Operational Research Applications in Development Management

Case Exercise Book

by Mike Luck and Geoff Walsham

Commonwealth Secretariat

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Management Development Programme

Commonwealth Secretariat
Marlborough House
Pall Mall
London SW1Y 5HX

Telephone: 01-839 3411
Telex: 27678
Cables: COMSECGEN

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CONTENTS

PREFACE

Adopting management techniques such as operations research and management information systems usually involves radical changes in current practices, skills and attitudes. As with other areas of management where organisational change has far reaching consequences, the decision makers can be considerably assisted by having access to the distilled experience of others and the case study has an important role in this.

Although the effective use of these techniques is a major factor in the success of development projects, there is very little training material available related to the needs of the development manager. The Management Development Programme is anxious to see this gap filled. As one of its activities in this direction, this collection of cases of the implementation of operation research approaches in developing countries is offered as a contribution to assist trainers in demonstrating the considerable benefits to be obtained from the management science approach. The authors have had in mind the decision makers, managers and senior government officials with large project responsibilities, and the cases have been prepared in the context of the unique requirements of the development management.

Readers' views on the cases, their relevance to actual problems and ways in which they could be made more closely adapted to the needs of development managers would be most welcome.

The Commonwealth Secretariat is grateful to Mike Luck and Geoff Walsham for preparing the cases and for their permission to publish them. The authors have also prepared a teaching manual for these cases which will be available on request.

We are also grateful to the Canadian International Development Agency (CIDA) for part of financial assistance for this project.

The Management Development Programme is working very closely with the regional and national institutions for increasing institutional capacity in the area of teaching materials development which has relevance to managerial issues in government and is based as local experiences. The programme has several projects in progress related to case development in a number of Commonwealth countries. This case book was prepared with the objective of helping faculty members in public administration and management institutions in introducing modern techniques in development management in a simplified approach and is based on actual experiences in developing countries.

Mohan Kaul
Director
Management Development Programme

Human Resource & Development Group
Commonwealth Secretariat
Marlborough House
Pall Mall
London SW1Y 5HX

Tel: 01-839 3411
Telex: 27678
Cable: COMSECGEN LONDON SW1

AUTHORS

Geoff Walsham is a lecturer in operational research at Cambridge University, UK. He graduated from Oxford University in 1966 and, after spending a year teaching in the Philippines, he completed a masters degree at Warwick University and then worked as an OR analyst in British Petroleum. He went to Kenya in early 1972 as a lecturer in the Faculty of Commerce at the University of Nairobi and worked there until July 1975. During the last ten years he has carried out a number of research and consultancy projects in the area of information technology and telecommunications in both developed and developing countries. He has also taken a particular interest in the design of relevant teaching programmes and the provision of teaching materials for management science in developing countries.

Mike Luck is a Senior Lecturer in Public Sector Management in Aston University, Birmingham, England. He has a degree in Mathematics and Philosophy from Cambridge University. He first worked in Operational Research in the oil industry, then gained an M.Sc in Operational Research at Case Institute of Technology, Cleveland, U.S.A. He returned to the U.K. and joined the Institute for Operational Research which was, in the mid 1960's, pioneering Operational Research applications in central and local government. From May 1972 to December 1975 he worked for World Health Organisation (W.H.O.) at the Health Service Research Centre, Surabaya, Indonesia. Subsequently he has carried out a number of assignments for W.H.O. concerned with managing Primary Health Care (P.H.C.). At Aston University his teaching and research is currently focussed on micro-computers and health service management.

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1. INTRODUCTION

1.1 O.R. AND DEVELOPMENT

The aim of these case exercises is to give the student practice in carrying out some aspects of an Operational Research (O.R.) project in a developing country. We see O.R. as:

a broad multi-disciplinary problem solving activity which is based on the scientific approach.

The reader is referred to a set of readings on O.R. in developing countries*, which demonstrates a full range of O.R. projects from broad systems approaches to complex mathematical models. However, these readings do not describe many important aspects of an O.R. project. They all give a view of the project written at the end. They do not give any idea of the process of search for relevant information and the continuous interaction with the client, which are important parts of O.R.

These exercises are not a substitute for real project experience but they are intended to give the student some experience in aspects of an O.R. project including:

searching for information
defining the problem and terms of reference
interacting with the client(s)
analysing the organisational context of the problem
planning for implementation

We believe that there are some special features of doing O.R. in developing countries which need to be considered. Most O.R. teaching has been carried out in western countries on western problems. There are basic assumptions built into the teaching of O.R. which do not necessarily hold in developing countries. These case exercises are intended to represent at least some of the differences so that the student is more alert for them when he/she starts to do real O.R. Particular features of development which are relevant for O.R. include:

dealing with multiple objectives, for example balancing effectiveness and efficiency with objectives such as the alleviation of poverty,

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* Luck G.M. and Walsham G. (Eds) (1982), Selected readings in operational research for developing countries, Birmingham, The Operational Research Society

lack of reliable infrastructure, such as transport and communications, which must be taken into account when planning new systems,

lack of specialised management training, in areas such as computing and O.R., which must be taken into account when the O.R. person communicates with managers,

cultural attitudes to decision making and authority, which mean that managers are more accustomed to operate according to custom and practice and do not accept the rational framework put forward by O.R. Management will sometimes see O.R. as a threat, undermining their authority.

1.2 AIMS OF CASE EXERCISES

Case Exercises are slightly simplified descriptions of real problem situations used as simulated O.R. projects. Two of the exercises, Cases 1 and 2, are worked in stages which approximate to those in a real project. The teacher may represent the client and thus give practice in interaction, for example in agreeing terms of reference and revising them as the project develops, and presenting information in meetings and reports. The exercises may be used to give practice in working in groups which represents the teamwork which is a common feature of O.R.

None of the exercises has a single right answer. A number of approaches are possible. Usually quite a lot of progress can be made with basic logic before mathematical models need to be used. We feel that this is an important lesson. A Teacher's Guide will be made available to teachers on request to the Commonwealth Secretariat.

Teachers can expand the exercises and use them as the basis for seminar discussion. Cases can be adapted to a particular country. The development aspects of the problem can be studied in more depth with guidance from the teacher.

1.3 SKILLS REQUIRED FOR O.R.

Successful O.R. work requires a broad approach using a range of qualitative and quantitative skills. The case exercises will help the student to practise these skills which include the following:

Analysis of the system establishes the formal organisational relationships and the informal relationships between people concerned with the problem.

Analysis of the operations carried out by the organisation such as production or information processing requires detailed flow-charting, preliminary estimation of production rates, identification of bottlenecks, etc.

Analysis of the factors in the environment which may affect the system requires basic knowledge of political systems, competitive features, labour markets and customers.

Basic statistical skills are needed to make a preliminary analysis of the available information. This will include tabulating data, carrying out simple statistical tests and graphing.

Communication skills are required to present proposals to clients. These skills include giving oral presentations and writing reports, taking account of the clients' knowledge and motivation.

Knowledge of behavioural aspects of organisations is needed in preparing proposals for implementation of change.

The case exercises can all be tackled using the above skills and elementary mathematical techniques. They are therefore suitable for students on introductory courses. In addition, the analysis of several of the cases can be extended using computer-approaches, such as spreadsheets on microcomputers, and more advanced mathematical methods such as simulation.

2. HOW TO TACKLE THE CASE EXERCISES

Some suggestions are made here which may be useful as a starting point for the beginner.

Questions to try to answer in the early problem structuring include:

Who is (are) the clients(s)? Many O.R. textbooks are written as if there is a single client who initiates the project and who can unilaterally accept the recommendations of the O.R. team and implement them. In the majority of projects, especially in developing countries, the situation is more complex. There may be several departments in the organisation which are involved in the study, all of whom have to agree before anything can be done. Also, the majority of development projects involve government departments and parastatal organisations. The student should identify these various interest groups and their objectives.

What does the client want from O.R.? Often the client(s) may know nothing about O.R. or have quite unrealistic expectations. The O.R. team will need to spend quite a lot of time throughout the project in exploratory and educational activities to produce a good mutual understanding. In the case exercises, much can be obtained by reading the text, but some imagination may be needed to fill out the picture. The teacher will probably be prepared to give some guidance on the assumptions which can be made.

What is the system of activities in the organisation? The organisation exists to produce products or provide services. A basic understanding of the system of activities is needed and this is achieved in real projects through interviews with persons in the system, through direct observation, and through study of statistics. In the case exercises this has to be done by careful study of the text. Diagrams are essential as a way of representing the system of activities.

What are factors and changes in the environment which affect the organisation, in particular reactions to changes proposed by the O.R. team? In developing countries there are usually rapid and unpredictable changes in government policies, and in terms of trade, thus affecting prices and availability of raw materials. The student should propose solutions which are 'robust' in the face of such changes. These are preferred to optimal solutions which are dependent upon narrow sets of assumptions.

All the cases provide the opportunity for working in groups which represents the common practice of team work in O.R. To work effectively in a group it is necessary to have adequate space for meetings. Visual aids such as a blackboard and flipcharts should be used for brainstorming and for communication within the group. Efficient group organisation is important including a clear allocation of tasks between group members and well-structured meetings. This will encourage participation of all the members and effective use of their time.

An essential part of all projects is the identification of benefits, costs and constraints. In development projects there may be benefits such as equitable distribution of income in the community which are important but difficult to quantify. Benefits may affect different groups and this must be recognised explicitly. When identifying financial costs, foreign exchange costs must be treated differently to internal costs. Important constraints should be identified such as shortage of labour. The student will often find it useful to make rough estimates of benefits and costs at an early stage. This may eliminate certain possible solutions and indicate where project effort needs to be concentrated.

The student should expect to recycle and rework the analysis several times adding more information and trying out reformulations of the approach. O.R. projects seldom if ever proceed directly to a solution without several deviations and revisions. Exposing your work to other students is a good step and of mutual benefit. In order to be able to do this the student needs to plan the time available as set by the teacher. The student should work backwards from the time of submission of the report to allow time for revision, redrafting and discussion. Most O.R. projects are under time pressure and decisions have to be made which balance the desire to carry out detailed work with the pressure for quick results.

All the cases require at least one report to be written for the client. It is important to write the report for the 'client' not for the teacher. In a particular case it may be apparent that the client knows little about O.R. so that the report should be written at a level suitable for someone without such knowledge.

CASE 1

CHAKULA ESTATE

1. BACKGROUND AND BRIEFING

1.1 Introduction
1.2 Preliminary meeting
1.3 Discussion with members of the cooperative
1.4 Horticultural policy
1.5 Second visit to Chakula
1.6 Briefing 1

2. STRUCTURING THE PROBLEM

2.1 Collecting information
2.2 The crops
2.3 Market opportunities
2.4 Resources and constraints
2.5 Other issues
2.6 Briefing 2

3. PRELIMINARY PROPOSALS

3.1 A possible allocation
3.2 Data
3.3 Briefing 3

4. REPORT WRITING

4.1 Briefing 4

THE CHAKULA ESTATE IN KENYA

1. BACKGROUND AND BRIEFING

1.1 INTRODUCTION

Walimu Consultants, management consultants based in Nairobi, Kenya have been asked to carry out a study for the Wageni Agricultural Cooperative into the potential for horticultural development of the Chakula Estate.

1.2 PRELIMINARY MEETING

Your boss at Walimu Consultants, Mr. Nchinda, has attended a meeting at the Wageni management office. Those present were:

Mr. Kusoni	Chairman of the Cooperative
Mr. Pederson	General Manager of the Cooperative
Mr. Mtali	Horticultural Development Authority
Mr. Nchinda	Walimu Consultants

The Chakula Estate has been proposed as one of the horticultural centres to be developed in Kenya. The Estate is to remain in the hands of the owners, the Wageni Cooperative, which must develop the area for the benefit of its members. The Government will only provide extension services and financial assistance if it is convinced that the Cooperative has an economically viable development plan for the Estate. The Government has threatened to take over the Estate if the Cooperative cannot demonstrate that it can develop the Estate properly. The Cooperative, advised by the Horticultural Development Authority, has requested Walimu Consultants to provide them with decision-making aids for the organisation and development of the Estate.

Walimu Consultants has been asked to concentrate on the potential for fruit and vegetable farming. Coffee is also included in the study because of the very good soil and climatic conditions for coffee growing prevailing in the Ndovu area, and because the quality of Kenya coffee has a high reputation on world markets.

Various studies of the Estate have been carried out to appraise the technical and agronomic feasibility of the Estate as a horticultural production farm. Walimu Consultants is required therefore to concentrate on alternative management approaches using the available data.

1.3 DISCUSSION WITH MEMBERS OF THE COOPERATIVE

After the meeting Mr. Nchinda stayed on and had an informal discussion with some members of the Management Committee of the Cooperative and friends. It is apparent that several of the members of the Cooperative are content with the small income they get from renting parts of the existing sisal estate to the Wabenzi Fibre Company, and from the sale of coffee from the 75 hectares coffee plantation. However, other members of the Cooperative are aware of the obvious benefits they are foregoing by not developing the area. It is realised, for example, that considerable farm potential is being exhausted by overgrazing, soil erosion, old 'sucker' sisal, and poor subsistence cultivation. Cooperative members are also becoming aware that by renting big parts of the Estate to outside parties, like the Wabenzi Fibre Company, they have less and less part to play in what is their own property, and are reduced to the role of mere farm labourers.

For a big commercial farm one objective to be met can be taken to be the financial returns from the farm. However, in the case of the Wageni Cooperative, various objectives have been identified. One of these is to get as much income from the resources as possible. However, in the pursuit of maximum income, consideration is given by Cooperative members to the need for early cash incomes. It has been observed that earnings in the earlier years of the development period are preferred to earnings in later years, even if the latter are higher than the former (and allowing for the time value of money). The reason given was that the farm needs 'quick' money to pay for the heavy financial commitments in early years and that management must prove that the investment is profitable early enough to ensure cooperation between them and the owners.

The risk of different farm programs also affects the farmers' choice of the operating program. Often investment programs which promise the highest expected incomes are the most risky. It is up to the farmers, therefore, given their degree of risk aversion, to opt for either the high expected income - high risk alternative or the low income - low risk alternative. One must not get the impression, however, that the farmers always aim at minimising risk. This is only true for those who are risk-averse; the 'gambling-type' of people will go in for the risky enterprises which promise high returns.

1.4 HORTICULTURAL POLICY

Mr. Nchinda returned via the regional town, Mboyu, and visited the office of the Horticultural Development Authority for a discussion with Mr. Mtali. He provided some useful information which is summarised below.

For most developing countries the agricultural sector is still the most important contributor to Gross Domestic Product (GDP) and Kenya is no exception. Most of the growth in the agricultural sector has been realised on the plantation farms producing coffee, tea, pyrethrum, and in the livestock industry. However, since the mid-1960s, attention has also been directed towards small-scale farming, particularly in horticultural production. The Kenya Government took steps to encourage the growing of fruits and vegetable crops by individual small-holders by establishing, in 1966, a Horticultural Crops Development Authority (HCDA) which was empowered to control the purchase, transportation and marketing of horticultural crops. Furthermore, in 1970, 'The Horticultural Working Party' was set up to study horticultural production possibilities in Kenya. The Working Party made various recommendations, ranging from marketing of the produce, training of extension workers, functions of the HCDA, research requirements, development of horticultural production centres, to problems relating to a number of specific crops.

The Government has attempted to implement some of the recommendations made by the Working Party in the following ways:

1. Various areas of the country have been ear-marked for development into horticultural production centres.

2. Packing and grading stations have been set up in various areas, where producers can have their produce graded and packed ready for distribution. The HCDA provide lorries to transport the produce from the packing stations to urban centres.

3. Plans have been made for the training of horticultural instructors and supervisors at various Kenyan colleges and in Europe.

It would appear that for the foreseeable future emphasis will still be on the small-holder in agriculture. Two aspects of small-holder farming stand out. First, the majority of small-holders grow some vegetables and fruits for their home consumption, and do not enter the commercial sector; and, second, some small-holders, near urban centres, or in the areas where grading and packing stations have been set up, grow horticultural produce for sale.

Establishment of large scale estates has not been an important method of horticultural production for two reasons. Firstly, it has been Government policy to encourage small-holder farmers so as to provide them with employment

and some cash income. Secondly, for an estate of say 500 hectares, given the current level of horticultural production from small-holders, the fresh market demand is not yet big enough to absorb all the produce from such an estate. The only outlet for the excess supply would be the processing, canning and dehydrating industries, but the prices offered by these industries are often too low to cover the operating costs of a big estate.

However, there are disadvantages associated with small-scale production. For example, it is quite difficult to offer extension services to small-holders because they are spread rather widely. For this reason too there is a problem of setting up grading and packing stations where the farmers can dispose of their produce. The small farmer may also be an inefficient producer since he will often not have the know-how nor the funds to improve his production methods. Further, small farmers, like small businesses, do not have easy access to loan finance, and where they have, they tend to think of the loans, especially from the Government, as gifts or free money and they are reluctant to pay back the loan.

It is not easy to determine the expectations of a Cooperative Society. Past experience of horticultural production cooperative movements in Kenya has not been encouraging. One reason for the poor performance of horticultural cooperatives has been failure to define their purpose. A survey was carried out in one of these cooperatives asking what purpose the cooperative society served. Most of the respondents gave answers like 'to help the farmers to market their produce more cheaply' and 'to give loans to farmers'. Emphasis was placed on material or financial benefits.

1.5 SECOND VISIT TO CHAKULA

The Walimu Consultants' team returned to the Estate for a two day visit to obtain basic information about the Estate.

Mr. Kusoni gave the team an introductory talk. The Cooperative was formed in the 1960s from ex-employees of the white farmer who owned the Estate before he sold it to the Cooperative when he left the country. The Estate is now settled by about 2,000 families who are members of the Cooperative, plus a number of 'squatters' from the surrounding district. Much of the Estate is used for grazing the large number of cows and goats of the settlers. A small portion of the land is under subsistence crops, mainly beans and maize. A section is under sisal which has been on the land for about the last thirty years. Only about 75 hectares is under coffee. The Estate is located 80km from Nairobi at an altitude of about 5,000 feet above sea-level. The total size is about 11,200 hectares.

Mr. Pedersen, the manager, then took the team on a tour of the estate by Landrover and on foot. He explained that there are basically two types of soil, high potential and low potential. Only the high potential soil could, with improved irrigation, support the profitable horticultural crops, and coffee and sisal. The high potential soil is estimated to be only 1,000 hectares. Currently, only 75 hectares of this are used for coffee, 220 for grazing and about 700 for the old low-yielding sisal.

The team then saw the much larger area of low potential, black cotton soil. About 100 hectares are planted with subsistence crops, over 4,000 for grazing and about 500 for the old sisal. The remaining 4,000 hectares are farmed individually by Cooperative members. About 1,500 hectares are not currently used at all.

On return to Mr. Pedersen's office, the potential for development of the Estate was discussed. The 1,000 hectares of high potential soil could be used, with improved irrigation, to grow coffee, fruits such as avocado, oranges and passion fruit, and vegetables such as French beans, onions, aubergines, chillies and capsicum. Of the low potential soil, Mr. Pedersen considered about 1,000 hectares could be used to grow sisal, maize and seed beans. The low potential area could also be used for grazing goats, sheep and cattle. But for the cattle to thrive, there would need to be improved irrigation, and planting with Lucerne leys for high quality fodder.

Those crops recommended for the black cotton soil, if they were to be grown on the more fertile soil would not increase their yields sufficiently to be competitive. Moreover, those crops recommended for the better quality soil would not grow well on the black cotton soil because they are sensitive to soil conditions. Thus there is no direct substitutability between crops on the high and those on the low potential soil.

1.6 BRIEFING 1

Mr. Nchinda called in the team and asked them to prepare proposals for continuation of the study. He asked them to pay attention to the attitudes to future development of the Estate by the various interested parties eg. different groups in the Wageni Cooperative.

Outline notes should be prepared for a meeting in his office. He plans to use these notes and the discussion to prepare a formal proposal to put to the Cooperative.

2. STRUCTURING THE PROBLEM

2.1 COLLECTING INFORMATION

The Walimu team now carried out a series of meetings over two weeks to collect more detailed information about the potentialities for the Estate.

2.2 THE CROPS

The team met an Agricultural Extension Officer from the Ministry of Agriculture in Mboyu. He supplied the following information.

(a) COFFEE

The Ndovu area is noted for high coffee yields, ranging from 2 to 5 tons of coffee per hectare. Maturity yield of the plant can be expected in the third year after planting, and the plant is likely to continue producing coffee berries for about 10 to 15 years. Like most of the produce on the Estate, coffee is produced for export and its profitability is subject to world market prices.

(b) ORANGES

Oranges and avocadoes have similar requirements with respect to soil and weather conditions. Both have been grown successfully in Ndovu. The two begin yielding in the 4th or 5th year after planting but do not reach full maturity until the 8th year. It is often necessary in the first five years to plant a cover crop like maize so as to protect the soil against erosion and to prevent evaporation of irrigated water during the dry season.

Avocadoes have a very profitable export market in Europe because of their high quality, but oranges are grown for local consumption because their quality is not high enough to be competitive in the European market with those produced in the Mediterranean regions and South Africa. The local market for fresh fruit in Kenya is limited, consisting of the upper income brackets living in Nairobi, Mombasa and other major urban centres. The processing and canning industry is expanding but the prices offered by the canners to the farmers do not compare favourably with the 'fresh fruit' market prices. For example, up to Shs.4/- per kg. is currently paid for first class fresh oranges, whereas that offered by the canners is only 50 cents per kg. (1 Kenyan shilling = 100 cents; 1 UK £ = 16 Kenyan shillings (approx.)).

(c) PASSION FRUIT

Passion fruit is a more risky crop than the other fruit mentioned because little is known about its yield and general soil and weather requirements. Passion fruit plantations in the Ndovu area are known to yield from 24 to 32 tons of fresh fruit per hectare. Cultivation is intensive and the plant needs frequent irrigation. The productive life cycle for the plant is about 3½years, so that at least every 4 years a new crop has to be planted.

(d) VEGETABLE CROPS

Some of the crops most suited for the Estate include French beans, aubergines, capsicum, chillies and seed-beans. These can grow all the year round using irrigation. However, during the period from November to April, sufficient horticultural products are produced by small-holders for the local market. Thus it may be wise for the Estate to intensify its production during the 'off-season' or dry period using irrigation. Otherwise an excess supply may depress prices or stay unsold during the normal harvest season. It is worth noting that irrigated crops are usually higher quality products than rain-fed crops.

The majority of the vegetable crops, i.e. French beans, aubergines, capsicum, and chillies, would be produced for export as well as for the domestic market. The exportable crops would have to be produced in the European winter months, when the European importing countries are not able to produce their own. They would therefore be produced in the months of October to March, since during the summer months the EEC countries put a ban on the importation of those crops they can produce which are French beans, aubergines, and capsicums. Those not produced in Europe can be grown and exported any time of the year.

In horticultural production some kind of crop rotation is necessary to preserve soil fertility, and the soil should normally be given time to rest. There is also the need to control various kinds of weeds, such as couch grass. It is thought that a maize crop grown after other crops helps to control some of these weeds.

(e) SISAL

The sisal occupying the Estate was planted over a period of 40 years, the most recent plantings being six to ten years old. The older plantings were made in single lines but sucker and weed growth have been unchecked in recent years, increasing the problem of uprooting and clearing. Fibre produced from this sisal is of lower quality than that from new plantations, and the yield is only about 40% of a well kept and young plantation. It would be convenient if the sisal could be 'slaughter harvested' before uprooting as this would lessen the cost of clearing.

The presence of sisal on the Estate has prevented over-settlement of the area; this has been an advantage in that it is occupying the best land for development. Clearance of the sisal should, therefore, be phased such that only the amount of land to be cultivated and put under crop should be cleared each year.

2.3 MARKET OPPORTUNITIES

Information on marketing opportunities for horticultural products was collected from Walimu's marketing expert and from an official in the Kenya Export Promotion Council.

Availability of ready markets for the produce is one of the major determinants of horticultural production. Unlike other agricultural products and manufactured goods, fresh horticultural produce needs to be disposed of almost as soon as it is harvested. Otherwise it will deteriorate and lose quality. Fresh produce cannot be stored for a long period of time, and storage of fruits and vegetables for any length of time is quite costly because storage facilities have to be set up. One factor that directly affects Kenya's horticultural market opportunities is that some of the countries competing for the European market have refrigerated ships to transport their produce, which Kenya does not have available at the present time.

In the analysis of the market situation a distinction has to be made between:-

I rural market
II urban mass market
III high income city market
IV export market
  (i) fresh
  (ii) dehydrated
  (iii) processed

The rural market as an outlet for horticultural production is the least developed, followed by the inadequately organised urban mass market. The high income city market caters for limited numbers of the high income class with the ability to demand and pay for better quality produce. The longer-term market prospects within Kenya for locally produced horticultural produce appear favourable. However, there are a number of marketing limitations and economic factors which have a restrictive influence on the expansion of the local horticultural industry. The most obvious of these factors include:

(i) Lack of an efficient marketing system, especially at wholesale level, which would be capable of handling increased quantities efficiently.

(ii) Lack of small-holder production and marketing organisations capable of stimulating planned horticultural produce marketing.

(iii) Lack of production planning to secure regular supply of commodities in the desired quantities, which to a large extent is due to lack of reliable production and marketing statistics and information.

The Kenya export market for fresh fruit and vegetables, dehydrated products, and processed produce has been growing over the last years. The EEC absorbs the vast majority of Kenya's horticultural exports. Air transportation has enabled exporters to have their produce available to the consumer in a sound, attractive and fresh condition - the general criteria of quality for horticultural produce. The most important reason for Kenya to develop her export market to Europe and to regard the long-term prospects as favourable is, besides the seasonal productive advantages, the trend for horticultural production to move out of Central and Northern Europe.

The export of fresh horticulture from Kenya has in the past depended almost entirely on air cargo space availability. The rate of increase of exports by air, besides satisfactory market demand, is likely in future to depend on:

(i) the growth of passenger air services through Nairobi;

(ii) freight rates; and

(iii) interest of air charter operators to increase the available services and their dependability.

As in the domestic market, the export marketing information system is inadequate, and a lot more could be done to promote Kenya's horticultural exports. Realising this problem, the Chairman of the Kenya Export Promotion Council had this to say:

> "... It (The Kenya Export Promotion Council) has, ten years after its inception, failed to become equipped with a satisfactory complement of trained and experienced staff in specialist fields of marketing, information and trade fair operation ... As a result it has rarely been in a position to give the optimum service to Kenya's exporters, Commercial Attaches and potential customers requiring guidance and information, which is one of its primary essential functions."

The HCDA and/or The Export Promotion Council could, among other things, put in a telex system to channel marketing information from Europe and other importing countries to Kenyan producers and marketing organisations.

2.4 RESOURCES AND CONSTRAINTS

Discussions were held with members of the Cooperative management committee, with the general manager, and with the manager of the Kenya Commercial Bank in Mboyu.

(a) LAND

The Estate consists of high potential land and low quality soil area. These are broad divisions. There are many subdivisions within each of these land categories. Strictly, land should be divided up according to soils, topography, improvements existing on the land, and according to the different seasons in which it is available for use. For example, about 400 hectares of the Estate consists of steep slopes suitable for perennial crops like coffee, oranges and avocadoes, which help to prevent soil erosion. If this area were planted with vegetable crops the soil would be washed away during the heavy rains. Land planted with perennial crops is not the same as land under annual crops, since the latter is available for a new crop each year, whereas the former is not. Moreover, the amount of land that can be cleared each year using available machinery and labour resources puts a serious limitation on how much is available for farming in that year.

(b) LABOUR

Like land, labour is not to be treated as a homogenous resource in production. It was mentioned that the Estate is settled by about 2,000 families. Not all members of each of these families are 'active' labour force for the farm; some are children who are not of age to work on the farm, others are women who often stay at home and work on their own subsistence plots. It is not easy therefore to say how much labour is available. Furthermore, most of these families are members of the Wageni Cooperative, which owns the Estate, and they feel that the farm operation should be a 'family' affair with no hired labour from outside. They are reluctant to take up additional casual labour, which would be readily available from the neighbouring areas, for fear that the labourers would settle on the Estate for good.

Agricultural production labour requirements are seasonal. Thus labour needs to be stratified into different seasonal quantities. In setting up labour supply periods the extent to which critical operations must be performed in a given time span needs to be considered. Broad labour supply periods for the Estate can be identified on the basis of farm operations. These periods are planting, weeding and harvesting periods. The planting period for most annual crops is August/September and December/January; the

harvest period is December and March, since the crops occupy the field for only 3 to 4 months. One reason for these growing periods is that most of these crops are grown for export and find the best market in Europe during the winter months. During the rest of the year, only those crops for the domestic market will be grown, and demand on labour will, therefore, be low. Labour requirements for perennial crops are more evenly spread over the year, and consist mainly of weeding, pruning and harvesting. The labour demand will be high, however, in the years when the particular crop is established and when it begins yielding. These crops should therefore be grown during that part of the year when there is a low labour requirement for the annual crops, eg. in mid-year.

Labour supply available in any season is also affected by how much time the settlers devote to their own subsistence crops and the time they spend tending their livestock. Nearly all subsistence farming is concentrated in the rainy months of April and November. During these months labour supply for the farm will become short, and it may be necessary to take up additional casual labour at this time.

(c) CAPITAL

The farm will need a great deal of capital equipment to be able to develop the Estate. The farm will also need a lot of working capital for seeds, fertiliser, manure, pesticides, insecticides and labour.

The amount of money for initial outlays which may be expected to come from the Cooperative members is difficult to estimate. The farm will certainly have to look to outside financiers for loans, at least for some of the initial capital investment. The problem may not be the procurement of a loan, since bodies like the Kenya Commercial Bank, and the Industrial and Commercial Development Corporation (ICDC), would be willing to give a loan if they were satisfied that the project were viable. Rather the financial constraint will come about when the farm has to repay the loan and the interest due on it. The question is whether the profits will be high enough in the long run to cover these commitments. The current ruling rate of interest charged by these bodies is at least 12%.

In the development plan for the farm it will be necessary to take account of the different maturity periods for the various crops since financial returns from them can only be expected after crops have begun yielding. For example, it takes 3 years for coffee to reach full maturity, 8 years for oranges and avocadoes, and 3 years for sisal. In the early years therefore it may be advisable to plant relatively more of the annual crops so that 'quick' money can be earned to meet working capital requirements.

2.5 OTHER ISSUES

Other relevant information was obtained, mostly in informal discussions, which is brought together here.

Besides resource and market constraints, there are also institutional restrictions that may affect farming activities. In general these may include grazing or water rights, tenure arrangements, and marketing quotas. Two of these restrictions have been identified as directly affecting the Chakula Estate. Firstly, on the production of onions for the fresh market, there is a Government regulation controlling the growing of onions. The Government's aim is to protect and encourage small-holders to grow the crop, and it has therefore restricted the production of onions from big farms. A tentative agreement between the Government and the owners of the Estate allows the latter a maximum of 20 hectares under onions. A second factor that will have bearing on the development of the Estate concerns ownership of the land and the legal status of the Cooperative. It would not be surprising if the Government one day decided to allocate the land to individual households especially if its development is delayed. It seems that the title deeds for the land have not been concluded and passed on to the Wageni Cooperative. However, for the purposes of this project it is assumed that the question of ownership is settled, and that the members of the Cooperative can go ahead and develop the land without interference.

Successful implementation of any development plan suggested for the Estate requires a competent management team. It has been observed that most problems connected with cooperatives in Kenya consist of "numerous cases of fraud, dishonesty and favouritism in the management, lack of understanding of business principles, and inability or unwillingness on the part of the society to recruit experienced staff". This should serve as a warning for the Wageni Cooperative to hire a qualified agricultural team of managers to run the farm. The current general manager of the Estate, Mr. Pedersen, is an expatriate who plans to leave Kenya in the relatively near future. The management should be divorced from the Cooperative members as far as possible. The possibility of interference with the management by the Cooperative should be restricted to obvious cases of mismanagement.

The yields given for the various enterprises are based on the assumption that high-level management skills will be available, especially for crops like oranges, avocadoes and passion fruit. Managerial ability is one of the most important factors in the production of horticulture, and it should always be considered in assessing alternative patterns of farming. A decision must be reached as to whether the managerial skills required for a particular activity are too complex or unavailable, in which case the expected yield from the activity will be curtailed.

The attitude of the Cooperative members to the operation of the farm is another important factor in future plans. Some of the members are of the opinion that the Estate should be fragmented and shared among them so that they can grow the crops on individual plots, and only have the Cooperative market produce for them. This would, however, raise problems of management and high cost of production. But the members can only be expected to support the communal farm if their ownership is not questioned and if they expect the benefits from its operation to accrue to them. The question of ownership is tied in with the likelihood of resettlement on the area ear-marked for cultivation. This would be more likely to occur on the land planned for vegetable crops. It might be suggested therefore that the area under plantation crops should be extended to make resettlement more difficult.

2.6 BRIEFING 2

After these two intensive weeks of information collection, the Walimu team spent three days in the Nairobi office trying to make sense of what they had learnt. At this stage Mr Nchinda told the team that they should come up with a procedure for generating some alternative plans for the Cooperative's development and ideas for how these alternatives should be compared. Also the teams should list what further detailed information they needed.

3. PRELIMINARY PROPOSALS

3.1 A POSSIBLE ALLOCATION

The management of the Cooperative in conjunction with Walimu Consultants have drawn up one possible allocation of land to crops. This allocation is shown in Table 3.1 It is a first effort at a sensible choice and should not be taken to be a final selection. The phasing plan for this allocation is shown in Table 3.2.

Table 3.1 Suggested Crop Allocation

Crop	Allocation (hectares)
Coffee	400
Oranges	150
Avocadoes	150
Passion Fruit	10
Sisal	900
French Beans	30
Onions	20
Aubergines	30
Capsicum	90
Chillies	20
Seedbeans	20
Maize	180
TOTAL	2,000

Table 3.2 Phasing Plan for Suggested Allocation[1]

Crop \ Year	1	2	3	4	5	6	7	8	9	10
Coffee	100	200	300	400	400	400	400	400	400	400
Oranges	50	75	100	125	150	150	150	150	150	150
Avocadoes	50	75	100	125	150	150	150	150	150	150
Passion fruit	10	10	10	10	10	10	10	10	10	10
Sisal	200	400	600	800	900	900	900	900	900	900

1 The plans show the phasing of the perennial crops; the annual crops occupy the same areas each year (ie. the area given in the basic allocation).

3.2 DATA

A considerable quantity of data has now been collected from many sources on prices, yields, labour requirements, material costs and capital costs.

Data on prices and yields contain a spread of values from 'pessimistic' to 'optimistic'. This reflects the considerable uncertainty which exists with respect to likely future values for these data elements. No such analysis has been done for labour requirements and material input costs although these are also uncertain to some extent.

(a) ESTIMATES OF PRICES

Table 3.3 Price Estimates

		PESSIMISTIC	EXPECTED	OPTIMISTIC
1.	COFFEE (SHS/TON)	7500	8360	9280
2.	ORANGE (SHS/Kg.)	1.00	1.30	2.5
3.	AVOCADOES "	1.50	2.00	4.0
4.	PASSION FRUIT "	.35	.50	.75
5.	SISAL (SHS/TON)	500	1980	3000
6.	FRENCH BEANS (SHS/Kg.)	.50	2.15	3.00
7.	ONIONS "	.50	1.20	1.50
8.	AUBERGINES "	1.00	1.50	2.0
9.	CAPSICUMS "	.50	1.70	3.0
10.	CHILLIES "	1.00	1.20	1.70
11.	SEED BEANS "	1.75	1.80	2.00
12.	COMMERCIAL MAIZE"	.40	.50	.60

The expected price estimates are based on the farm gate or F.o.b. Nairobi airport price (for horticultural crops which are exported by air). They are a weighted average of prices over the last six or so years. For horticultural produce both the price offered by the processing industry and the 'fresh produce' market price were taken into account in

determining the range of price estimates. In most cases the "processing industry" price was taken as the pessimistic estimate (since it was so much lower than the fresh produce market price), the optimistic estimate was based on what price can be fetched on the "fresh" market.

(b) ESTIMATES OF YIELDS

Table 3.4 Yield Estimates for Perennial Crops (Tons/Ha)

	YEAR OF GROWTH							
CROP	1	2	3	4	5	6	7	8
COFFEE*	0.0	0.05	1.6	2.5	2.5	-	-	-
ORANGES: (1)								
LOW	0	0	0.58	1.65	4.84	10.24	15.53	18.23
EXPECTED	0	0	0.63	1.83	5.38	11.38	17.25	20.25
HIGH	0	0	0.69	2.01	5.92	12.52	18.97	22.77
AVOCADOES: (2)								
LOW	0	0	0	0.34	1.12	3.94	12.37	18.0
EXPECTED	0	0	0	0.38	1.25	4.38	13.73	20.0
HIGH	0	0	0	0.44	1.44	5.04	15.81	23.0
PASSION FRUIT: (3)								
LOW	19.2	25.6	25.6					
EXPECTED	24.0	32.0	32.0					
HIGH	28.8	38.4	38.4					
SISAL*	0	0	3.0	3.5	3.5			

NOTES:
* For coffee and sisal yields only one set of estimates were used because they were assumed to be more or less certain.
(1) A 10% yield variation was assumed for oranges.
(2) A 10% negative variation and 15% positive variation were assumed for avocado yields.
(3) Passion fruit being the most risky crop a 20% variation in the yield was assumed.

Table 3.5 Yield Estimates for the Annual Crops (Tons/Ha)

	ANNUAL CROP	LOW	EXPECTED	HIGH
1.	FRENCH BEANS	6.0	7.0	8.0
2.	ONIONS	12.5	16.0	25.0
3.	AUBERGINES	12.5	18.0	25.0
4.	CHILLIES	6.5	9.0	12.0
5.	CAPSICUMS	6.0	13.0	20.0
6.	SEED BEANS	1.6	2.0	2.5
7.	COMMERCIAL MAIZE	3.8	4.0	4.5

(c) LABOUR REQUIREMENTS

Table 3.6 Estimated Labour Requirements (1)

	C R O P	MANDAYS/HA	ESTIMATED AVERAGE COST/MANDAY (Shs)
1.	Coffee	510	6.00
2.	Oranges	70	4.80
3.	Avocadoes	90	4.80
4.	Passion Fruit	970	5.25
5.	French Beans	1,110	5.25
6.	Onions	245	5.25
7.	Aubergines	280	5.25
8.	Capsicum	280	5.25
9.	Chillies	165	5.25
10.	Seed Beans	51	5.25
11.	Commercial Maize	28	5.25
12.	Sisal	1,480	7.00

(1) These estimates were provided by the Extension Team in the Ministry of Agriculture. They are based on a detailed analysis of monthly requirements by the various crop enterprises.

(d) COST OF EMPLOYING LABOURERS

There are three different organising bodies which set wage rates:

1. Ministry of Labour for agricultural industry workers, who are not working in tea, sisal, coffee, or sugar plantations.
2. For the sisal workers; by the agreement between the Kenya Sisal Growers' Association and the Agricultural and Plantation Workers' Union.
3. For coffee, according to the Agreement between the Coffee Growers' Union and the Kenya Agriculture and Plantation Workers' Union.

Calculation of the daily wages for a permanent worker has been done as follows:-

Working days per year	=	270 days
Paid leave per year	=	21 days
Paid holidays per year	=	8 days
Sick days per year	=	14 days
Sundays or unpaid leave	=	52 days
		365

I. AGRICULTURAL WORKERS

1) Permanent Employees	Labour costs/day (Shs)
Male 18+ yrs.	5.25
Female 18+ yrs.	4.35
Tractor Driver	7.00
Lorry Driver	8.25
Section Foreman	12.00
Farm Foreman	18.00

2) Casual Workers	
Male 18+ yrs.	5.00
Female 18+ yrs.	4.00

II. WORKERS IN SISAL INDUSTRY

1) Permanent Employees	SHS/working day
Cutter	7.50
Employed for brushing, transportation etc.	7.00
Non specified labour -	
Male	6.00
Female	4.50

2) Casual Workers	
Cutter	6.80
Loader	6.30
Male (non-specified)	5.40
Female (non-specified)	3.50

III. COFFEE PLANTATION WORKERS

1) Permanent Workers	Shs/Working Day
Male	6.10
Female	5.50

2) Casual Workers — Shs/Working day

Male	4.80
Female	4.15

(e) MATERIAL INPUT COSTS

Table 3.7 Material Input Costs* (Shs/Ha)

	SEED(LING)	(2) FERTILIZER	SPRAY	(1) OTHER
Coffee	1,372	4,854	1,110	1,105
Oranges	2,170	2,924	636	626
Avocadoes	1,500	3,334	432	626
Passion Fruit	-	3,338	730	8,206
Sisal	733	-	1,006	-
French Beans	836	1,326	491	342
Onions	95	1,754	189	1,013
Aubergines	58	3,522	214	1,110
Capsicum	83	3,522	214	329
Chillies	78	2,436	214	329
Seedbeans	168	956	491	325
Commercial Maize	-	955	255	267

* The cost figures given in the Table are mainly annual (variable) costs; they exclude, therefore, the establishment and harvesting costs.

(1) Estimates in the column headed 'OTHER' are mostly 'capital' maintenance costs. They also include cost of irrigation, cost of nets for onions, gunnies for maize, pots for passion fruit, etc.

(2) A sample of prices assumed for fertiliser and spray are:-

- Triple Supers	Shs. 3.16 per kg.
- Urea	2.71 " "
- Single Super	2.16 " "
- Potash	2.45 " "
- Sprays	18.00 " "
- Diafolitan	4.55 " "

(f) CAPITAL COSTS

Table 3.8 Estimates of Initial Capital Outlays*

	ITEMS	ESTIMATED COST (SHS.)
1.	CATERPILLAR DC 6	440,000
2.	TRACTORS (10)	580,000
3.	DISC PLOUGHS (2)	10,000
4.	DISC HARROWS (1)	9,000
5.	TOOTH HARROWS (1)	3,800
6.	GYROMOWER (1)	6,700
7.	CULTIVATORS (2)	9,600
8.	MAIZE PLANTER (1)	20,000
9.	COMB DRILLER (1)	15,000
10.	FERTILISER SPREADER (1)	3,000
11.	PLANTATION SPRAYER (1)	20,000
12.	FIELD CROP SPRAYER (3)	13,000
13.	FIELD ROLLER (1)	3,500
14.	TRAILERS (6)	44,000
15.	25-TON LORRIES (2)	430,000
16.	9-TON SISAL TRAILER (3)	499,000
17.	SISAL CRUSHER (1)	6,000
18.	BRUSHING MACHINES (17)	102,000
19.	FACTORY REPAIR	70,000
20.	COFFEE FACTORY	302,000
21.	IRRIGATION DAM & PLANT	697,500
22.	POWER STATION REPAIR	15,000

* These items are necessary to prepare the land for any large-scale farming, particularly in uprooting the old sisal on the Estate, and also in processing some of the produce like coffee and sisal.

3.3 BRIEFING 3

The Walimu Consultants team is now required to:

(a) Evaluate the desirability of the allocation given in Table 3.1.

(b) Generate alternative allocations and evaluate them.

(c) Discuss the criteria for evaluation.

4. REPORT WRITING

4.1 BRIEFING 4

Walimu Consultants are required to report to the Management Committee of the Wageni Agricultural Cooperative on the findings and recommendations from the project. The Management Committee need information which can be used in negotiations with government agencies and banks and this material needs to be comprehensive. However, Cooperative members are also interested in the results of the project and any material written for their benefit should be relatively simple, bearing in mind their limited educational background.

Firstly, consider what form the reporting from Walimu Consultants should take. Secondly, develop and produce the necessary material.

CASE 2

DEVELOPMENT PLANNING IN THE SUDAN

1. INTRODUCTION TO THE CASE

2. BACKGROUND INFORMATION

2.1 General
2.2 The economy
2.3 The regions
2.4 Government structure
2.5 Development planning

3. THE CASE

Session 1 Terms of reference
Session 2 Strategies
Session 3 Projects
Session 4 Evaluation
Session 5 Broader aspects of planning

DEVELOPMENT PLANNING IN THE SUDAN

1. INTRODUCTION TO THE CASE

This case is concerned with development planning for a large, poor country, the Sudan. It is assumed that the students are members of a Task Force reporting to the National Planning Council (NPC), to provide assistance in producing a new national 5-year development plan.

The case takes place in five sessions. Each session starts with a memorandum from the Director General of the NPC to the Task Force, accompanied by information including minutes of meetings, data on projects, etc. The Task Force is required to make a report at the end of each session to the Director-General of NPC (represented by the teacher) which may be written or spoken.

Extensive background material about the Sudan now follows in part 2. The Task Force material is given in part 3.

2. BACKGROUND INFORMATION

2.1 GENERAL

The Sudan is located in the north-east of Africa, with its north-eastern boundaries facing the Red Sea. Its area is about one million square miles. It extends from the equatorial region in the south to the desert in the north. The country's population is 17 million.

2.2 THE ECONOMY

The economy of the Sudan depends mainly on agriculture. About 40% of the population work in agriculture. More than 75% of industrial establishments use agricultural products as raw material. Farmers normally use traditional methods of cultivation and depend on rain for irrigation. They cultivate what they need for their living with a small surplus to enable them to purchase what they cannot produce. About 60% of the population are nomads. They rear cattle, sheep and camels. These animals supply them with what they need for their food and they sell some of the animals to buy their clothing.

There are some salient features characterising the Sudanese economy which is still in an early stage of economic growth. These are:

1. The existence of primitive or underdeveloped systems of agriculture, which cannot do much more than provide for the subsistence needs of the producers and those who depend on them.

2. The consequential absence of surplus which can support, by providing an adequate market for its products, a more diversified and industrialised economy.

3. A low rate of capital accumulation in relation to gross national product, sometimes marked by an added tendency for the limited savings which are made to find their way into speculative investment or real estate rather than long-term productive development.

4. Low productivity of labour owing to lack of education, training or health, even when improved tools and techniques are introduced.

5. The absence, by comparison with more advanced countries, of a large middle-class to provide the administrators, managers and supervisory and professional personnel, necessary in expanding the economy.

6. Modernisation of productive techniques on any large-scale has been confined to one or two industries, usually of a primary producing character and largely dependent on export markets, which are themselves subject to wide fluctuation.

2.3 THE REGIONS

Figures 1 and 2 show various characteristics of the regions of the Sudan including a political map, and the location of agriculture. The individual regions are now described in detail.

The North East

The region has deposits of iron, manganese, salt and chromite. A source of natural gas has been discovered in the Red Sea area. Mountains extend along the sea shore, and to the west of the mountains is the desert. The country's main port, Port Sudan, is in the region and is linked with the interior of the country by a railway line. There are no constructed roads, no power, and only a small number of inhabitants living there, who are mainly nomads.

Gezira/East

This region covers the area between the two Niles, White and Blue, and the eastern region of the Sudan. Almost all the agricultural schemes are found in this region. The Gezira scheme, an area of about 2 million feddans, produces the only Sudanese cash crop, cotton. The El Managil extension which is an extension to the Gezira scheme is also found in Gezira/East Region, and also the El Gadanef mechanised schemes where cotton, sesame and dura are cultivated. Two sugar projects were established in El Gunied and El Girba in 1962 and 1965 respectively.

For further development of the irrigated lands and extraction of high agricultural yield, construction of new schemes took place:

Project	Crops grown	Area (000 feddan)
El Rahad	Cotton, Rice, Water-melon, Sesame	300
El Suki	Dura, Wheat, Legumes, Maize	85
North West Sennar	Sugar Cane	50
Gravity Irrigation Schemes	Caster Oil, Dura	150
Gumeia	Vegetables, Potato	10
Hajar Elasalaya	Sugar Cane	72
Kinana	Sugar Cane	300
Abu Naama	Kenaf, Groundnuts	30

The region is connected by a railway network which runs from the east to the west and the north to the south. The only constructed roads in the country are found in this region. There are more than a thousand miles of built roads. All the country's sources of electric power, three dams, are in the region. Almost all the industrial processing projects are located in the region. Its labour supply is exhausted.

The South

The region extends from the equatorial zone in the south to the rich savanna in the north of the region. Its soil is suitable for agriculture. The crops grown there are: rice, dura, tea, coffee, kenaf and barley. Also there are varieties of fruits: banana, mango, grapefruit, oranges, etc. The inhabitants of this region own large numbers of cattle.

The region is rich with minerals such as iron ore, manganese and chromites. The western side of the region is linked with the other regions by a railway line. The main transport link of the region with the other parts of the country is the steamers which travel between Juba in the south and Kosti in the north. The roads are usable for the dry season only. There is no power at all, except small stations in the major towns used for lighting.

The West/Central West

The region includes Kordufan and Darfur provinces. It extends from the rich Savanna in the south to the desert in the north of the region.

Figure 1: Political Map of the Sudan

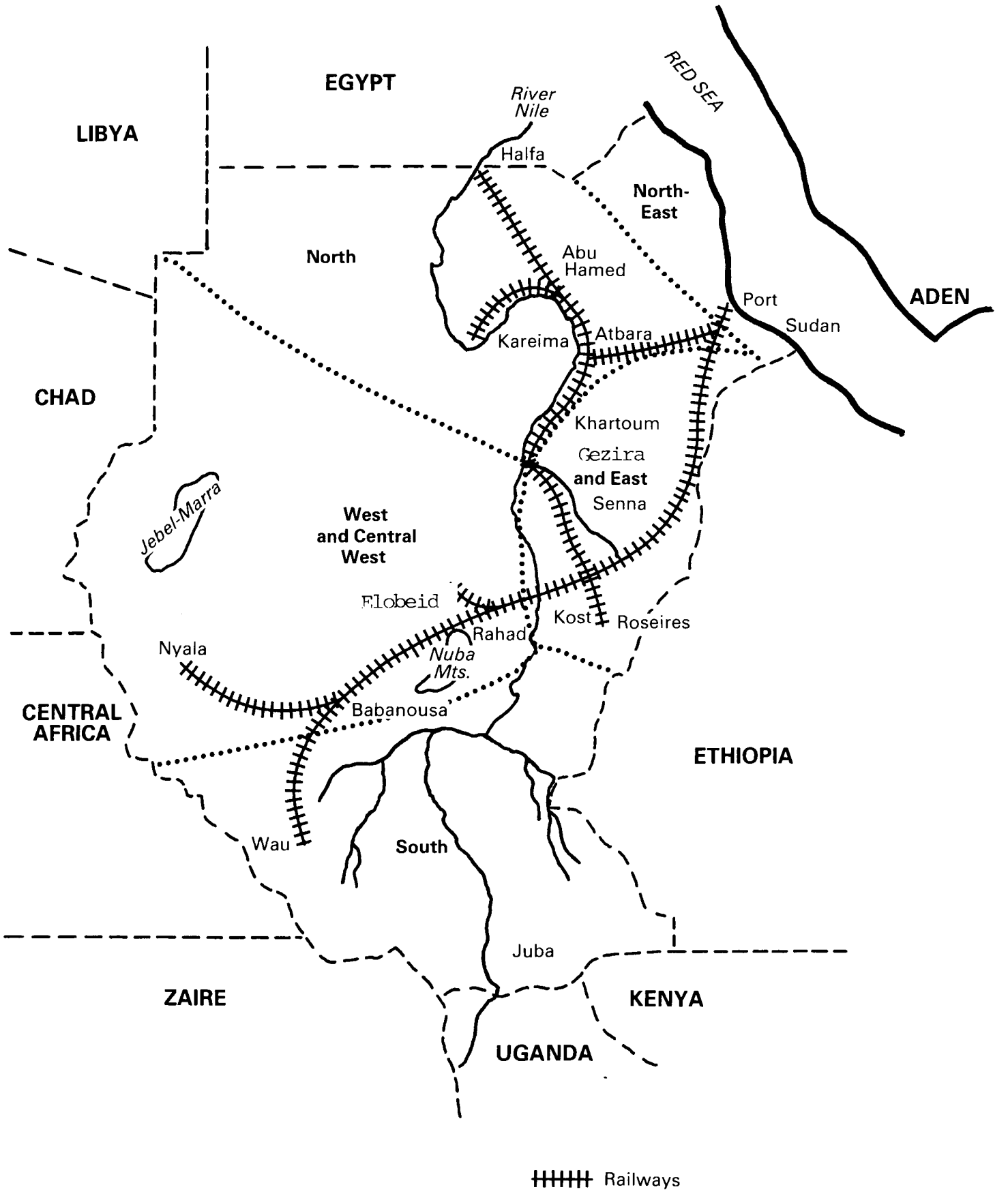
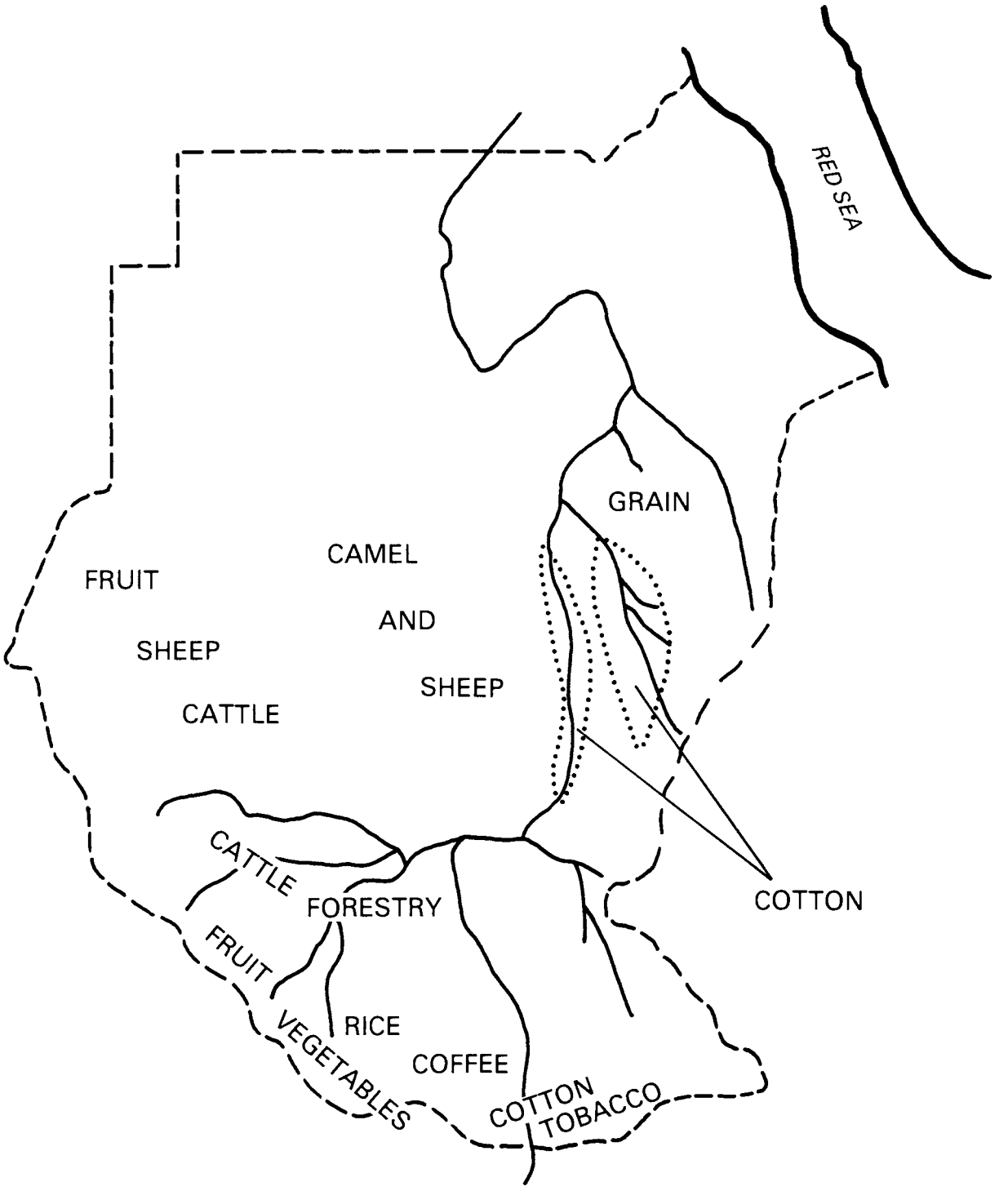


Figure 2: Agriculture



The region is rich in mineral deposits: iron ore, lead, manganese ores, chromites, magnesite, and gypsum. More than 45% of the country's animal resources come from this region. The savanna zone of the region is very suitable for breeding cows, sheep and goats. The desert zone is suitable for camels and sheep.

In the western part of the region lies the mountain of Jebel Marra, more than 19,000 feet above sea level. The altitude of its slopes makes the growing of all the Mediterranean fruits possible. There are also large scale tobacco plantations in the mountain area.

In the eastern part of the region there are mechanised schemes. Here, the soil is similar to that in the eastern region of the Sudan. Rain is very heavy. Cotton, dura, sesame, dukhn, legumes, groundnuts, and melon are grown in the area.

New agricultural schemes were started with the plan in 1971:

Project	Crops grown	Area (000 feddan)
Jebel Marra	Dukhn and Dura	10
Nuba Mountain	Dura, Sesame, Cotton and Legumes	500
Darfur	Dukhn, Groundnuts and Melon	400

The region is the largest producer of Arabic gum in the world.

Transportation facilities are very poor. The railway runs only through the southern part. There are about 186 km of built road, in the eastern side, to link the mechanised schemes in the Nuba mountains with the railway. Also, there are about 228 km of built road under construction. It is designed to link the agricultural area in western Darfur with the railway. The soil in the region, apart from the southern part, is a sandy soil. This makes the tracked roads passable during the rainy season.

The region has no source of power, apart from small stations used for domestic uses in major towns and for light industry.

The North

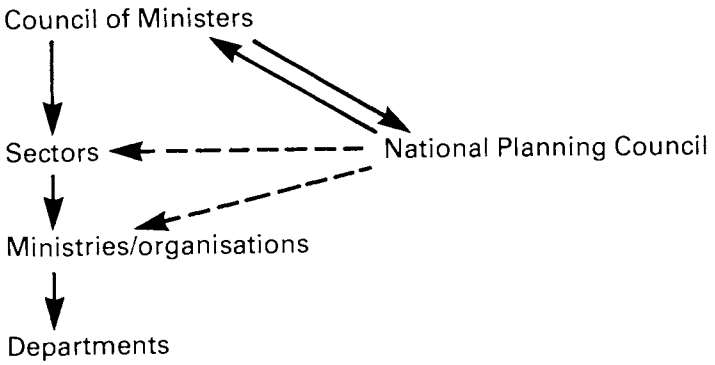
This region constitutes the southern zone of the African Sahara. The only inhabitants living in the region are living around the River Nile. Agricultural activities are carried out near the river banks. Camel owners spend two or three months in the region when it rains in the south.

The eastern side of the region is linked with a railway line. Also, steamers are used between Karima and Halfa and Swan in Egypt. The search for minerals is going on in this region and expectation for their discovery is very high.

2.4 GOVERNMENT STRUCTURE

Decision-making varies according to the level at which the decision is taken. At the national level, decisions are taken by the Council of Ministers. These decisions take note of technical advice but are mainly dominated by the political aspect. The main objective of the government is political stability.

Figure 3: National Government Structure



The intention of the National Planning Council (NPC) is to take rational decisions and produce sound plans for the benefit of the whole country. In cases of conflict, the NPC gives way to the decisions of the Council of Ministers.

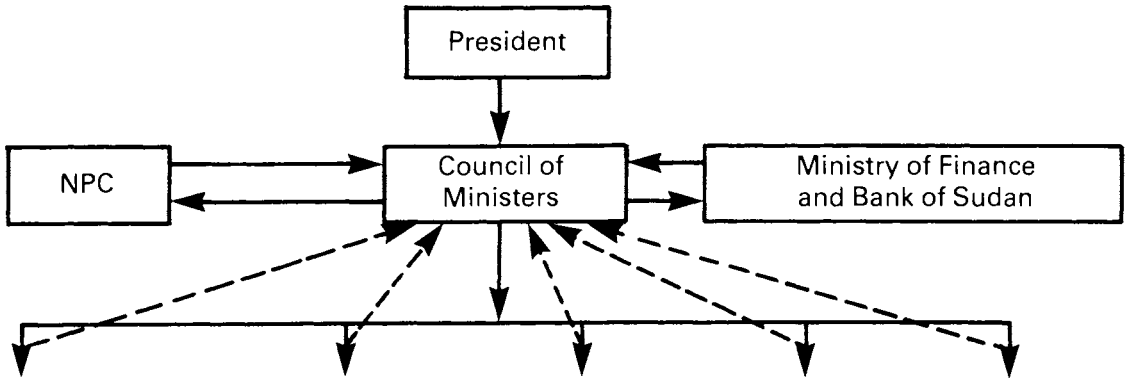
Figure 3 shows an outline of the national government structure. Figure 4 shows a more detailed sectoral breakdown of Government responsibility.

2.5 DEVELOPMENT PLANNING

Development planning first started in the Sudan in 1946, when the first five-year plan (1946/47-1950/1) was set. The Development Priorities Committee was created in 1946 to analyse and evaluate economic and social development projects, and advise the government on priorities for the implementation of these projects.

In 1951, the Development Priorities Committee was replaced by the Development and Construction Committee. This Committee was authorised to set the plan and advise on how projects were to be financed. It called on all government units to propose projects to be listed in the plan.

Figure 4: Sector Breakdown



Agricultural Sector	Industrial Sector	Transport Sector	Service Sector	Housing Construction & General Works
Gezira	Processing:	Railways	Health	Housing
El Rahad	Sugar	Roads	Education	Water Supply
El Suki	Textiles	Airways	Culture	Sewage
Gumeia	Kenaf	Sea lines	Youth	Electricity
El Gadaref	Tanning	River lines	Welfare	
Mech. Schemes	Vegetable Oils	Tourism	Religious affairs	
(Habila)	Light industry	Hotels		
Jebel-Marra	Extracting:			
Animal Resources	Mining			
	Quarrying			

During the implementation of the early plans, frequent revisions were made on a year by year basis. Sometimes new projects were added or the amount of money allocated to a certain project was increased if the actual cost turned out to be more than the estimates. This continued until 1957 when it was found that the plan would cost more than the total of internal and external sources of finance. The plan was then cancelled and a one-year programme was adopted.

Some observations about these early plans are:

1. There was no survey on the availability of natural and manpower resources before the setting of the plan. Projects were then proposed by government units without any study or analysis, which created many problems during the implementation period.

2. The plans included only new projects. Improvements of existing projects were not included.

3. The plans totally excluded the private sector, and by doing so ignored an important economic sector and a major source of finance.

4. It is clear that the planners were more concerned with the required finance rather than the project itself.

5. There was an overall lack of co-ordination between the different projects.

In the early sixties, the Sudanese economy was faced with the following problems:

a. A fall in the national income which meant a fall in the standard of living and the amount of savings and investment. These effects were mainly caused by the political instability in the country.
b. The country depended mainly on one crop, cotton, to supply foreign exchange.
c. High levels of imports for consumption and capital goods resulted in a continuous deficit in the balance of payments.
d. Lack of experienced personnel and technical and organisational know-how.

To solve at least some of these problems, the government set the ten-year plan (1961/62 - 1970-71). The end objective of the plan was to increase the share of the industrial sector in the national income by 9%.

The plan was different from the previous plans in the sense that it involved the private sector. The objectives of the plan were detailed and inclusive. The total size of investment was higher than any previous plan.

After five years, the plan was revised. It was found that deviations from the original plan were very high, so a new five-year programme was devised to cover the period 1965/66 to 1970/71.

In 1970, a further five-year plan was published. It listed the unfinished and left-over projects from the previous plan. Some of the objectives of this plan were to:

i. Secure a continuous increase in the gross domestic product.
ii. Increase the value of industrial production by 50%.
iii. Develop an urban and rural power network.
iv. Stimulate the active participation of the private sector to invest in economic and social projects of vital national importance.
v. Promote prosperity of the people through the growth of productivity, realisation of full employment, enhancement of employees' intrinsic skills and capabilities and the expansion of public services and other related activities.

Although the plan was set by experts from the USSR, its achievements were limited, partly because the experts were from a different culture and had no experience of the Sudan.

The more recent ten and five-year plans did not correct, in many cases, the shortcoming of the very earliest plans. The necessary economic and technical surveys of resources and potentialities, as well as basic economic and statistical studies, were not undertaken at the right time by the departments or organisations best qualified for the purpose. Plans were normally drawn up only as plans of budgetary revenues and expenditures for the coming year, without identifying the targets to be achieved in specific economic and social sectors. In addition to not specifying targets, there was no proper mechanism to follow-up the execution of the plans and this feature has characterised the country's economic development during the last twenty years.

3. THE CASE

Session 1 Terms of Reference

Document 1.1

The Republic of the Sudan
National Planning Council

MEMORANDUM

TO: Task Force

FROM: Director General

A new 5-year plan needs to be set because the current plan period is about to finish. The heads of the section are appointed to form a task force which is to be responsible for setting the new plan.

The task force is required to carry out assessment of the situation and make a preliminary listing of the elements of a development strategy taking account of differences between regions.

Enclosed are minutes of a recent meeting of the Council of Ministers and a synopsis of the current plan. The follow-up section is reviewing the plan and the final report will be passed to you in due course.

Enclosures: Minutes of the Council of Ministers Meeting.
Synopsis of the Current Plan.

Document 1.2

The Republic of the Sudan
The Council of Ministers HQ

MEMORANDUM

TO: National Planning Council
FROM: Council of Ministers

The Cabinet of the Republic of the Sudan met last week. The meeting was chaired by the President and attended by all the senior ministers.

In the meeting they discussed the progress of the previous plan. It appeared that some departments will not be able to achieve their planned targets. Also it appeared that the plan has concentrated on social services and given minor attention to economic development. The country is depending very much on imports and suffering heavily from a worsening balance of payments.

The immediate task for the National Planning Council is to set a new plan for the coming five years, focusing mainly on economic development with some attention to social development.

Enclosures: Minutes of the Council Meeting.

Extracts from the Minutes of the Council Meeting

- The Minister of Industry stated that the industrial sector is going to be unable to meet its planned target because it faced many problems. First, the amount of funds allocated to the sector is very small. Second, the transport sector is failing to meet its commitments. Most of the machinery and equipment are in Port Sudan waiting to be transported to the construction sites.

- The Minister of Agriculture told the Council that the Sudan has large areas which are suitable for agriculture. The Sudan can grow food to satisfy its need as well as that of neighbouring countries.

- The Minister of Transport denied his sector is going to fail to meet its target. If they fail to meet the plan, it will be because of procedural delays in government offices, mainly the Treasury. Most of the sectors did not submit schedules for their transport requirements.

- The Finance Minister stated that the Country's resources are very limited. The World Financing Agencies are imposing difficult conditions on loans. The new plan must be restricted to the projects that meet the necessities and at the same time improve the economy of the country.

Synopsis of the Current Plan (published 1970)

Agriculture:

Crop	Planned Area (feddan)	Planned Production (tons)
ground nuts	845,000	401,000
sesame	1,200,000	275,000

The agriculture sector is to adopt modern techniques and new methods of cultivation. It has to raise the productivity by a substantial percentage. Chemical fertilizers and insecticides are to be used.

Industry:

New industrial establishments are to be constructed. Industry is to concentrate on processing agricultural products currently exported as raw material to other countries. Public and private sector capacities are to be utilized efficiently.

Power:

Electricity is to be extended to major towns and industrial areas.

Transport:

Public transport efficiency is to be raised and bottlenecks are to be solved by the end of the plan. The feasibility of new rail lines and built roads is to be investigated.

Education:

The intake of students in all levels of education is to be increased. Efficient methods of teaching are to be maintained in schools. Training is to be planned and based on the requirements of the sectors of the economy.

Health:

Medical services as in 1971 were:

Hospitals	76
Health Centres	56
Dispensaries	535
Dressing Stations	652
Pharmacies	148

The Republic of the Sudan
National Planning Council

MEMORANDUM

TO: Task Force

FROM: Director General

Further to my previous memo, I have received the review of the plan which is attached.

The different sectors responded, this year, very quickly to the review of the plan. Their response resulted in statements justifying each position. These statements are attached for you to use as references.

The task force is required to recommend a list of strategies for the plan in terms of sectors and regions. This list should include alternative views on which region or regions should be emphasised and which sectors should be developed fastest.

Enclosures: The Review of the Plan
Statements from Sectors

A Review of the Previous Five-Year Plan

The economic and social development of the country for the last five years has been outlined by the plan for 1971/72 - 1975/76. In essence the plan did not form major trends and patterns of economic and social development, rather it was a mere compilation of numerous unco-ordinated projects backed by no reliable sources of financing.

The annual economic and social development plans were drawn up only as plans of budgetary revenues and expenditure for the forthcoming year, without identifying the targets to be achieved in economic and social terms. As a result of that attitude there was no proper mechanism to follow up the execution of the previous five-year plan, and that was the feature which characterised the country's economic development during the last five years.

Agriculture

The growth of production has been achieved mainly through the expansion of cultivated areas and the increase in the planned volume of capital expenditure by 12%. For example:

Crop	Planned Area (feddan)	Planned Production (tons)	Actual Area (feddan)	Actual Production (tons)
Ground nuts	845,000	401,000	1,041,000	385,200
Sesame	1,200,000	275,000	1,332,000	200,000

The figures are explained by a failure to achieve the planned increase in productivity in the last five years.

Low productivity was attributable to the violation of rotation periods in the irrigated lands, inadequate utilisation of chemical fertilizers and lack of mechanised sowing. Rainfed cultivation is developed with inferior agricultural techniques. Agricultural production processes lacked mechanisation. The number of tractors per unit of rainfed area is 25% below the number in neighbouring countries.

Livestock development was restricted to inadequate traditional patterns despite improvements in the source of water. In addition veterinary services were poorly organised.

Industry

During the plan period, new enterprises were built and industrial output increased. Nevertheless industrial production is small in relation to national production potential. Industry is engaged mainly in primary processing of agricultural raw materials. Light industry uses imported materials produced by other countries from basic raw materials originally exported from the Sudan.

Due to the lack of a processing industry for indigenous raw materials, and poor co-ordination of imports of certain materials, the existing capacities of public and private sectors are poorly utilised.

Despite favourable geological and economic conditions, indigenous mineral deposits have not been exploited, due to the lack of an effective marketing organisation abroad, and export potential has not been fully realised.

Power

Power development was concentrated mainly in the central region, large towns and provincial centres of trade and industry. Information about development of electrical power all over the country is not available.

Transport

No success was achieved during the five years of the plan. Poor transport facilities limited both the linking of the country's major productive areas and export-import activities. The efficiency of the public sector transport capabilities declined and the failure to implement the capital investments programme hampered the development of the transport system.

Owing to the inefficient utilisation of the money allocated to railway transport, the number of trains did not increase; train speed slowed down; train weight was utilised to only 70%; passenger trains were not available; total traffic capacity was utilised to only 35-40% of capacity. Steamers and airways operate at a loss. No effective steps were taken to improve their operations.

Education

The number of schools at all levels increased as well as the intake of pupils. There are still some shortcomings, i.e. low efficiency of the teaching process at all levels, a high percentage of students who fail to appear to take their examinations, and many more who fail to achieve their certificate. A considerable number of students repeat the course in the same class.

The intake of the higher education institutions has increased. The essential shortcomings in the sphere of higher education are as follows: training of specialists without duly considering the requirements of the sectors of the economy, and a general lack of co-ordination in education planning in terms of relating the type of training to the growth sectors of the economy, and adapting syllabuses to local conditions.

Health

The health services witnessed a remarkable advancement that improved considerably medical services for the population.

	1970	1975
Hospitals	76	93
Health Centres	56	73
Dispensaries	535	605
Dressing Stations	652	1,161
Pharmacies	148	202

The number of doctors per 100 thousand population increased to 7. Medical services to the population are provided mainly by government health institutions.

Statement from the Industrial Sector

We think the previous plan has achieved a reasonable level of food production. The agricultural products are exported to be used as raw materials by other countries. If we turn to processing these products locally, we will be able:

1. To construct new industrial establishments for processing the agricultural products.

2. To produce locally some of the goods needed and save some hard currency and improve the balance of payments.

3. To create some jobs and thus help to solve the unemployment problem.

4. To start a processing industry which will lead the country towards self-sufficiency.

Following from what has been said we propose the dropping of food production as a top priority and instead adopting the processing industry as a top priority of the new plan.

Statement from the Agricultural Sector

Food production was the top priority in the previous plan, but the achievement of the plan is not satisfactory due to unavoidable reasons. The obstacles that hindered the success of the plan are:

1. Required machinery and equipment have not been received in time due to bad transport facilities.

2. Crops did not have the amount of water they need because irrigation constructions were not finished in the planned time.

3. Insects damaged the crops due to lack of insecticides.

If we produce more food, we can export some of it to the Middle Eastern countries, where it is badly needed, and we will be able to earn some hard currency.

Following from what has been said, we suggest that we should maintain food production as a major priority for the new plan.

Statement from the Services Sector

It is good to produce more food and solve the problems of the Middle East, and nice to add to the value of exported raw materials, but we feel that these gains are minor compared to the problems created by the adoption of a single priority - as in the previous plan - and to the concentration of development in one region. For example:

1. The production of food concentrates the development in Gezira/East and neglects the other regions.

2. People tend to move from the high unemployment areas to where they can find work and that will lead to the concentration of population in one region.

3. Illegal living areas (shanty towns) develop around big towns and they will encourage crime.

4. There is a big difference in the standard of living between Gezira/East and the other regions.

For these regions we need a reconsideration of the policy priorities. We suggest that, in the plan, regions of the greatest needs and high unemployment should be considered first; the North East, West/Central West, and the South may be focused on as priority for development.

Statement from the Ministry of Finance

Sudan, like the other underdeveloped countries, suffers from a lack of financial resources, skilled labour, and technical knowledge. The sources of finance available for the country are:

A. The World Bank.

B. Machinery producers (suppliers' credit).

C. The Sudanese Industrial Bank.

D. Individuals.

Loans given by any of these sources are relatively small and sometimes tied to a certain type of activity, e.g. agriculture, industry or transport. This makes it difficult to promote development in all regions and sectors at the same time. It will be more beneficial if we pushed one, or, at the most, two sectors.

Based on these reasons the Ministry is obliged to set a limited budget for development. The plan can be designed up to a maximum cost of £34 million.

Statement by the Minister of Local Government

The objective of the plan is to implement projects within given constraints and at the same time ensure a balance among the different regions and sectors considered by the plan. Diversification will give us the chance to consider different types of projects in different regions, and we will be able to make use of the economic advantages given by diversification.

Although concentration of development may have some economic advantages, it is not socially desirable. It is important not to implement more than one project in the same location.

The Republic of the Sudan
The Council of Ministers HQ

MEMORANDUM

TO: Director General NPC
FROM: Council of Ministers

The Council of Ministers has considered the crude evaluation of the alternative strategies and it would like the NPC to concentrate its future attention on the following four strategies:

1. Focus development on one of the most needy areas and encourage development which leads to self-sufficiency.

2. Develop as many needy areas as the funds allow and work towards self-sufficiency.

3. Encourage the start of development which creates a base for heavy industry and at the same time leads to the satisfaction of the local market.

4. Continue along the same lines and consolidate the previous plan.

A list of projects received from the ministries is attached and detailed data for evaluating these projects has been requested from the different departments and will reach you in due course.

Please assess the feasibility of these projects and develop more detailed alternatives relating the individual projects to the broad strategies in preparation for detailed evaluation when the data becomes available.

Document 3.2

The Republic of the Sudan
National Planning Council

MEMORANDUM

TO: Task Force

FROM: Director General

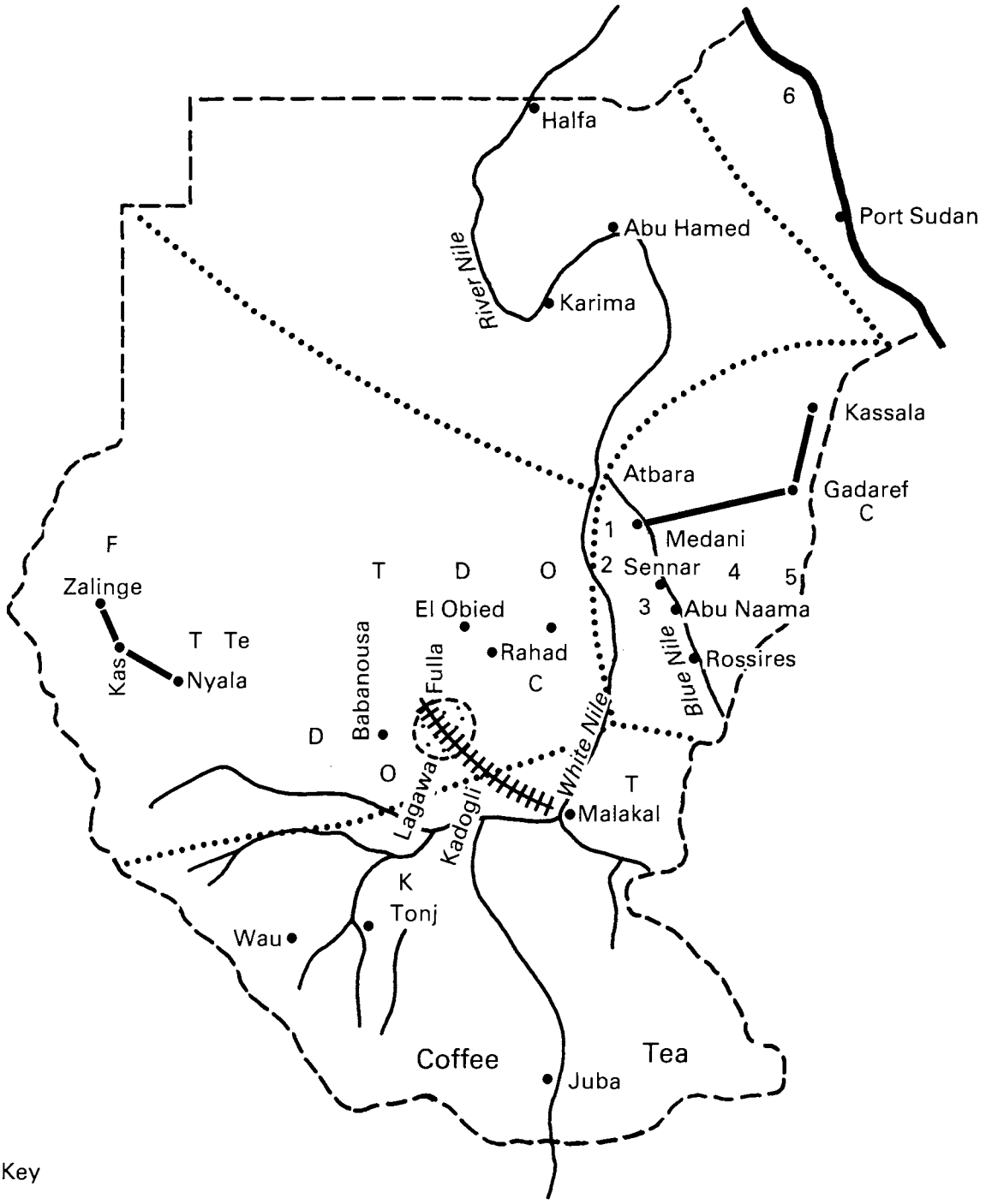
Please find attached a list of projects proposed by ministries, as requested by the Council for the preparation of the new National Development Plan.

LIST OF PROPOSED PROJECTS

PROJECT		AREA 000 FEDDANS	CONSTRUCTION PERIOD	USERS OF OUTPUT
Sugar	: North West Sennar	50	2 years	Local consumption
	Hajar Elasalaya	72	4 "	50% export
	Kinana	300	6 "	Export
Cereals	: Elrahad	300	4 "	Export
	Elgadaref	900 *	2 "	Local consumption
	Habila	500 *	1 year	" "
	Jebel Marra	10	1 "	" "
Vegetables	: Gumeia	10	2 years	" "
Coffee	:	150	2 "	" "
Tea	:	200	2 "	" "
Tanning	: Elobeid		1½ "	30% export
	Nyala		4 years	Export
	Malakal **		3 "	"
Dairies	: Elobeid		2 "	Local consumption
	Babanousa		3 "	" "
Canned Fruits	Kas		3½ "	Export
	: Wau		1 year	Local consumption
	Zalinge		1½ years	" "
Textiles	: Kadogli		4 years	" "
	Nyala		2½ "	" "
Oil	: Lagawa		1½ "	" "
	Omrowaba		3 years	50% export
Kenaf Products	: Tonj		2 "	Local consumption
	Habila		5 "	" "
Mining	: Iron		3 "	" "
	Manganese		2 "	" "
Railways	: Fulla-Lagawa-Kadogli-Malakal: about 500km, feasibility study will be ready in a year's time.			
Roads	: Medani-Kassala: 420 km, costing about 14.08 million Sudanese pounds. Nyala-Kas-Zalinge: 228km, costing about 4.5 million pounds.			

* Elgadaref and Habila Schemes depend on rain for irrigation.
** Malakal Tannery is planned to tan skins of reptiles.

Figure 5: Location of Projects



Key

S	1	North West Sennar
S	2	Hajar Elasalaya
S	3	Kinana
C	4	El Rahad
C	5	El Gadaref
V	6	Iron and Managanese

T	Tanning
Te	Textiles
D	Dairies
C	Cereals
S	Sugar
F	Fruits
O	Oils
K	Kenaf

Railway under study

Planned roads

Nukri area

The Republic of the Sudan
National Planning Council

MEMORANDUM

TO: Task Force
FROM: Director General

It is our hope and responsibility to lead the country from the state of being under-developed to the developing and then the developed state in the future. This makes us think carefully when we set the economic and social development plans.

The Ministry of Finance has stated clearly that the finance of the new plan depends mainly on loans. The agreements on some of these loans are not finalised yet and others are tied to specific activities.

I would like to remind you that we might run short of finance during the implementation period. Also we might find it necessary to add new projects if the new projects in the transport sector prove successful and are implemented in a reasonable time.

Though our main job is to produce a plan within the current constraints, we should not overlook projects that might be useful in the future.

Please find enclosed detailed data about the projects; you are required to carry out a detailed evaluation for the projects listed. The Task Force is required to submit results of a preliminary evaluation for the projects. Extracts from the minutes of a meeting of the Council of Ministers are attached. You might find these helpful, particularly in identifying which decisions should be taken now and which decisions can be made later after further study.

Detailed Projects Data

Project	Estimated Cost (millions)	No. of Jobs (000)	Capacity (millions)	Usage of output	Transport Facilities	Const. Period
1 N.W.Sennar	23	5	.11 tons	L.C.	Railway + Road	2yrs.
2 H. Elasalaya	23	5	.11 "	50% export	Rail 25km away	4 "
3 Kinana	50	12	.250 "	export	Rail 60km away	6 "
4 Elrahad	12.930	-	2.401 "	"	Railway	4 "
5 Elgadaref	2.984	-	.614 "	L.C.	"	2 "
6 Habila	2.412	-	2.357 "	"	Road	1 "
7 Jebel Marra	.701	-	.441 "	"	Railway 100km away	1 "
8 Gumeia	.415	-	.79 "	"	Road	2 "
9 Coffee	.190	-	.045 "	"	Steamer 150km away	2 "
10 Tea	.120	-	.016 "	"	Steamer 80km away	2 "
11 Elobeid	1.800	.58	.6 piece	30% export	Railway	1½ "
12 Nyala	1.823	.60	1.14 "	export	"	4 "
13 Malakal	.828	.48	.15 "	"	Steamer	3 "
14 Elobeid	.900	.127	.8 tins	L.C.	Railway	2 "
15 Babanousa	1.433	1.09	1.7 "	"	"	3 "
16 Kas	1.028	.705	1 "	export	Railway 98km away	3½ "
17 Wau	1.045	.6	4.667 "	L.C.	Railway	1 "
18 Zalinge	.806	.448	2.5 "	"	30km away	1½ "
19 Kadogli	6	1.4	14 meters	"	Road	4 "
20 Nyala	2.06	1.2	12.5 "	"	Railway	2½ "
21 Lagawa	1.15	1.2	.84 pints	"	Road 105km away	1½ "
22 Omrowaba	1.19	1.238	1.68 "	50% export	Railway	3 "
23 Tonj	1.6	4.5	4.5 sacks	L.C.	"75km away	2 "
24 Habila	6.5	5.8	10 "	"	Road	5 "
25 Iron	4.66	3.307	.25 tons	"	Railway about 200km away	3 "
26 Manganese	.524	.8	-	"	"	2 "
27 Medani-Kassala	14.06	-	-	-	-	4 "
28 Nyala-Zalinge	4.5	-	-	-	-	1½ "

Rail transport is more reliable and economical than steamers due to greater capacities and speeds.

Document 4.3

The Republic of the Sudan
Council of Ministers HQ

Extracts from the Minutes

- The Minister of Local Government said that, after repeated requests from the provinces in the West/Central West and Southern regions for a decision on the priority of development, it was absolutely imperative that the Council make a clear statement of their priorities and a commitment one way or another on at least a short-term future for each region.

- The Minister of Finance went on to add that if any decisions were to be made about development priorities, the longer term effects of that decision must be taken into consideration and provision made for them.

- The Transport Minister suggested that any decision on transport and related areas must await the results of Fulla-Malakal railway feasibility study and the survey of Nyala-Zalinge and Phase II of Medani-Kassala roads, if they were to be in any way realistic.

- It was moved by the Minister of Irrigation and seconded by the Minister of Industry that the National Planning Council be asked to submit their recommendations for short-term actions making clear the longer term implications and possibilities in the new five-year plan at the next Council meeting. The motion was carried.

The Republic of the Sudan
National Planning Council

MEMORANDUM

TO: Task Force

FROM: Director General

I would like to thank the Task Force for the nice job carried out on the preliminary evaluation of projects. This work will set guidelines for the detailed evaluation.

I have recently received the attached letter from the President's Office. I think we should take these comments very seriously and put a high priority on taking some action to meet the President's request. In order to start this process, please produce a detailed list of areas for consideration and a short description of problems in these areas. You should also make preliminary recommendations on what action could be taken in these areas.

The President's Office have also passed on the attached copy of a petition from tribesmen in the Nukri Area. You should try to include some ideas on the problems they raise in your report which I have requested above.

Document 5.2

The Republic of the Sudan
The Presidential Palace

Elsayed D.G. NPC
Dear Sir,

The President has recently returned from the OAU Summit. One of the working sessions at the summit impressed him very much - it concerned the failures of National Planning in African countries over the last two decades.

The President was particularly interested in the criticism of the process for production of Development Plans. A number of delegates made the point that Development Plans concentrate on lists of specific projects and produce estimates of their potential viability. These estimates are frequently proved to be too optimistic due to constraints and problems which have not been considered. Particular mention was made of management inefficiencies, inadequate consideration of infrastructure needs and skilled manpower shortages.

The President has asked me to pass on his concerns to you and hopes that these matters will be addressed in your work on the next Plan.

Sincerely yours,

Senior Officer
Presidency Secretariat

Petition from Nukri Area, Western Region

(Signed by Head of Messeria (nomadic) Tribe, Sheikhs and 200 other Tribesmen).

The most important thing we want is settlement. We are not asking for a change to occur overnight, although the more we keep moving with our animals looking for fodder and running from pests, the more we lose those animals.

The youth are attracted by the development going on in other parts of the country. They left the area looking for easy jobs with a secure future. We are afraid of the loss of our traditions and so our identity.

Our animals are taxed heavily. In return we are having nothing. No fair veterinary services or industrial establishments; instead the animal products are taken to be processed in other regions.

The standard of living in the area is very low compared with the other regions. We think it is time that the area should have some sort of development, at least to compensate the inhabitants for the tax they pay.

CASE 3

EAST AFRICAN RAILWAYS

1. THE CURRENT POSITION

The Mombasa Area Manager of East African Railways Corporation is concerned about the delays in the Mombasa marshalling yard. He considers this to be a costly waste of time and resources. He has raised his concern with the Chief Engineer who is responsible for the design of a new marshalling yard. They have agreed that the O.R. unit should look at the planned design and give their advice.

The O.R. unit has been requested to produce a preliminary report based on the existing system. The report should examine areas of concern and should advise whether further detailed work and data collection and analysis is needed to improve the design of the marshalling yard.

The O.R. manager has assigned you the task of preparing and presenting the preliminary report to the Mombasa Area Manager and the Chief Engineer.

2. THE RAILWAY CORPORATION

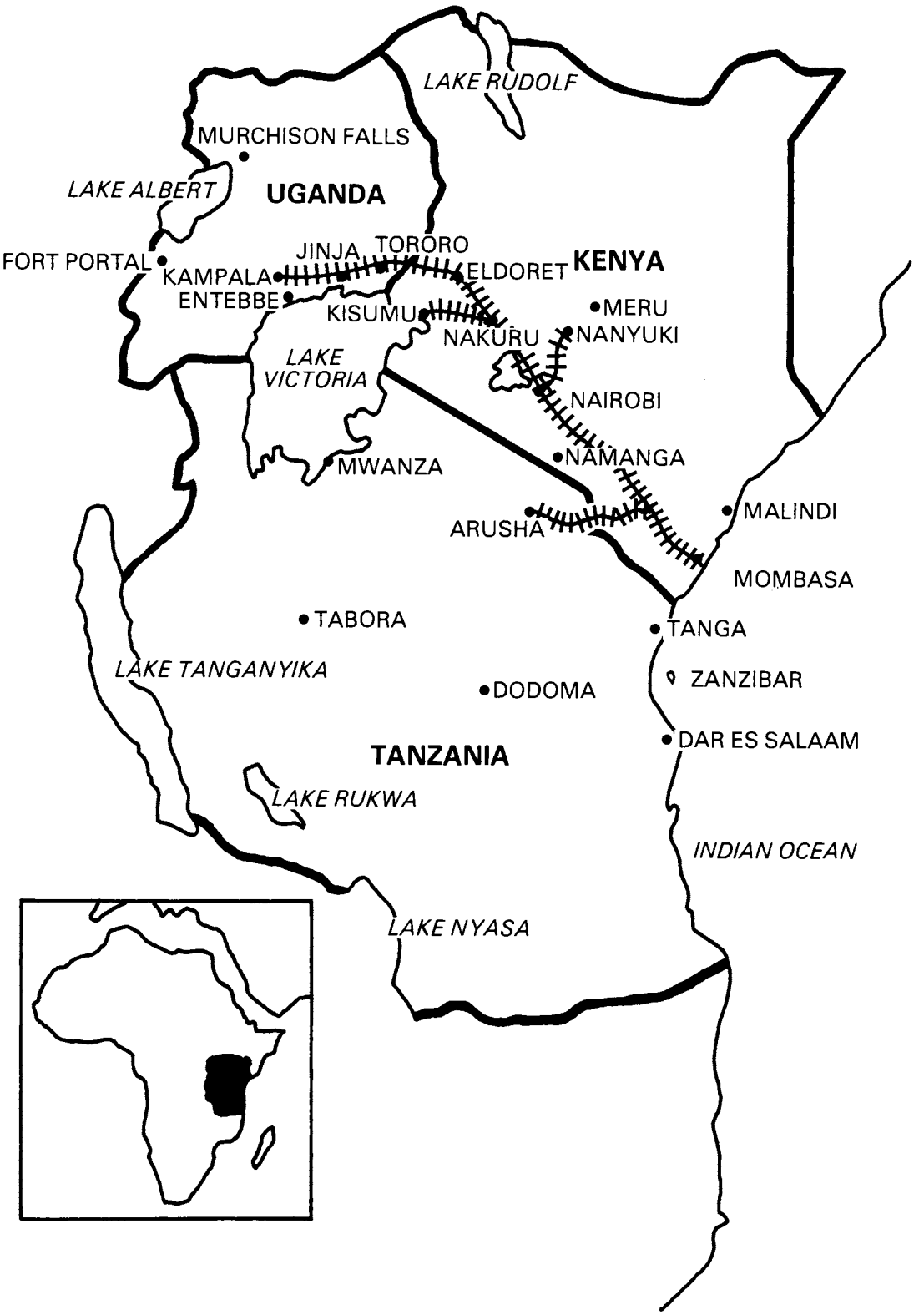
East African Railways Corporation is responsible for the management of the railways system in the three East African countries of Kenya, Uganda, and Tanzania. The main railways passing through Mombasa are shown in the map overleaf. Mombasa is Kenya's main port and second largest town. A significant proportion of Kenya's imports and exports pass through the port and the rail link to the capital city, Nairobi, is a very important element of the communications system.

3. THE AREA MANAGER'S VIEW

You attend a meeting with the Area Manager at which he puts forward his view of the problem and his suggestions to put it right. He tells you that there have been serious difficulties and delays for a number of years in the marshalling yard. He sees the main problem being with the marshalling of trains to leave the port and that this causes serious delays in the traffic to Nairobi and beyond. Proposals have been made for improving and even rebuilding the marshalling yard. He has proposed that the 'trip' locomotives for marshalling wagons from the port are not powerful enough and should be replaced, and secondly, that there should be more 'receiving' lines for wagons from the port before they are made up into trains to the various destinations.

Map of East Africa

Main Railways through Mombasa



4. THE MARSHALLING YARD

The Chief Engineer takes the O.R. team for a walk around the marshalling yard. Starting at the port, goods are unloaded into wagons which are moved by a trip train to the receiving lines. The next stage of the marshalling process is that wagons are moved from the receiving lines by a shunter engine to the far end of the marshalling yard and recombined into groups with a common destination. For example, all the wagons destined for Nairobi and beyond are joined into one train. At present approximately half the wagons are in this category. In reply to a question the Chief Engineer estimates that one shunter can clear and reorganise a full receiving line of 20 wagons in approximately 25 minutes.

At the far end of the marshalling yard the freight trains are assembled. A completed freight train consists of 30 wagons and, when this number has been assembled by the shunting process for a particular set of common destinations, a locomotive will be connected in due course and the train will leave. An exception to this rule is planned for the case of wagons going to Nairobi and beyond. Trains for this set of destinations are planned to leave every 1 hours on a regular schedule whether or not the 30 have been assembled. The interval of 1 hours was chosen since it gives 16 trains a day and the approximate average number of wagons currently going to Nairobi and beyond is 450 a day.

The far end of the yard which is to be used for the train assembly is part of the existing railway network. Up to 40 wagons can be assembled for Nairobi and beyond using this system but when 40 are assembled no more can be brought up by the shunter until a train has left. Similar problems could occur for other destinations but rather more spare capacity is available for these destinations.

The O.R. team now moved back to the port for a more detailed examination of operations there. Ships are mainly offloaded at the port between the hours of 8.00 a.m. and 5.00 p.m. Up to 400 wagons can be held at the port with the existing facilities, but when this number has been reached offloading must be stopped until a trip train has taken some of the wagons away. Everyone recognises that the 'demurrage' cost of keeping a ship waiting is prohibitive, in some cases it can be US$25,000 a day. The peak time for trip train deliveries from the port is expected to be 12 noon to 6.00 p.m. but the trains will continue to operate on a 24 hour basis if required. One trip train can pull a load of 20 wagons and during the peak period it is anticipated that a trip train will arrive in the marshalling yard from the port every 15 minutes. This estimate is based on current demand patterns for rail freight traffic.

At the marshalling yard it is planned to have six receiving lines each of which can take 20 wagons. If a line is free the trip train will be able to leave the wagons and return to the port; otherwise the train will have to wait and this may slow and delay subsequent trains from the port.

5. SOME COST DATA

The younger members of the O.R. team were surprised that it proved extremely difficult to get any cost estimates. A considerable amount of discussion and some international phone calls were necessary to get even crude estimates.

The capital cost of a trip train was estimated at US$150,000 and the running costs including fuel, drivers wages, maintenance and spare parts at KSh400,000 a year. A shunter locomotive was estimated to be less than half as expensive, with a capital cost of US$60,000 and a running cost of KSh250,000.

The costs of additional track were estimated to be US$25,000 for the addition of one receiving line in the yard with an annual running cost of KSh50,000. To provide an additional track of 40 wagons for the assembly of Nairobi trains was estimated to cost US$35,000 and running costs of KSh75,000 a year. (US$1 = 10 Kenyan shillings = KSh10).

6. THE O.R. REPORT

The O.R. manager has asked you to draft a report which he will see before it is sent to the Area Manager. It should address the following:

(1) In what areas are delays likely to occur?

(2) Will either or both of the Area Manager's suggestions help to reduce these delays?

(3) Further suggestions to improve the marshalling system given the current information.

(4) A discussion as to whether it is necessary to develop a more detailed model. If so, what type of model and what further data will have to be collected?

CASE 4

AIRCRAFT REPLACEMENT

BACKGROUND

An O.R. group was formed one year ago at the Government Staff College of Transitania (GOSCOT). At first the O.R. group was concerned with introducing O.R. into the senior and middle management courses at GOSCOT. O.R. then proposed that they should carry out consultancy projects in government departments and parastatal organisations which also use GOSCOT. This took some time to be accepted as departments and parastatals don't like outsiders to examine their workings. However, recently the President has appointed a Commission on Administrative Efficiency so some departments believe that they would be wise to carry out their own studies before the Commission starts to examine them. O.R. carried out a number of short appraisals and statistical monitoring projects. But the first significant and successful project was carried out for the national oil company, Transitania National Oil Company (TRANOC). The project was concerned with the expansion of the main oil port. It recommended a number of improvements in scheduling tankers and overcoming bottlenecks in loading and unloading. The TRANOC study was described on the next senior management course at GOSCOT. One of the participants on the course was the Head of Engineering of the Airline Corporation of Transitania. He seemed very interested in the O.R. approach. As part of the course each participant formulated a project in his work situation. The Head of Engineering described the current debate in ACT about whether to replace aircraft. After the course he persuaded ACT's Managing Director to invite O.R. to look at this problem.

PRELIMINARY WORK

1. MEETING WITH DIRECTOR OF FLIGHT OPERATIONS

The Director tells you that he is most concerned with replacing the elderly Beaver aircraft operating on the main internal route from the capital Douba to the main industrial city of Ebbyville. His department have carried out a preliminary appraisal of possible replacement aircraft and feel that there is a clear-cut case for the new Zippo aircraft to be the replacement. However, each Zippo will cost US$6 million and the Minister of Finance has been blocking the purchase in the Cabinet on the grounds that Transitania has a severe shortage of foreign exchange. It is thought that the President favours the purchase of the Zippos for prestige reasons but has not been prepared to overrule the Finance Minister in this case.

2. MEETING WITH THE MANAGING DIRECTOR

You are taken in to meet the Managing Director (MD) as an important formality in agreeing to outsiders having access to the airline. Part of the conversation goes as follows:

MD Welcome. What we want you experts to do is to help us make a case which will convince the Cabinet that Zippos are essential. The Finance Minister keeps on asking the Minister of Defence (ACT's Minister) to produce figures justifying the expenditure. The Minister of Energy is on our side. He sees increase of oil output and increased business activity boosting ACT. Similarly, the Minister of Tourism backs us. But several Ministers such as Labour, Health, Education, and Agriculture oppose spending foreign exchange on new aircraft.

OR Well sir, we will certainly explore the alternatives as objectively as possible but can't say now what will be the result.

MD We have no doubt that Zippos are needed.

OR Is there any urgency in producing the report? At present I am the only O.R. person assigned to this project, and I am not full-time.

MD Yes, there is urgency. We would like to put our proposal to the Cabinet meeting in three weeks.

OR I will do my best.

3. SECOND MEETING WITH DIRECTOR, FLIGHT OPERATIONS

Beavers

The current fleet consists of eight Beaver aircraft. There are two flights every morning from Douba to Ebbyville, and two flights each morning in the opposite direction. The flight takes seven hours. Each aircraft can only take one flight a day because neither airport has modern equipment for night landing and take-off. This is under the Airport Authority which is not controlled by ACT.

Zippos

We could probably operate with two Zippos. They are much faster and would take about four hours on the Douba-Ebbyville route. So if we can achieve a one hour ground turnaround a Zippo could make two flights a day, one in each direction. Since the Zippo has more seats than a Beaver we would have more capacity. The Zippo has 250 seats, the Beaver 150.

4. MEETING WITH HEAD OF ENGINEERING

If the Beavers are not replaced in the next year they will require a major overhaul, with new engines, which will cost US$100,000 each and prolong their flying life by five or six years. Maintenance costs for the eight Beavers currently total $3 million a year. We estimate the total maintenance costs for two Zippos to be about the same as for the eight Beavers because they are more complicated and the spares are more expensive.

It has been suggested that the Beavers could be sold to one of Transitania's neighbours for military use for about $250,000 each.

5. MARKETING AND SALES

ACT currently averages about two-thirds capacity on the Douba-Ebbyville route. The single one-way fare is $85. Passengers are about one-third each business people, government officials and tourists. If the oil exploration succeeds in two or three years then we expect the business trade to increase rapidly. Our best hope in the short term would seem to be expansion of the tourist trade but the government tourist board has not been very active in promotion. However, even in the short term, we would expect some increase in revenue if we go for Zippos due to the extra attractiveness of the 4 hour flights compared to the 7 hour ones. It is difficult to estimate this precisely without detailed market research but a 25% increase in sales revenue due to the Zippos should be conservative.

6. FINANCE

Fixed costs, not related to flying, are estimated to be $2 million a year. Aircrew costs total $4 million a year. The number of crews could be cut approximately in proportion to the length of flights. Since a number of foreign crew members are reaching the end of their contracts it will be feasible to cut manpower. Fuel costs for the Beavers total approximately $3 million a year. The fuel costs for the Zippo are estimated to be $4,000 a one-way flight.

CHANGES IN TERMS OF REFERENCE

After a few days when you have assembled the above information you are called in to see the Managing Director.

MD Several other airlines have put in orders for Zippos. The company has told ACT that if it does not confirm its option within a few days and make a firm offer ACT will go to the bottom of the queue and have to wait at least another two years.

I am going to see the Minister of Defence the day after tomorrow to brief him for the Cabinet meeting on the next day. I must have your report to take with me justifying the purchase of two Zippos.

OR Well I will do my best to give you a preliminary review of the main alternatives based on the information so far.

To the student:

A. Make a short report for the MD outlining the main alternatives and the costs and benefits. Consider how existing uncertainties affect your analysis of alternatives.

B. Write a note for your OR boss explaining the organisational setting in ACT and how confident you are in your report to the MD and what you would like to do next if more time is given.

CASE 5

MARKET ASSESSMENT FOR A PROJECT PLANNING SYSTEM

You are a member of the Management Science Department of the University of Capitalville and have been approached by a visiting consultant, Mr. Smooth, from Materialist Management Systems Ltd (MMS). MMS have pioneered the development of a project planning system based on a mini-computer with appropriate input and output facilities and graphics display. This total system is not prohibitively expensive, and includes good software for setting up networks, identifying critical activities, scheduling resources and writing reports. The system has sold well in Europe and the USA and MMS are considering marketing it in Third World countries.

Mr. Smooth's proposal is for you to survey the market for potential sales of their system in your country. MMS have identified the construction industry as one suitable target but they would be happy to explore the market in other sectors if you advise that this would be more appropriate. MMS would wish to comment on your proposal and then get you to conduct the survey and to write a report on the results. You will, of course, receive a suitable fee for your services and thus are keen to help Mr. Smooth as he suggests. You accept the project after a relatively short discussion on terms and conditions.

You describe your consultancy project to a colleague in the tea-room that day. He expresses interest and says that he has some material which may be of relevance. In due course, he comes up with two documents. The first document contains an extract from a report on attitudes towards formal project planning methods in the construction industry in Kenya. The report was written by an MBA student at the University of Nairobi. The second document consists of a transcript of a conversation which your colleague had concerning the use of network analysis to help plan an extension to the Kali Water Supply. The two documents are reproduced here as Appendices 1 and 2.

Instruction to student:

1. Design a survey.
2. Conduct the survey.
3. Write a report.

APPENDIX 1 Extract from MBA Student Paper on Network Analysis in the Construction Industry in Kenya

One of the characteristics of any developing country is a high rate of growth in the construction industry. In Kenya output from the construction industry is growing at the rate of approximately 20-25%. The gross product of the construction industry amounts to over 8 million Kenya Pounds. This figure is expected to double over the next five years.

The construction industry happens to be one sector where the operational research tools of network analysis and CPM can play a vital and very advantageous role. To try and evaluate the planning techniques currently in use and the future prospect of the employment of network analysis in the industry I conducted a small sample study of the planning activity.

The sample used for the study included oral interviews with four leading contractors and four groups of architects currently in operation within the Kenyan economy.

The questionnaire presented below was used to study the planning pattern currently being employed in the construction industry in Kenya. Attached also in a summary of the results of the interviews conducted.

The planning tools currently in employment in the construction industry are the traditional tool of bar-charts and Gantt charts. In the construction of the charts no effort is directed towards evaluating for the critical path that could affect the project completion. The reason given for the use of the bar-chart is that it enabled the site manager to keep the other participants in the project informed about the job progress.

Those who knew of the existence of CPM as a planning tool and who readily accepted the fact that CPM was a better tool still rejected the idea that it would serve just as well in the Kenyan case. Though a number of reasons were put forward as to why it had not been employed the basic reason that was stressed throughout the interviews was the lack of know-how factor. For to use CPM analysis to its fullest, all the participants must be aware of the method and must understand the logic of the method. This is what is lacking. One respondent reckoned that less than 10% of the people involved in the construction industry knew of its existence, let alone used it at any time.

QUESTIONNAIRE

Q.1 What method do you use in the planning for jobs or projects under your control?

ANS (i) Traditional Gantt-chart or bar-chart.
(ii) Critical path analysis using bar-charts.
(iii) Critical path analysis using network analysis on arrow diagrams.
(iv) Computer used in evaluation.
(v) Other.

Q.2 How useful is the tool currently being employed in your project planning?

Q.3 Is the plan thus drawn up used, reviewed and employed through the life-span of the project under-hand?

Q.4 Do you tender for and accept government building or construction contracts?

ANS (i) Yes (ii) No (If yes to Q.4 ask Q.5)

Q.5 Has the Government stipulated any particular planning format to be used on their projects?

ANS (i) Yes (ii) No (If answer to Q.1 is (i) ask Q.6)

Q.6 Have you ever heard of CPM?

ANS (i) Yes (ii) No

Q.7 Have you in your career ever used CPM for project planning?

ANS (i) Yes (ii) No (If yes to Q.7 ask Q.8)

Q.8 Where have you employed or come across the employment of CPM in project planning?

Q.9 How useful do you consider CPM is as compared to traditional bar-chart?

Q.10 If you consider CPM as the better tool, why then is it not in employment in the construction industry in Kenya?

Q.11 Do you foresee the use of CPM in the construction industry in Kenya in the future?

SUMMARY OF THE RESULTS OF THE QUESTIONNAIRES

1. All the project planning done in the construction industry in Kenya uses the Gantt or bar-chart.

2. The reasons quoted for the use of the above tool was that it was the only tool currently in employment within the construction industry in Kenya.

3. The bar or Gantt chart, though used throughout the life of the project, was employed as a communication tool, so that the site manager could keep the other participants informed as to the progress of the project.

4. The government of Kenya contracts architects and contractors on a rate basis, for the construction of public utilities.

5. The government does not stipulate any particular format to be used for their projects.

6. Of the sample interviewed less than half (3) knew of or had heard about the CPM for planning as a tool whose application in the construction industry can achieve high returns.

7. Only one architect of the sample used had ever been involved in a project that used CPM and this was when he was working in the UK.

8. All the three who had heard of the CPM were quick to agree that it was a better tool for project planning. But they reckoned that its usefulness in Kenya would be limited. The reason cited was lack of know-how amongst the participants in the project.

9. A variety of reasons were given as to Q.10. These were:
   (i) Lack of know-how.
   (ii) Because many of the raw materials used in the construction industry were imported. Their arrival and delay made any time estimate very vague and generally either very optimistic or pessimistic.
   (iii) Competition in the construction industry in Kenya is not as high as that in the developed countries. Thus planning and project delays do not appear as critical constraints.

(iv) Delays in project completion on average do not cost the constructor as highly as they would in other countries where he operates i.e. other developed areas where labour costs are higher. Thus the saving (i.e. costs due to bad planning) are not high enough to provide for stronger reasons to use better planning tools.

(v) Most of the projects undertaken are not large enough to make the use of bar-charts a cumbersome exercise and most of the supposed large projects are usually undertaken for the government and these are usually broken-down to phases.

10. All those interviewed who know of CPM said that it would take a very long time, without committing themselves to any particular period, before CPM as a planning tool enters the construction industry in Kenya. The chief reason given here is that it will occur only when most of the participants become aware of the tool.

APPENDIX 2 Edited Transcript of Conversation on Network Analysis for Project Planning

The following conversation took place between Dr. V. Portant of the University of Capitalville (VP) and Mr. G. Lots (GL) of Amundsen, Heath and Partners.

VP Good morning ... What can I do for you?

GL I understand that you teach Network Analysis here at the University and I wanted some advice.

VP Yes. Fire away.

GL We are using network analysis to plan an extension to the water supply for the town of Kali. At the moment the network is drawn out by hand and we've done the planning that way. I wondered if it might be a good idea to put the network on a computer.

VP What stage is the project at? Have you actually started or are you still at the planning stage?

GL Well that's the point. We've been doing the planning so far but we're starting the project soon and think that it may be easier to put in the actual times which jobs have taken and re-evaluate the network if we had it on a computer.

VP What made you use a network analysis? Is it standard procedure for Amundsen, Heath?

GL No it isn't and actually half the money for the project is coming from a World Bank loan and the Bank stipulated that it must be used by the consulting engineers.

VP Why were you allocated to it - did you have any special knowledge?

GL No. I was put in charge of the project and, after we'd been told to use network analysis, I read it up for myself ... I think it fair to say that we only used network analysis because we had to, but we now realise that it's a much more realistic method than bar-charts and it has greatly improved our project planning.

VP That's interesting. Well, in terms of computers, you could ask yourself a number of questions. Like, how frequently are you likely to update the network and how often are you likely to re-run it. Or, put it another way, do you see it as being an occasional aid or something for close control?

GL Well, I think we'll want to update it fairly frequently and run it perhaps once a month.

VP So it's not for close control.

GL No. I don't think we see it used in that way.

VP How big is the network anyway? I should have asked you that earlier.

GL It's about 250 activities, give or take a few.

VP That's not very big as networks go. My feeling, off the top of my head, is to stick to your manual system. What access to computers have you got?

GL Well, none at the moment. Could we try it on your University machine?

VP I'd be happy to put it on for you myself but it's a cumbersome monster. I don't think you'd want to use it on a regular basis.

GL Well, thanks for the offer. I may take you up on it. But your feeling is to go ahead by hand?

VP Yes, I think so. But I'd be quite keen to try to put it on the University machine as a trial. Let me know about that.

GL OK after I've had a chat back at base. Well, thanks for your help ...

Sequel: GL rang VP a week or so later to say that they'd decided not to put it on a computer and thanks again for his advice. His boss wasn't very keen on the trial idea but perhaps another time.

CASE 6

VILLAGE WATER PUMPS

1. BRIEFING

Jacob Nzande is a student on the M.Sc. Operational Research at the University of Lanton. He has successfully completed his examinations and is now required to carry out a three month project. He had been discussing a project on stock control in an engineering company. Just at that time he received a telex from the Ministry of Manpower in his country of Transbabwe summoning him home. Transbabwe has just emerged from a long war of independence from post-colonial rule. The new government is committed to a rapid improvement in the lives of the majority of the black citizens which have been seriously disrupted by the independence war. Educated Transbabweans are few so that the government has been recalling students as soon as they finish courses abroad.

At first Jacob was quite annoyed to have his plans disrupted and thought of postponing his return. But he then thought that he should take the opportunity of helping his country which had subsidised his education. After discussion with his university tutor he felt more confident that he could find work in Transbabwe which would prove suitable to be written up for his M.Sc. report.

After his return to Ambrosia, the capital city, Jacob was assigned by the Ministry of Labour to Transbabwe Manufacturing Company (TMC). The Managing Director of TMC received Jacob with enthusiasm assigning him to form a trouble-shooting and planning team.

Transbabwe Manufacturing Company was formed by the new government taking over Anglo-Continental Holdings (ACH) which was the Transbabwe arm of a multi-national company. After independence ACH had withdrawn all its foreign managers leaving the company in a very bad state. The government had therefore taken over the company and put in its own managing director. He was desperately trying to rebuild the company. One of the main products of TMC is pumps for village water supply for irrigation and drinking.

The Managing Director has just come back from a meeting with the Minister of Industry who has reported to him on the recent Cabinet Meeting. Rebuilding of the villages and encouragement of agriculture has been given the top priority in order to establish the people's confidence in the new government. One of the key items discussed was the supply of drinking water and irrigation. The Minister of Industry has promised the Cabinet that TMC can carry out assessment and repairs of the present village pumps in two months.

Part of the conversation:-

Jacob I don't think that it will be possible with the present staff of two mechanics in each workshop even if they are fully occupied on the project for two months.

MD Why not? Can you give me an accurate plan?

Jacob Because of the uncertainty of the number of pumps and their state of repair I can only make a rough estimate.

MD Well work full-time for the next two days to make a plan and particularly estimate how we can do the job in two months. I will have to report to the Minister at the end of the week before he goes to the next Cabinet meeting.

2. THE PUMPS

Jacob set out to gather information about the pumps, and searched in Head Office for records before he went out into the field. It seemed that very few records were available as the ACH management has taken them away or destroyed them at nationalisation. Most of his information came from hearsay discussions with long serving clerks.

Between 1961 and 1975 ACH imported all the pumps but then in 1976 switched completely to local manufacture in Transbabwe. The average number imported prior to 1976 was estimated to be 100 per year. It is thought that about half of those never got to the villages but were sold in the small towns for a variety of purposes. The life of a pump with good care is ten years but as the standards of maintenance in the villages is usually poor only a small proportion of the imported pumps would be expected to be in use for ten years.

From 1976 ACT manufactured the pumps in Transbabwe. The production figures are known accurately.

1976	200
1977	100
1978	100
1979	100
1980	200
1981	200
1982	250
1983	250

The type of pump manufactured in Transbabwe since 1976 is an improved version, more robust for village use so its life should be extended. Also the adaption means that very few would be used in the towns. During 1977/78/79 production was only half that planned because of various disruptions due to the war. Now production has reached 250 pumps a year which is the capacity of the present factory. Any increase would need major capital investment.

Jacob was unable to get any accurate figures of the life of pumps based on his enquiries in the Head Office. He decided that he must visit some of the workshops. This meant that he could not complete the report in two days for the Managing Director. He had an extremely difficult discussion before the MD accepted that a report in two days would be of little value. The MD then had to convince the Minister of Industry to allow an extension and in his turn the Minister had to get Cabinet agreement for a postponement.

3. THE PEOPLE

The last census took place in 1971 and, because of the political and military struggle of the last few years it is very difficult to get accurate population estimates. A visit to the department of Demography, University of Ambrosia, produced the following estimates for mid-1981.

Total population	=	6,000,000
the population of the three major towns is		
Ambrosia	=	500,000
Bandara	=	250,000
Cresgi	=	250,000
in addition there are thirty small towns with average populations of 50,000		
	=	1,500,000
there are estimated to be about three hundred villages with an average population		
of 1,000	=	3,000,000
in addition there are nomadic people in the isolated eastern region		
	=	500,000

Like most developing countries the population is young and growing - 45% of the population are under the age of 15, and the annual growth rate is 2.5%.

So far there has not been the heavy influx of rural population into the towns and cities which has occurred in so many developing countries. The government has stated that it wants to build up the services in the villages in order to prevent rural-urban migration.

Although the government has nationalised several subsidiaries of multi-nationals which were particularly exploitative it is not setting up a completely controlled economy. It is permitting a market economy but with import and investment controls. The government's stated objectives include: the spread of labour intensive industry to soak up urban employment; the production of simple but not luxury consumer goods; the building up of a transport and communications infrastructure; the achievement of self-sufficiency in agriculture, together with the development of villages, health services, etc., to stem the migration to the towns.

4. THE WORKSHOPS AND THE MECHANICS

Jacob decided that it was essential that he visited some of the workshops to find out what the mechanics could do and what they knew about the pumps in the villages.

In each of the thirty small towns there is a workshop with two mechanics capable of the repair and maintenance of the pumps. Major repairs require dismantling the pump and bringing it into the workshop. Few of the workshops had records of the current state of pumps in their neighbouring villages. One or two had some rather out-of-date records of the life of pumps which Jacob thought could be useful. A major repair of a pump takes one mechanic about five days in the workshop if there is an adequate supply of spare parts. Installing a new pump in a village takes about five days.

The mechanics have to divide their time between major repairs in the workshops, travelling to the villages for assessment, and minor repairs. A proposal was made by one mechanic that they should train village maintenance workers. His experience was that pumps were often out of operation for very minor reasons which should not need a mechanic travelling out from the town. He estimated that ten villagers could be trained together for a week up to an adequate standard. Jacob's assessment of the mechanics was that the majority were quite competent and quite highly motivated considering that they had been left very much to their own devices in the past few years with little supervision, limited transport, and, what they complained about most, an erratic supply of spare parts.

Jacob decided to take three of his precious days to make a trip out with a mechanic to some of the villages. He thought that this was the only way that he could get some idea of the real problems that he had to advise on. He was thus able to observe directly the situation, admittedly in a very small number of villages in one locality. But he was also able to draw on the mechanic's wide experience and talk much more openly than they could in the office in the town.

They started with travel to the first village. This took about three hours. Later, work with a map measuring a sample of inter-village journeys showed that three hours was quite a good estimate of the average travel time between villages.

Next, the mechanic carried out a preliminary assessment of the pump, if there was one there. The records were not accurate enough to be able to bypass a village. The assessment took about two hours. The pump may be judged beyond repair and scrapped, or needing minor repairs which could be carried out in the village provided that the mechanic could start off with a full set of spare parts.

Minor repairs would take about three hours. On the other hand if the pump needed major repairs it has to be dismantled and taken on the vehicle to the workshop. If there was time at the end of the day the mechanic would travel on to the next village before nightfall. The situation was too dangerous in most parts of the country for night travel as well as the poor state of many of the roads. The total working time including travel for the mechanics is supposed to be nine hours. Given the difficulties of the work and travel Jacob felt that this was fair. He felt quite exhausted himself at the end of the day. Admittedly he had been outside the country for two years and needed to get re-acclimatised.

If the village had no pump or the pump was scrapped Jacob and the mechanic spent about three hours trying to assess the needs of the village for a water pump. It seemed to Jacob that there must be differences in priorities for allocating new pumps but no procedure had yet been developed.

Overall, Jacob felt that his three days travel had been extremely useful in getting a general feel for the situation on the ground and also for getting some specific estimates of activity times which could be used for a first attempt. Of course, these would have to be revised and updated.

5. MORE ON THE PUMPS

When Jacob returned to head office he was told that a report had been found on the life of pumps manufactured in Transbabwe since 1976. This suggested that for the first five years of life about five per cent of the working pumps failed and had to be scrapped each year. From the sixth year it was predicted that the failure rate would increase linearly and that by the twelfth year virtually all pumps would have been scrapped.

6. THE TASK

Produce a short report for the Managing Director, with technical appendices as necessary, setting out a feasible plan for the project to assess and upgrade the village pumps. Include a procedure for Jacob's planning unit to monitor and control the progress of the project.

CASE 7

USERS' PERCEPTION OF TELEPHONE SERVICE

You have just complete your M.Sc. in Operational Research and have joined the Transitanian Government Operational Research Group (TGORG). This is a small group of O.R. staff which has recently been formed to supply O.R. consultancy services to Government organisations.

Prior to your arrival at TGORG, the Group had been commissioned by the Telephone Corporation of Transitania to carry out a survey of the telephone system in two regions of Transitania, Nangi and Elsabet. The general purpose of the survey was to gain a better understanding of the link between the telephone system and economic development in order to make recommendations to TCT on desirable policies for expansion of telephone supply.

At the time of your arrival at TGORG, a major survey of telephone users has been carried out and a large quantity of data has been compiled into tables. The O.R. Group is now analysing this data as a preparatory stage to writing their report for TCT. The O.R. Manager has decided to test your abilities by asking you to carry out this analysis stage in one particular area. The area which he has selected for you is the relatively simple one of user perceptions of the telephone service. The available data in this area consists of five tables of results from the survey together with a brief description of the survey method which produced these results. The tables and the survey method description are contained in Appendix 1.

The O.R. Manager has asked you to study these tables carefully and to write a short draft report. If this report is satisfactory, the Manager plans to incorporate all or part of it in the main report to TCT. The Manager has asked you to concentrate on the main conclusions which can be drawn from the survey results. In some cases, it may not be possible to form a firm conclusion, but the Manager is willing for you to put forward some reasonable hypotheses to explain the results, provided that you state clearly that these are not definite conclusions.

Whilst carrying out your task, you have the opportunity to be involved in a meeting with the Deputy Managing Director of TCT and the Managers of all the telephone regions, including Nangi and Elsabet. This meeting concerns future policy for the development of the telephone service in the various regions of the country. A transcript of part of the meeting is given in Appendix 2.

To the student: Write a short report (max. 500 words) as required by the O.R. Manager. Your inferences on user perceptions of the telephone service should be related to some of the policy issues mentioned in the policy meeting.

APPENDIX 1 SURVEY METHODS AND RESULTS

The sampling frame for the survey was the total set of telephone users in the selected regions. The population was stratified by economic category and by the hierarchical level of the place where the respondent carried out his business: these being Principal Towns, Urban Centres, Rural Centres and Market Centres in descending order of size. The survey included about 200 personal interviews with the telephone subscribers, over 100 sets of diary forms on actual telephone calls made, approximately 300 postal questionnaires and some interviews with coin box users and applicants for the telephone service. The vast majority of the respondents to the survey were business users of the telephone since private, or residential, use is very low in the regions surveyed.

The regions of Nangi and Elsabet are in different areas of the country of Transitania but are both predominantly rural regions, in the sense that the livelihood of the great majority of the people is gained directly from farming. Both regions contain one Principal Town and a number of smaller places which are classed as Urban Centres, Rural Centres or Market Centres. The regions do however differ in their state of development. The region of Nangi is a relatively prosperous, rapidly growing region with good infrastructure. The Principal Town in the Region has strong connections with the other places in the Region in terms of the amount of trade between them. In contrast, Elsabet has poor rural infrastructure but high urban growth in the Principal Town. This is explained by the fact that the Principal Town in the Region contains a number of industries which are geared to a market outside the Region. This market is primarily the capital city of Transitania and export markets. The Principal Town in Elsabet does not have strong economic links with the smaller places in its Region.

With respect to the questions on the telephone service which were directed to survey respondents, a number of points should be noted. The automatic telephone service, in which callers are able to dial other people automatically, is only available in the larger places of the regions, namely both Principal Towns and a few of the Urban Centres. The telephone service in smaller places is termed 'Operator Service' and relies on the user dialling the operator and waiting for the operator to connect their call. In both cases of automatic and operator service, distinction is made between local and non-local service, namely calls being made to persons in the local area of the caller and to more distant places respectively. When questioned about any aspect of the telephone service, respondents were free to make 'no comment' if they wished.

Five detailed tables of survey results are attached.

Table 1 Perception of Automatic Service

Set of Respondents: All

Number of respondents making the given comment about the local and non-local components of the automatic phone service
(Number of respondents making the comment as a percentage of respondents making at least one comment)

Comment made	Local Service			Non-Local Service		
	Nangi Region	Elsabet Region	Total	Nangi Region	Elsabet Region	Total
No problems	45 (53.6)	45 (64.3)	90 (58.4)	36 (39.1)	6 (8.2)	42 (25.5)
Delays acceptable	21 (25)	17 (24.3)	38 (24.7)	13 (14.1)	4 (5.5)	17 (10.3)
Some delays	7 (8.3)	2 (2.9)	2 (5.8)	9 (9.8)	5 (6.8)	14 (8.5)
Delays bad	6 (7.1)	4 (5.7)	10 (6.5)	14 (15.2)	14 (19.2)	28 (17)
Delays very bad	5 (6)	1 (1.4)	6 (3.9)	17 (18.5)	45 (61.6)	62 (37.6)
Crossed lines	2 (2.4)	1 (1.4)	3 (1.9)	9 (9.8)	2 (2.7)	11 (6.7)
Bad during day	1 (1.2)		1 (0.6)	7 (7.6)	14 (19.2)	21 (12.7)
Wrong numbers				7 (7.6)	1 (1.4)	8 (4.8)
Too difficult to use				6 (6.5)	1 (1.4)	7 (4.2)
Total of respondents making at least one comment	84	70	154	92	73	165
No comment	265	155	420	257	152	409
% of respondents making at least one comment	24.1%	31.1%	26.8%	26.4%	32.4%	28.7%

Table 2 Perception of Operator Service

Set of Respondents: All

Number of respondents making the given comment about the local and non-local components of the operator controlled phone service (Number of respondents making the comment as a percentage of respondents making at least one comment)

Comment made	Local Service			Non-Local Service		
	Nangi Region	Elsabet Region	Total	Nangi Region	Elsabet Region	Total
No problems	88 (38.6)	34 (17.3)	122 (28.8)	27 (11.9)	12 (6.0)	39 (9.2)
Delays acceptable	34 (14.9)	33 (16.8)	67 (15.8)	19 (8.4)	10 (5.0)	29 (6.8)
Some delays	32 (14.0)	41 (20.9)	73 (17.2)	25 (11.1)	18 (9.0)	43 (10.1)
Delays bad	48 (21.1)	60 (30.6)	108 (25.5)	79 (35)	52 (26.0)	131 (30.8)
Delays very bad	23 (10.1)	18 (9.2)	41 (9.7)	84 (37.2)	128 (64.0)	212 (49.8)
Wrong numbers	1 (0.4)	2 (1.0)	3 (0.7)	3 (1.3)	2 (1.0)	5 (1.2)
Crossed lines	1 (0.4)	1 (0.5)	2 (0.5)	2 (0.9)	5 (2.5)	7 (1.6)
Operators inefficient	22 (9.6)	39 (19.9)	61 (14.4)	18 (8.0)	41 (20.5)	59 (13.8)
Operators rude	22 (9.6)	25 (12.8)	47 (11.1)	19 (8.4)	26 (13.0)	45 (10.6)
Operators need reminding	3 (1.3)	4 (2.0)	7 (1.7)	3 (1.3)	7 (3.5)	10 (2.3)
Faint or noisy lines	5 (2.2)	8 (4.1)	13 (3.1)	11 (4.9)	14 (7.0)	25 (5.9)
Too difficult to use	4 (1.8)	1 (0.5)	5 (1.2)	6 (2.7)	3 (1.5)	9 (2.1)
Easier to visit than to phone	2 (0.9)		2 (0.5)			
Cut off during calls	1 (0.4)	7 (3.6)	8 (1.9)	2 (0.9)	10 (5.0)	12 (2.8)
Bad during day				6 (2.7)	15 (7.5)	21 (4.9)

Table 2 (continued)

Comment made	Local Service			Non-Local Service		
	Nangi Region	Elsabet Region	Total	Nangi Region	Elsabet Region	Total
Total of respondents making at least one comment	228	196	424	226	200	426
No comment	121	29	150	123	25	148
% of respondents making at least one comment	65.3%	87.1%	73.9%	64.8%	88.9%	74.2%

Table 3 General Perception of Service

Set of Respondents: All

Number of respondents in different regions making given comment (Number of respondents making the comment as a percentage of respondents making at least one comment)

Comment made	Nangi	Elsabet	Total
Bill greater than use	10 (8.5)	19 (19.4)	29 (13.5)
No bill explanation	4 (3.4)	1 (1.0)	5 (2.3)
No call delay explanation	2 (1.7)	2 (2.0)	4 (1.9)
Delay causes loss/inconvenience	34 (29.1)	26 (26.5)	60 (27.9)
Maintenance delay causes loss/inconvenience	19 (16.2)	10 (10.2)	29 (13.5)
Prices too high	4 (3.4)	2 (2.0)	6 (2.8)
Want 24 hours service	5 (4.3)	5 (5.1)	10 (4.7)
Want automatic or STD service	32 (27.4)	40 (40.8)	72 (33.5)
Equipment provision slow	7 (6.0)	3 (3.1)	10 (4.7)
No complaints/good	15 (12.8)	1 (1.0)	16 (7.4)
Number of respondents making at least one comment	117	98	215
Number of respondents making at least one comment as a percentage of all respondents	33.5%	43.6%	37.5%

Table 4 Complaints made by Economic Actors Compared to Average Rate of Complaint

Set of Respondents: All

Economic Category	Ratio of the number of comments classed as complaints made by respondents in economic categories to the average number of comments classed as complaints made by all respondents
Construction	1.27
'Hard' Industry	1.17
Public Administration and Security	1.13
Other Services	1.12
Banking & Finance	1.12
Other Communications	1.05
Utilities	1.02
Wholesale Trade	1.0
Transport & Storage	0.96
'Soft' Industry	0.94
Retail Trade	0.93
Other Agriculture	0.88
Plantation Agriculture	0.81
Residential	0.45

Table 5 Complaints at Level in Hierarchy Compared to Average Rate of Complaints

Set of Respondents: All

Level	Ratio*
Principal Town	1.21
Urban Centre	1.02
Rural Centre	0.55
Market Centre	1.11

* As defined for Table 4

APPENDIX 2 PARTIAL TRANSCRIPT OF A POLICY MEETING

DMD Deputy Managing Director
MNR Manager - Nangi Region
MER Manager - Elsabet Region

MNR But we are going to need a rapid development of the telephone service to the smaller places in the Nangi region over the next few years. The region is expanding rapidly, as you know, and we must make sure that the telephone service keeps pace with that development.

DMD We'll try to help you as far as possible but the Government imposes a strict constraint on our foreign exchange borrowing and there is a very large unmet demand for the telephone service in all our major cities. You know that we make a much better return on capital by expansion of the service in major urban areas compared to expansion elsewhere.

MNR Well, I know that's true, but we must find funds to help development in the rural regions. The President's speech last week emphasised the need to provide resources in the rural areas to make it attractive for people to develop those areas. This applies to the telephone service as well as other infrastructure. Nangi region is being successful and we must keep it that way.

MER I realise, DMD, that funds are going to be limited for telephone service expansion in the regions and I hope we in Elsabet are going to get our fair share. Nangi is already a much more prosperous region than my own and it would be wrong to spend all the capital there. We need to catch up with them and priority should be given to our problems.

DMD We'll try to make a fair allocation of funds between the regions but it's very difficult. We have to show some return on capital from our investments and improving service in small rural places doesn't pay in financial terms. That's particularly true in the smaller places in regions like Elsabet where demand for the service is low.

CASE 8

PLANNING NURSE TRAINING

PART I - THE PLAN

1. BACKGROUND

The Transitania Ministry of Health has adopted the World Health Organisation (WHO) policy "Health for All by the year 2000". This places increased emphasis on primary health care (PHC) to deliver adequate health services to the rural areas where 80% of the population of Transitania live. At present 60% of the health budget goes to the high technology hospitals in the cities which serve a small proportion of the population.

Some research studies have shown that nurse training is largely based on hospital care and does not prepare nurses for work in rural health centres. Currently all nurse training takes place in the cities and recruits from the villages are reluctant to return there when they have graduated. The Minister of Health has ordered that nurse training be changed and decentralised out of the cities to a great extent. A joint planning team has been set up with members from the Nursing Division and the Health Planning Unit to prepare a proposal.

A proposal has been put forward by the Director of Nursing which discusses the curriculum and administration arrangements. However, it contains very few numbers or specific targets and no cost information.

At present there are three nurse training schools, one in each of the major cities attached to the general hospitals. It is proposed to reduce the intake of the three city schools so that they produce just enough graduates for the city hospitals, and to open a number of new schools in small towns with much of the training taking place in rural health centres outside these towns.

2. BASIC INFORMATION

The joint planning team decided that it needed to obtain information about the current numbers in post by age in order to estimate future needs. The staffing of the city hospitals is 500 nurses and is expected to remain the same over the next ten years. Although the 5 year plan does suggest some cut back in hospital beds it is thought that advances in medical techniques and shorter patient stay will require an increase in the nurse staffing ratio per bed.

An age profile of the current nurses in city hospitals is available from a recent survey.

Age band	Number	Annual Wastage %
26-30	140	4
31-35	80	3
36-40	100	3
41-45	100	3
46-50	80	2
Total	500	

The uneven numbers were caused by changes in policy on recruitment and staffing over the years and political unrest. The estimates of annual wastages are very rough. All nurses retire at 50 years of age.

The annual intakes of the three schools are:

A	50	students a year
B	40	" " "
C	30	" " "

The training is for three years. Data has been analysed which shows that the average drop-out of students is 5% in each year, and that 10% of students taking the final examination fail. Of the graduates about 50% have taken jobs in rural health centres, about 40% in the city hospitals, and the remaining 10% have stayed in the city taking jobs in the private sector.

The present number of nurses in rural health centres is 450 with the age distribution given below.

Age band	Number	Annual Wastage %
26-30	150	2
31-35	100	1
36-40	100	1
41-45	60	1
46-50	40	1
Total	450	

The wastage rates are lower for the nurses in rural health centres because they are less likely to move, and female nurses can have their children and continue working after maternity leave. This is less feasible in the city hospitals. The current proposal for expansion of rural health services envisages increasing the present 450 nurses to 700 in five years, and to 1,000 in a further five years.

The proposed new training schools will be placed in small towns with considerable practical attachments to selected rural health centres. These new schools will have a maximum intake of 20 students a year, for a three year training program as before.

A paper has been put out by the Finance Department with the Building Division which says that it will not be possible because of financial and building constraints to start more than two schools a year. The capital cost of a school is estimated to be $T1,000 per student place, and the operating cost to be $T250 per student per year including the additional costs for the health centres. But there is a capital cost of building overnight accommodation at the training health centres of $T200 per place. The operating costs of the city training schools are $T500 per student per year.

3. BRIEFING 1

Assume that you are a member of the joint planning team.

Develop a plan for building the rural training schools and show if it is possible to meet the targets. Consider also the intake to the city training schools needed to maintain the nursing strength of the city hospitals.

PART II - RESPONSE TO THE PLAN

4. RESPONSE TO THE PLAN

The Minister was rather impressed by the plan and used some of the material in a speech. This provoked a range of different comments.

The Minister himself wanted a link made between nurse training and the training of doctors. Decisions have to be made shortly about the proposed expansion of the medical school. At present Transitania has a number of foreign doctors on contract. There is considerable pressure from the Transitania Medical Association to expand the medical school and aim for only Transitanian doctors in a few years.

However, there is a counter-view from the so-called "Chinese" group of politicians that doctors, among other professionals, are too expensive and do not serve the people. Their view is that the number of doctors should be cut back and many more village health workers could be afforded.

The reaction from the nursing establishment to the draft plan is split. One group believes that standards will decline in the rural training schools and therefore the minimum number should be built. Also that wastage rates will increase significantly. The other group, mainly younger with public health education, wants to reduce nurse training to two years so as to improve the national coverage of health services more rapidly.

Detailed discussion of the draft plan with the Engineering Division brought the comment that it was unlikely that health centres would be built, staffed and equipped as rapidly as had been assumed. Therefore, there was a danger that nurses would be trained before there were posts available for them.

5. BRIEFING 2

The joint planning team is required by the Minister to consider how the plan might be revised to deal with the wider range of alternatives and the various uncertainties in the future.

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