainfall and productivity 1975 to 1990.

Year	Months									Total(mm)	Yield(tons/ha)
	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun		
1975	-	-	-	103.5	107.3	93.3	11.0	-	-	327.1	1.0
1976	-	21.3	16.8	128.0	52.3	24.0	63.3	29.5	-	365.3	1.16
1977	24	75.2	63.2	105.4	96.5	214.0	19.2	6.9	-	624.4	1.59
1978	-	115.5	141.3	87.7	159.6	31.9	134.1	31.9	13.4	625.0	1.47
1979	-	14.0	145.3	134.5	31.0	219.1	113.2	20.3	-	587.4	1.42
1980	-	21.7	184.5	20.0	77.9	68.9	122.2	13.4	-	507.5	1.13
1981	3.2	21.6	136.9	135.5	122.2	103.8	95.1	-	3.7	515.0	1.30
1982	6.1	205.8	157.3	94.5	96.6	29.4	2.3	11.2	-	577.7	0.78
1983	6.3	37.0	126.3	333.0	113.3	36.3	94.3	23.7	-	756.9	1.47
1984	3.2	44.7	75.2	16.4	244.5	104.3	23.5	15.9	-	530.7	2.23
1985	-	71.2	65.4	222.4	32.7	127.5	73.7	33.9	-	626.6	1.66
1986	3.3	56.2	266.0	148.6	107.9	46.1	77.4	13.4	-	760.4	1.53
1987	-	16.1	33.2	130.3	12.6	148.3	37.0	-	29.0	377.5	1.42
1988	15.9	1.1	17.7	183.7	112.3	103.7	146.6	36.2	-	622.7	2.61
1989	-	30.0	244.1	32.1	167.1	70.3	195.0	-	-	798.1	1.96
1990	-	2.4	64.9	100.9	64.0	134.8	31.0	0.5	-	402.5	1.42

Source: Setchet Farm production and Research file, no. NAFCO/SHC/RFM/57

Appendix 7. Tanzania: Official producer price for wheat grain, 1973 to 1991 (in shs)

Year	Current prices	Constant prices (1989 = 100)
1973	0.57	17.72
1974	0.77	19.47
1975	1.00	21.80
1976	1.20	23.95
1977	1.25	22.36
1978	1.25	19.27
1979	1.35	16.30
1980	1.65	15.80
1981	2.20	17.82
1982	2.50	15.10
1983	3.00	14.19
1984	4.50	15.29
1985	6.00	15.89
1986	7.20	14.40
1987	9.00	13.54
1988	10.35	12.37
1989	13.00	13.00
1990	32.00	27.12
1991*	38.40	27.58

Sources: MDB 1989.
* =Indicative price.

Appendix 8: Arusha: Financial analysis for Setchet wheat farm at 1.8 tons/ha and income tax rate of 45% of gross profit (in million shs)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-99
BENEFITS																	
Wheat Sales	0	1.47	2.61	4.94	7.57	10.38	10.57	10.43	10.11	20.65	51.52	42.13	63.83	93.44	126.7	17.42	332
Other Income	0	0.1	1.25	0.85	0.34	0.16	0.19	0.32	1.51	1.33	16.57	22.72	3.25	8.43	15.21	15.14	16
Loan received	2.85	6.45	0	0	0	0	0	0	0	2.15	0	0	0	0	0	0	0
Total benefits	2.85	8.02	3.89	5.79	7.91	11.04	10.76	10.81	11.62	24.13	68.09	64.45	67.08	101.92	141.91	32.86	348
COSTS																	
Capital items:																	
Investment Costs	5.15	7.0	5.31	8.16	3.43	0	0	9.7	14.16	0	0	19	26	0	0	5.73	0
Loan repayment Costs	0	0	0	0	0.22	0.22	0.22	1.23	0.44	0.61	1.33	1	1.7	1.2	1.2	1.2	0
Taxes	0	0	0	0	0	1.75	0.47	0	0	3.61	15.6	7.94	19.13	5.85	49.1	0	60
VARIABLE COSTS																	
Seeds	0	0.67	0.54	0.64	0.83	0.16	0.74	1.15	1.98	2.04	3.09	4.89	5.35	5.69	6.6	6.63	7
Insecticides/ herbicides	0	0.06	0.08	0.12	0.33	0.06	0.17	0.16	0.34	1.45	2.43	3.12	5.17	13.38	18.95	20	25
Fuel, oil and lubricants	0.16	0.36	0.86	0.95	1.23	1.63	1.75	1.85	2.37	3.0	4.25	6.41	7.23	9.59	13.51	18.89	20
Casual labour	0.05	0.12	0.17	0.25	0.27	0.23	0.29	0.37	0.43	0.49	0.57	0.65	0.8	1.02	1.52	1.68	3
Operator meals	0	0	0	0	0	0	0	0	0	0	0.29	0.22	0.15	1.08	1.83	0.11	2
Other variable expenses	0.57	0.2	0.3	0.12	0.13	0.24	0.19	0.06	0.25	0.19	0.76	0.98	1.1	1.05	2.0	2.83	3
SEMI VARIABLE COSTS																	
Repair and Maint. (Vehicles & Mach.)	0	0.24	0.43	0.59	0.63	0.67	1.45	1.36	1.34	1.32	3.62	4.86	6.31	8.82	11	13.64	15
Repair and Maint. (Build and Farm equip)	0	0	0	0.02	0.07	0.54	0.99	1.09	1.32	1.33	1.66	1.88	2.43	3.67	5.94	8.52	10
FIXED COSTS																	
Field, Workshop and Admin. Salaries	0.09	0.15	0.17	0.25	0.33	0.29	0.44	0.85	0.75	0.83	0.88	0.97	0.99	1.38	2.31	3	4
Admin. Overhead	0.33	0.36	0.44	0.54	1.4	1.05	2.75	1.75	1.91	2.97	4.78	6.78	12.39	16.82	33.03	17.2	20
Total Costs	7.35	9.16	8.1	11.54	8.83	6.89	9.56	19.62	25.19	17.86	40.52	58.59	89.65	69.42	159	100.45	172
Net benefits	(4.5)	(1.14)	(4.21)	(5.75)	(0.92)	4.15	1.2	(8.81)	(13.57)	6.27	27.57	6.26	(21.57)	32.5	(16.04)	(68.59)	76
Discount Factor at 25% interest rate	0.794	0.63	0.50	0.397	0.315	0.25	0.198	0.157	0.125	0.099	0.079	0.062	0.05	0.039	0.031	0.025	0.083
Discounted net benefits	(3.57)	(0.72)	(2.11)	(2.28)	(0.29)	1.04	0.24	(1.39)	(1.7)	0.62	2.18	0.39	(1.08)	1.27	(0.5)	(1.66)	6.0
NPV =	(2.93)																
FIRR =	22%																

Appendix 9 (Cont)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-99
BENEFITS																	
Gross benefit	2.35	3.03	3.89	5.79	7.31	11.04	10.76	10.31	11.63	24.45	63.09	64.35	67.05	101.91	141.91	32.25	243
Discount factor at 36% interest	0.794	0.63	0.5	0.39	0.31	0.25	0.19	0.15	0.12	0.09	0.079	0.06	0.05	0.039	0.031	0.025	0.023
Discounted gross benefits	3.26	5.05	1.95	2.26	2.49	2.76	2.13	1.70	1.45	2.39	5.38	4.02	3.35	3.97	4.40	0.82	215
Sum of discounted gross benefits = 67.12																	
COSTS																	
Gross cost	7.35	9.19	8.1	11.54	8.83	6.39	9.56	15.62	25.19	17.36	40.52	58.59	38.65	63.12	156	109.45	718
Discount factor at 36% interest rate	0.794	0.63	0.5	0.397	0.31	0.25	0.19	0.15	0.12	0.09	0.07	0.06	0.05	0.039	0.031	0.025	0.053
Discounted gross costs	5.84	5.77	4.05	4.56	2.78	1.72	1.83	3.03	2.15	1.77	3.20	3.63	4.43	2.71	4.90	2.51	14.0

Sum of discounted gross costs = 70.4

B/C ratio = $\frac{67.42}{70.01}$ = 0.96

Appendix 9. Arusha: Financial analysis for Setchet wheat farm at 1.5 tons/ha and income tax rate of 35% of gross profit (in million shs)

Item/Year	1978	79	80	81	82	83	84	85	86	87	88	89	90	91-95
BENEFITS														
Wheat Sales	0	1.47	3.47	4.94	7.57	10.38	10.57	13.45	18.11	20.85	31.28	42.15	63.38	95.44	126.70	17.42	233
Other Income	0	0.1	1.35	0.85	0.34	0.15	0.19	0.32	1.51	1.83	16.87	22.72	3.58	6.45	15.21	15.44	16
Loan received	5.35	6.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.15	0.00	0.00	0.00	0.00	0.00	0.00	9
Total benefit	5.35	8.52	3.39	5.79	7.91	11.34	10.76	10.21	11.62	24.13	53.09	64.85	67.08	101.92	141.91	33.36	248
COSTS																	
Capital/investment costs	5.15	7.00	5.31	8.15	3.49	0.00	0.00	9.70	14.16	0.00	19.00	26.00	0.00	0.00	5.78	0.00	0
Loan repayment	0.00	0.00	0.00	0.00	0.22	0.22	0.22	1.23	0.44	0.61	1.33	1.90	1.70	1.20	1.20	1.50	9
Income tax	0.00	0.00	0.00	0.00	0.00	1.75	0.47	0.00	0.00	3.60	15.80	7.94	19.31	5.32	49.10	0.00	0
VARIABLE COSTS																	
Seeds	0.00	0.67	0.54	0.64	0.83	0.16	0.74	1.15	1.68	2.04	5.03	4.89	5.35	5.69	5.6	6.65	7
Agro-chemicals	0.00	0.06	0.03	0.12	0.23	0.06	0.17	0.16	0.24	1.45	5.43	5.12	5.17	13.23	12.56	20.05	25
Fuel, oil & Lubric.	0.16	0.36	0.66	0.85	1.23	1.68	1.75	1.35	2.37	3.00	4.45	6.41	7.23	9.53	13.81	18.99	20
Casual labour	0.05	0.12	0.17	0.25	0.27	0.23	0.29	0.37	0.43	0.49	0.57	0.65	0.80	1.02	1.52	1.89	3
Operators meal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.22	0.15	1.08	1.32	1.11	2
Other variable exp.	0.57	0.20	0.30	0.12	0.15	0.24	0.19	0.06	0.25	0.19	0.76	0.93	1.10	1.65	2.00	2.69	5
SEMI VARIABLE COSTS.																	
Repair and maintare-nce (vehicl.& mach.)	0.00	0.24	0.43	0.59	0.63	0.67	1.45	1.26	1.34	1.35	3.82	4.86	6.31	8.82	11.00	13.64	15
Repair& maint.- (build & equip)	0.00	0.00	0.00	0.02	0.07	0.54	0.99	1.09	1.32	1.33	1.66	1.88	2.43	3.67	5.94	8.52	10
FIXED COST																	
Field, workshop & Administr. salaries	0.09	0.15	0.17	0.25	0.33	0.29	0.44	0.85	0.75	0.83	0.88	0.37	0.39	1.33	2.91	3.00	4
Administrative-overhead	0.33	0.36	0.44	0.54	1.40	1.05	2.75	1.75	1.91	2.97	4.73	6.67	12.29	16.82	35.03	17.12	20
Total costs	7.35	9.16	8.10	11.54	8.83	6.89	9.56	19.62	25.19	17.86	40.52	58.59	88.65	69.42	158	100.45	158
Net benefits	(4.5)	(1.14)	(4.21)	(5.75)	(0.95)	4.15	1.20	(8.81)	(13.57)	6.27	27.57	6.26	(21.57)	32.59	(16.04)	(66.59)	90
Discount factor - at 26%	0.79	0.63	0.50	0.40	0.32	0.25	0.20	0.16	0.13	0.01	0.08	0.06	0.05	0.04	0.03	0.03	0.03
Discounted net-benefits	(3.57)	(0.72)	(2.11)	(2.28)	(0.29)	1.04	0.24	(1.38)	(1.7)	0.62	2.18	0.39	(1.08)	1.27	(0.50)	(1.66)	7

NPV = (1.61)
FIRR = 24%
B/C =0.98

Appendix 10. Arusha: Financial analysis for Satchet Farm, at 2.0 tons/ha and income tax rate of 35 % of gross profit (in million shs).

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-99
BENEFITS																	
Wheat Sales	0	1.47	3.64	4.94	7.57	10.83	10.57	10.49	10.11	20.85	31.32	42.12	63.33	95.14	126.79	17.42	258
Other Income	0	0.1	1.25	0.85	0.34	0.16	0.19	0.32	1.51	1.35	10.57	22.72	3.55	8.48	15.21	15.44	16
Loan received	2.85	6.15	0	0	0	0	0	0	0	5.15	0	0	0	0	0	0	
Total benefit	2.85	8.02	3.89	5.79	7.91	11.01	10.76	10.81	11.62	24.13	66.09	64.85	67.08	101.92	141.91	32.86	274
COSTS																	
Capital/Investment Costs	6.15	7.3	5.31	5.16	3.49	0	0	3.7	14.16	0	1	19	36	0	0	5.78	0
Loan repayment	0	0	0	0	0.22	0.22	0.22	1.59	0.44	0.61	1.33	1	1.7	1.5	1.2	1.2	0
Income tax	0	0	0	0	0	1.75	0.47	0	0	3.60	15.6	7.94	15.13	5.52	49.1	0	53
VARIABLE:																	
Seeds	0	0.67	0.54	0.64	0.53	0.16	0.74	1.15	1.38	2.04	3.09	4.39	5.55	5.59	6.6	6.63	7
Agrochemicals and spraying	0	0.05	0.08	0.12	0.23	0.06	0.17	0.16	0.34	1.45	2.43	3.12	5.17	13.26	18.95	20	25
Fuel, Oil and	0.16	0.56	0.66	0.85	1.25	1.68	1.75	1.35	2.37	3.0	4.35	5.41	7.23	9.59	13.81	18.39	20
Casual labour	0.05	0.12	0.17	0.27	0.23	0.22	0.29	0.37	0.43	0.49	0.57	0.65	0.8	1.02	1.52	1.52	3
Operators real	0	0	0	0	0	0	0	0	0	0	0.29	0.22	0.15	1.08	1.83	1.11	2
Other variable costs	0.57	0.2	0.3	0.12	0.13	0.24	0.19	0.06	0.25	0.19	0.76	0.98	1.1	1.35	2.0	2.68	3
SEMI VARIABLE COSTS:																	
Repair and Maint. (Vehicle & Mach.)	0	0.24	0.43	0.59	0.63	0.67	1.45	1.36	1.34	1.35	3.82	4.86	6.31	8.82	11.0	13.64	15
Repair and Maint. (Build and Equip)	0	0	0	0.02	0.07	0.54	0.99	1.09	1.32	1.33	1.66	1.88	2.43	3.67	5.94	8.52	10
FIXED COSTS																	
Field Workshop admin. salaries	0.09	0.15	0.17	0.25	0.33	0.29	0.44	0.85	0.75	0.83	0.88	0.97	0.99	1.38	2.91	3	4
Admin. Overhead	0.33	0.36	0.44	0.54	1.4	1.05	2.75	1.75	1.91	2.97	4.79	6.67	12.29	16.82	33.63	17.2	20
Total costs	7.35	9.16	8.1	11.54	8.83	6.89	9.56	19.62	25.19	17.86	40.52	58.59	98.65	69.42	158	100.45	167
Net benefit	(4.5)	(1.14)	(4.21)	(5.75)	(0.92)	4.15	1.2	(8.81)	(13.57)	6.27	27.57	6.26	(21.57)	32.5	(16.04)	(66.59)	107
Discount factor at 26% interest rate	0.794	0.63	0.5	0.397	0.315	0.25	0.198	0.157	0.125	0.099	0.079	0.062	0.05	0.039	0.031	0.025	0.083
Discounted net benefits	(3.57)	(0.72	(2.11)	(2.28)	(0.29)	1.04	0.24	(1.38)	(1.7)	0.62	2.18	0.39	(1.08)	1.27	(0.5)	(1.66)	8.83

NPV = 0.27

FIRR = 26%

Appendix 10 (Cont.)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-99
BENEFITS:																	
Gross benefits	2.35	3.02	3.88	5.79	7.31	11.74	16.76	18.51	11.62	24.15	35.39	44.35	57.35	101.31	111.31	33.53	574
Discount factor at 26% interest rate	0.794	0.63	0.5	0.397	0.315	0.25	0.198	0.157	0.125	0.099	0.079	0.062	0.05	0.039	0.031	0.025	0.198
Discounted gross benefits	2.99	3.85	1.95	2.33	2.45	2.76	3.13	2.7	1.45	3.59	2.56	4.02	2.85	3.97	4.4	0.89	97
Sum of discounted gross benefits = 60.42																	
COSTS																	
Gross costs	7.35	3.15	3.1	11.54	8.85	8.29	9.56	19.62	25.19	17.85	49.52	53.59	38.65	66.19	155	130.15	197
Discount factor at 26% interest rate	0.794	0.63	0.5	0.397	0.315	0.25	0.198	0.157	0.125	0.099	0.079	0.062	0.05	0.039	0.031	0.025	0.198
Discounted costs	5.84	5.77	4.05	4.58	3.78	1.72	1.89	3.03	3.15	1.77	3.93	3.33	4.43	2.71	4.9	3.51	19
Sum of discounted costs = 70.01																	
B/C ratio = $\frac{\text{Sum of discounted gross benefits}}{\text{Sum of discounted costs}}$ = $\frac{60.42}{70.01}$ = 0.89																	

Appendix 11. Arusha: Financial analysis for Setchet wheat farm at 5.0 ton/ha yield and income tax rate of 35% of gross profit (in million shs)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-9[illegible]
BENEFITS																	
Wheat sales	0	1.47	2.64	4.34	7.57	10.85	10.57	10.47	10.11	20.65	51.52	45.10	60.86	93.44	125.7	17.42	337
Other income	0	0.1	1.25	0.65	0.54	0.36	0.12	96.35	1.51	1.55	16.57	25.72	3.25	8.48	15.51	15.21	15
Loan received	2.95	6.45	0	0	0	0	0	0	0	5.15	0	0	0	0	0	0	0
Total benefits	2.95	8.02	3.99	5.79	7.31	11.34	10.73	10.91	11.62	21.15	68.09	64.35	67.03	101.92	141.91	32.99	[illegible]
Costs																	
Capital items:																	
Investment costs	6.15	7.0	5.31	8.16	2.49	0	0	9.7	14.16	0	0	19	26	0	0	5.78	0
Loan repayment	0	0	0	0	0.22	0.22	0.22	1.23	0.44	0.61	1.55	1	1.7	1.2	1.2	1.2	0
Taxes	0	0	0	0	1.75	0.47	0	0	0	3.80	15.0	7.94	19.13	5.82	49.1	0	103
Variable taxes																	
Seeds	0	0.67	0.54	0.24	0.33	0.16	0.74	1.15	1.38	2.04	3.09	4.39	5.35	5.59	5.6	6.65	7
Insecticides and herbicides	0	0.06	0.03	0.12	0.23	0.06	0.17	0.16	0.34	1.45	2.43	3.12	5.17	13.23	13.35	30	35
Fuel, oil and lubricants	0.16	0.36	0.66	0.65	1.33	1.65	1.75	1.25	2.37	3.0	4.35	6.41	7.23	9.59	13.31	16.39	20
Casual labour	0.05	0.12	0.17	0.25	0.27	0.23	0.29	0.37	0.43	0.49	0.57	0.65	0.8	1.02	1.52	1.68	3
Operator meal	0	0	0	0	0	0	0	0	0	0	0.23	0.22	0.15	1.05	1.83	1.11	2
Other variable costs	0.57	0.2	0.3	0.13	0.13	0.24	0.19	0.05	0.25	0.13	0.76	0.98	1.1	1.05	2	2.68	3
Semi variable costs																	
Repair and maint. (vehicle & Machinery)	0	0.24	0.43	0.59	0.63	0.67	1.45	1.36	1.34	1.35	3.62	4.88	6.31	8.92	11.0	13.84	15
Repair and maint (build & equip)	0	0	0	0.02	0.07	0.54	0.93	1.03	0.96	1.32	1.56	1.98	2.43	3.67	5.34	8.52	10
Fixed Costs																	
Field, workshop and admin. salaries	0.09	0.15	0.17	0.25	0.33	0.29	0.44	0.85	0.75	0.93	0.85	0.97	0.99	1.38	2.91	3	4
Admin. Over-heads	0.33	0.36	0.44	0.54	1.1	1.05	2.75	1.75	1.91	3.97	4.78	6.67	12.29	15.32	23.03	17.12	20
Total costs	7.35	9.16	8.1	11.54	8.63	6.89	9.56	19.62	25.19	17.86	40.52	58.59	59.65	69.42	158	100.45	212
Net benefits	(4.5)	(1.14)	(4.31)	(5.75)	(0.92)	4.15	1.2	(8.81)	(13.57)	6.27	27.57	6.26	(31.57)	32.5	(16.04)	(66.04)	191
Discount factor at 26%	0.794	0.63	0.5	0.397	0.315	0.25	0.198	0.157	0.125	0.099	0.079	0.062	0.05	0.039	0.031	0.025	0.095
Discounted benefits	(3.57)	(0.72)	(2.11)	(2.28)	(0.29)	1.04	0.24	(1.38)	(1.7)	0.62	2.18	0.39	91.08)	1.27	90.05)	(1.650	16

NPV = 6.45

FIRR = 30%

Appendix II (continued)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-92
Computation of benefit-cost ratio																	
BENEFITS																	
Gross benefits	2.55	5.02	3.89	5.76	7.31	11.04	10.76	10.31	11.82	14.15	53.09	54.35	57.09	101.32	141.91	52.96	103
Discount factor at 26% interest rate	0.79	0.63	0.5	0.397	0.315	0.25	0.198	0.157	0.125	0.099	0.079	0.063	0.05	0.039	0.031	0.025	0.198
discounted gross benefits	2.26	5.05	1.95	2.59	2.43	2.76	2.13	1.7	1.45	2.63	5.38	4.05	3.86	3.97	4.4	0.52	38
COSTS																	
Gross costs	7.35	9.16	9.1	11.54	8.39	6.69	3.56	13.62	25.19	17.35	40.52	56.53	38.56	69.42	156	100.45	197
discount factor at 26%	0.79	0.63	0.5	0.397	0.315	0.25	0.198	0.157	0.125	0.099	0.079	0.063	0.05	0.039	0.03	0.025	0.198
discounted gross cost	5.34	5.77	4.05	4.58	2.75	1.72	1.83	3.08	3.15	1.77	3.2	3.56	2.17	2.71	4.9	2.51	16

Sum of discounted gross costs = 66.77

B/C ratio = $\frac{78.42}{67.75} = 1.17$

Appendix 12 Arusha: Economic analysis of Setchet wheat farm at yield level of 1.8 tons/ha (in million shs)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-95
Revenue																	
Wheat Sales	0	1.95	3.09	7.73	8.76	10.93	13.72	14.44	14.31	22.34	56.51	46.85	63.86	93.69	141.30	42.12	332
Other income	0	0.1	1.25	0.85	0.34	0.16	0.19	0.32	1.51	1.33	16.57	22.72	3.25	3.48	15.21	15.44	16
Total benefits	0	2.05	4.34	8.58	9.1	11.09	13.91	14.76	15.82	23.67	73.13	67.37	72.09	108.17	157.11	47.36	348
COSTS																	
Capital items	6.15	10.5	11.2	13.06	17.99	0	0	20.75	18.9	0	0	0	30.32	0	0	5.75	0
Operational Costs																	
Seed	0	0.67	0.54	0.64	0.56	0.18	0.74	1.15	1.38	2.04	3.03	4.33	5.35	5.59	6.6	6.65	7
Herbicides	0	0.09	0.12	0.13	0.55	0.09	0.26	0.24	0.51	2.16	3.65	4.68	7.76	13.92	28.45	30	36
Fuel oil and lubricants	0.34	0.54	0.99	1.36	1.56	2.52	2.63	2.73	3.55	4.5	6.35	9.62	13.35	14.39	20.72	28.54	30
Casual labour	0.08	0.19	0.27	0.4	0.43	0.37	0.46	0.59	0.69	0.78	0.91	1.04	1.28	1.63	2.43	3.01	5
Operators Meal	0	0	0	0	0	0	0	0	0	0	0.29	0.22	0.15	1.08	1.66	1.11	2
Other variable Costs	0.57	0.2	0.3	0.12	0.13	0.24	0.19	0.06	0.25	0.19	0.76	0.36	1.1	1.05	2.0	2.68	3
Semi Variable Costs																	
Repair and Maint. (Vehicles)	0	0.24	0.48	0.52	0.63	0.67	1.45	1.36	1.34	1.35	3.82	4.35	6.31	8.52	11.0	13.64	15
Repair and Maint. (Building)	0	0	0	0.02	0.07	0.54	0.39	0.39	1.32	1.32	1.66	1.86	2.43	3.67	5.91	8.52	10
Spares	0	0	0.02	0.06	0.3	0.51	0.57	0.61	1.12	1.5	2.0	2.4	3.8	4.7	5.02	6.7	8
Fixed costs																	
Permanent admin. labour	0.09	0.15	0.17	0.25	0.33	0.29	0.44	0.85	0.75	0.83	0.88	0.97	0.99	1.38	2.01	2	4
Admin. Overhead	0.33	0.36	0.44	0.54	1.4	1.05	2.75	1.75	1.91	2.37	4.76	5.17	12.29	16.32	33.03	17.12	20
Total costs	7.46	13.11	14.64	17.3	24.45	6.84	10.67	31.52	32.7	18.13	28.97	38.98	83.97	80.57	121.56	129.19	142
Net Benefits	(7.46)	(11.06)	(10.3)	(8.72)	(15.35)	4.25	3.24	(16.76)	(16.88)	5.49	44.21	30.44	(11.99)	27.6	35.55	(90.83)	206
Discount Factor at 14 percent interest rate	0.877	0.769	0.675	0.592	0.519	0.456	0.4	0.351	0.308	0.27	0.237	0.208	0.182	0.16	0.14	0.123	0.508
Discounted benefits (Net)	(6.54)	(8.51)	(6.95)	(5.16)	(7.97)	1.94	1.3	(5.88)	(5.20)	1.48	10.48	6.33	(2.16)	4.42	4.98	(9.72	64

Sum of discounted net benefit at 14 percent rate (NPV) = 36.64
Economic Internal rate of return (EIRR) = 23%

Appendix 13 (continue)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Revenue																	
Gross benefits	0	2.05	4.34	8.53	9.1	11.09	13.91	14.76	15.32	23.67	73.18	69.37	72.33	108.17	157.11	47.36	243
Discounting factor at 14 interest rate	0.877	0.769	0.675	0.592	0.519	0.456	0.400	0.351	0.308	0.27	0.237	0.208	0.182	0.16	0.14	0.123	0.108
Discounted gross benefits	0	1.58	2.93	5.08	4.72	5.06	5.13	4.87	4.87	6.39	17.34	14.43	13.12	17.31	22	5.89	181
Sum of discounted gross benefits = 282.46																	
Costs																	
Gross costs	7.46	13.11	14.64	17.3	24.45	6.34	10.67	31.52	22.7	18.16	33.97	38.93	83.27	80.57	121.56	122.49	142
Discounting factor at 14	0.877	0.769	0.675	0.59	0.519	0.456	0.40	0.351	0.308	0.27	0.237	0.208	0.182	0.16	0.14	0.123	0.608
Discounted gross costs	6.54	10.08	9.88	10.21	12.69	3.12	4.27	11.06	10.07	4.91	8.87	8.1	15.28	12.89	17.02	15.80	86

Sum of discounted gross costs = 244.82

B/C ratio = $\frac{282.46}{244.82}$ = 1.15

Appendix 18. Arusha: Economic analysis for Selchet wheat farm at yield level of 3.0 tons/ha (in million shs)

Item/Year	1975	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91-93
Benefits																	
Wheat Sales	0	1.35	3.03	7.73	8.76	10.33	13.72	14.11	14.31	22.34	36.61	46.65	69.83	99.69	141.9	32.42	387
Other Income	0	0.1	1.25	0.55	0.35	0.15	0.19	0.32	1.51	1.33	16.57	25.72	3.65	5.48	15.21	15.44	16
Total benefits	0	3.05	4.34	8.59	9.1	11.03	13.91	14.75	15.82	69.37	73.19	69.37	72.98	102.17	157.11	47.86	403
Costs																	
Investment costs	8.15	10.5	11.2	13.06	17.99	0	0	22.75	13.90	0	0	0	30.32	0	0	5.79	0
Operational Costs																	
Seeds	0	0.67	0.54	0.64	0.85	0.16	0.74	1.15	1.36	1.84	3.02	4.29	5.35	5.69	6.6	6.63	7.6
Herbicides	0	0.09	0.12	0.18	0.35	0.09	0.26	0.24	0.51	2.16	3.65	4.58	7.76	19.32	28.43	30.0	35.0
Fuel, oil and lubricants	0.24	0.54	0.99	1.28	1.35	2.52	2.65	2.79	3.56	4.5	6.38	9.62	10.35	14.39	20.72	20.0	28.0
Casual labour	0.09	0.19	0.27	0.4	0.43	0.37	0.46	0.59	0.69	0.78	0.91	1.04	1.28	1.63	2.43	3.1	5.0
Operators Meal	0	0	0	0	0	0	0	0	0	0	0.29	0.32	0.15	1.08	1.83	1.11	2.0
Other Variable Expenses	0.57	0.2	0.3	0.15	0.13	24	0.19	0.36	0.25	0.19	0.76	0.98	1.1	1.05	2.0	2.68	3.0
Semi Variable costs																	
Repair and Maint. (Vehicles and Mach.)	0	0.24	0.43	0.59	0.63	0.67	1.45	1.36	1.34	1.35	3.32	4.86	6.31	6.82	11.0	13.0	15.0
Repair and Maint (Build & Equip)	0	0	0	0.02	0.07	0.54	0.99	1.09	1.32	1.33	1.66	1.36	2.43	3.67	5.94	6.52	10.0
Spares	0	0	0.02	0.06	0.3	0.51	0.57	0.61	1.12	1.5	2.0	2.4	3.8	4.7	5.02	6.7	8.0
Fixed costs																	
Permanent Admin. Labour	0.09	0.15	0.17	0.25	0.33	0.29	0.44	0.85	0.75	0.83	0.88	0.97	0.99	1.38	2.91	3	4
Admin. Over heads	0.33	0.36	0.44	0.54	1.4	1.05	2.75	1.75	1.91	2.97	4.76	6.17	12.29	16.32	33.03	17.12	20
Total Costs	7.46	13.11	14.64	17.3	24.45	6.84	10.67	31.52	32.7	18.18	28.97	38.93	83.97	80.57	121.56	123.49	142
Net benefits	(7.46)	(11.06)	(10.3)	(8.72)	(15.35)	4.25	3.24	(16.76)	(16.88)	5.49	44.21	30.44	(11.89)	27.6	35.55	(80.63)	106
Discount factor at 14%	0.877	0.769	0.675	0.592	0.519	0.456	0.4	0.351	0.308	0.27	0.237	0.208	0.182	0.16	0.14	0.123	0.606
Discounted benefits	(6.54)	(8.51)	(6.95)	(5.16)	(7/97)	1.94	1.3	(5.88)	(5.20)	1.48	10.48	6.33	(2.16)	4.42	4.98	(9.92)	64

NPV = 151.49
EIRR = 28%

Appendix 13 (Continued)

Item\Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991-99
Benefit-Cost ratio Computation																	
Benefit																	
Gross benefits	0	2.05	4.34	8.56	9.1	11.09	13.91	14.76	15.82	23.67	73.18	63.51	72.09	106.17	167.11	17.96	350
Discount factor at 14% interest rate	0.877	0.769	0.675	0.592	0.519	0.456	.400	0.351	0.308	0.27	0.237	0.208	0.182	0.16	0.14	0.12	0.833
Discounted gross benefit	0	1.58	2.93	5.03	4.72	5.06	5.56	5.18	4.87	6.39	17.34	14.18	13.12	17.01	23.0	2.39	245
Sum of discounted benefit = 376.46																	
Costs																	
Gross costs	7.46	13.11	14.64	17.0	24.15	6.81	10.87	31.52	32.7	13.19	28.97	39.28	50.97	90.37	121.5	120.1	140
Discount factor at 14%	0.877	0.769	0.67	0.59	0.519	0.456	0.40	0.351	0.30	0.27	0.237	0.208	0.182	0.16	0.14	0.12	0.833
Discounted gross costs	6.54	10.08	11.33	10.24	12.69	3.12	4.37	11.06	10.07	4.31	6.87	8.18	15.69	12.69	17.01	15.61	98
Sum of discounted costs = 240.17																	
B/C ratio = $\frac{376.46}{240.17}$ = 1.56																	

Appendix 14. Arusha: Setchet wheat farm, adjustment of items from financial price to economic values (in million shs)

Item	Foreign exchange converted to local cost and multiplied at a factor of 50 percent	Local costs	Total costs
Land Development	5.10 x 1.50 = 7.65	18.90	26.55
Farm Machinery and implements	22.00 x 1.50 = 33.00	0.00	33.00
Motor vehicles	20.00 x 1.50 = 30.00	0.00	30.00
Tools and Equipments	5.70 x 1.50 = 8.55	4.30	12.85
Water Scheme	0.00 x 1.50 = 0.00	4.00	4.00
Building and Housing	15.75 x 1.50 = 11.75	14.75	26.50
Training	5.00 x 1.50 = 7.50	0.00	7.50
Technical assistance	0.00 x 1.50 = 0.00	6.00	6.00
Total	59.30 x 1.50 = 89.55	44.95	134.60

Source: Computed from table 1-5.