

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
SCHOOL OF INFORMATION STUDIES FOR AFRICA

PLAN FOR ESTABLISHMENT OF A NATIONAL INFORMATION
SYSTEM FOR AGRICULTURAL DEVELOPMENT IN SUDAN

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT
FOR THE DEGREE OF MASTER OF SCIENCE IN INFORMATION SCIENCE

BY

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ADDIS ABABA UNIVERSITY
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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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26 May, 1994

The thesis has been submitted for examination with our approval as university advisors



Prof. A. Neelameghan

Date 26-05-1994



Dr. G. Bhattacharyya

Date 26.05.1994

DEDICATION

This work is dedicated to :

- * My parents : William Girgis and Marium Yagoub
- * My brothers : Romel, Robert, and Rida;
- * My sisters : Nagah, Entisar, and Manal; and
- * To whom I owe my education

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It is impossible to list all those to whom I owe a debt of some kind in the preparation of this thesis, and it will be invidious to select only a few for special mention. However, it will not be out of place to mention some here.

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My sincere gratitude to my parents, my sisters and my brothers who have continuously prayed for my safety and welfare in Ethiopia.

ABSTRACT

It is being recognized in an increasing measure that for faster pace of socio-economic development, it is not only necessary to promote scientific and technological research and development but also to disseminate information about the findings and products at a faster pace targeted at their potential users. Further, it is also being recognized by many developing countries that a National Development Plan should include strategies for developing a national infrastructure for development information.

This study proposes a plan for establishing a national agricultural information system for Sudan and a strategy for its implementation. Questionnaires were sent to different agricultural institutions/organizations, research stations/centres in livestock, fisheries, forestry, environment and natural resources, etc. in Sudan to survey the status of agricultural information facilities, and to researchers in agriculture and related sciences to survey their information needs. Based on the findings of the survey, Sudan's existing infrastructure in relation to agricultural education, research, extension services, organizations and institutions, documentation and information services and transportation and communication is discussed. Constraints and

limitations in relation to agricultural research, extension services and information service facilities are discussed.

The planning, designing and development of the national agricultural information system, must take into account the elements of the environment, namely Sudan. Further, the information system plan should be compatible with and eventually integrated into the national socio-economic plan. Therefore, information about and description of the country, especially its geographic location, climate and vegetation, population, planning and development, and economic situation is presented.

National agricultural information system and network, their objectives, functions and activities are discussed. A plan for establishing a national agricultural information system and its implementation strategy is formulated. The development of national agricultural information network with the National Documentation and Information Centre (NADIC) as a focal point is suggested. Development of databases containing sample records on information sources and systems, experts, institutions, etc. relating to agriculture is suggested to facilitate referral service on agriculture. Proposed vocabulary control tools by using computer is suggested. Finally, a summary, conclusion and recommendations are presented.

LIST OF ABBREVIATIONS

AACR2	Anglo-American Cataloguing Rules 2
ACADI	Arab Centre for Agriculture, Documentation and Information
AGRIS	The International Information System for the Agricultural Sciences and Technology
AOAD	The Arab Organization for Agricultural Development
ARC	Agricultural Research Corporation
CAB	Commonwealth Agricultural Bureaux
CARIS	Current Agricultural Research Information Systems
CCF	Common Communication Format
CEHANET	Centre for Environmental Health Activities Network
CEC	Commission of the European Communities
DIC	Documentation and Information Centre
DSRC	Development Studies and Research Centre
FAO	Food and Agriculture Organization
IBE	International Bureau of Education
IBM	International Business Machine
IDIN	International Development Information Network
IES	Institute of Environmental Studies
ILCA	International Livestock Centre for Africa
ILO	International Labour Organization

INFOTERRA	International Information Centre for the Environment
INIS	International Nuclear Information System
ISBD	International Standard Bibliographical Description
ISIS	Integrated Set of Information System
ISO	International Organization for Standardization
LAN	Local Area Network
MARC	Machine-Readable Catalogue
MFN	Master File Number
MIBIS	Manual for preparing records in Microcomputer-based Bibliographic Information Systems
NADIC	National Agricultural Documentation and Information Centre
NCR	National Centre for Research
OECD	The Organization for Economic Co-operation and Development
PADIS	Pan-African Development Information System
SAA	Sudan Agricultural Abstracts
TCDC	Technical Cooperation among Developing Countries
UNDP	United Nation Development Programme
WHO	World Health Organization
WAN	Wide Area Network

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CHAPTER 1
INTRODUCTION

1.1 WORKING DEFINITIONS

In recent times, it has been well realized that for faster pace of socio-economic development, it is not only necessary to promote scientific and technological research but also disseminate information about the findings and products at a faster pace targeted at their potential users. Further, it is also being well recognized by many developing countries that a National Development Plan should include strategies for developing a national infrastructure for scientific and technological information. This awareness on the part of national planners, scientists, technologists, and others has led to drawing up plans for national, regional and local information system and services for different subject-oriented and mission-oriented fields (Seetharama, 1990, p. 1).

In attempting to discuss the subject of planning information systems and services, it would be helpful to define the scope of some specialized terms which would be frequently used in this work. This is especially necessary because the interpretation of the meanings of terms depends on the context in which they are used.

1.1.1 Information System

An information system essentially comprises of a combination of various functions, including facilities for the collection and analysis of data, its storage, retrieval and dissemination to users. These functions require institutional infrastructure and arrangements for collecting data from information sources at national and international levels, and storing, processing such data for easy retrieval (Inganji, 1988, p. 2).

1.1.2 Information Services

Supplying necessary scientific, technical, developmental and other information by information agencies and services to potential users. Information services can take various forms, including information publications, (indexing, abstracting and various periodicals and bulletins), bibliographies, translation of scientific documents from one language to another and the preparation of reviews, factual data and recommendations. Information service also involves supplying clients with original or copies of scientific and technical documents. The most promising direction for expansion of information services is in the development and implementation of a system for selective

dissemination of information that would take into account the specialists or a group of them.

1.1.3 Information Infrastructure

The national capabilities for making knowledge and information accessible, for the transfer of knowledge and information and therefore for putting knowledge to work are often referred to as a country's infrastructure (Atherton, 1977, p. 1). It consists of information resources, services and systems, supported or not by informatics and telecommunication facilities, necessary for the processing and delivery of information. The traffic within this infrastructure is information itself (Montviloff, 1990, p. 6).

1.1.4 Information Network

An Information Network is any arrangement for facilitating access to and exchange or sharing of information and data and for providing mutual assistance between two or more developing countries and/or between developing countries and developed countries with a view to supporting national and regional socio-economic development plans, programmes and activities. A system or

network may be operated totally manually or use information technology (Neelameghan, 1991, p. 2.).

1.2 OBJECTIVES OF THE STUDY

1.2.1 General Objective

The general objective of the study is to examine the information support facilities for agricultural development in Sudan and to come up with proposals, plans and recommendations for the establishment of an effective and efficient national information support system and services for agricultural development in Sudan.

1.2.2 Specific Objectives

The following specific objectives are derived from the general objective :

- 1) To identify the existing agricultural information support facilities and to examine their contribution toward the growth of the agricultural sector, agricultural development plan preparation, etc. i.e. to conduct a survey;

- 2) To identify problems and inadequacies, if any, of the existing agricultural information systems and services;
- 3) To identify the information needs and sources for, researchers, investors in business, decision makers, planners and executers in government, associations, international and regional agencies, etc, concerned with agricultural development;
- 4) To propose development of a national agricultural information centre as a referral centre for investors, agriculturalists, managers, planners, policy makers, decision makers, and others.
- 5) To prepare several prototype data bases :
 - i. Agricultural research projects;
 - ii. Experts in the field of agriculture;
 - iii. Agricultural units and institutions and their information products;
 - iv. Agricultural information system profile
- 6) To propose vocabulary control methods and tools to:
 - facilitate the consistent representation of subject matter by indexers and researchers through the use of vocabulary control tools including online; and
 - to improve information retrieval from agricultural data bases;

1.3 SCOPE AND LIMITATIONS OF THE STUDY

This study focuses as indicated in the preceding sections specially on information support planning for agricultural development in Sudan, to identify the information requirements of the different groups involved in agricultural development process, and how these groups obtain the information they need and the different sources they use for the purpose. It will discuss the problems involved in providing information to agriculture development.

As Sudan is a vast country and the means of transport especially roads and railways are not adequate, it was not possible in the limited time and finance available to reach each and every agricultural institution/organization, and research centres/stations scattered all over the country. All organizations surveyed are located in Khartoum and Wad Medani and account for 80 per cent of the total number.

Issues covered by this survey are : organizational activities and objectives concerning agriculture, specialization, existing data types, communication practices, on-going projects, available manpower and technological resources, etc.

During data collection, an effort was made to approach departments concerned with agriculture. Because of the non-existence of a well-organized information unit, which systematically handles the information generated within the organization, it was very difficult to get all information in one place. Most of the documents useful for this study were available only in one copy each, and because of lack of photocopy services in most libraries and information units, I failed to obtain photocopies of some of them.

The assessment of the existing data/information status of each organization might have missed some relevant items, data/information which could not be obtained at the time of data collection. The other important problem faced during data collection was that with some respondents it was necessary to meet each of them more than three times to get the completed questionnaires. Questionnaires mailed to different agricultural institutions outside Khartoum, elicited relatively poor response.

1.4 PROBLEM STATEMENT AND JUSTIFICATIONS

1.4.1 Problem Statement

Sudan, the largest country in Africa, has an area of 2.5 million square kilometres (967,500 sq.mi); almost one-third size of continental US. The land is generally flat with mountains in the eastern and western regions. Climatic conditions vary between low rainfall in the north to tropical rains in the south. One-third of the land area is desert or semi-desert, while the other two-thirds can be considered as potential arable land. The population was estimated at 26.2 million in 1989, with an annual growth rate of about 3 per cent, and an average density of 10.5 persons per square kilometre. Eighty per cent of the population live in and derive its livelihood from rural areas; and over 60 per cent of them are engaged in agriculture.

The major economic sector is agriculture, and therefore its productivity and efficiency are central to any program for Sudan's economic recovery. Agriculture accounts for about 40 per cent of the Gross Domestic Product (GDP), 75 per cent of the GDP in the production sector, and 90 per cent of the labour force. GDP (1988 est.) : \$9 billion. GDP annual growth rate (1990 est.) 0.0 per cent; Per capita income GDP (1990 est.) : \$300.

The general composition of agriculture in Sudan consists of production of basic consumer crops and cash products. Agricultural products include cotton, peanuts, sorghum, sesame seeds, gum arabic, sugar cane, livestock, and fish. Most productive capacity outside of agriculture is dependent on agriculture - as a source of raw materials, as a consumer of goods and services, or as the major source of foreign exchange.

Traditional and mechanized farming is rain-fed, whereas modern schemes are irrigated from the Nile and its tributaries (White Nile, Blue Nile, etc). In addition, there is a poorly exploited animal husbandry sector. The mechanized rainfed sector covers about 10 million feddans and is geographically confined to the western and eastern states of the country extending along the savanna belt. Sorghum and sesame are the main crops and production is market-oriented. Unfortunately the sector expanded more rapidly than was consistent with good farming practice during the 1980's. Over-cultivation, short and base fallow lands and heavy machinery all took their toll of the soil and when the drought came in 1984/85 wind erosion became an environmental problem.

The role of agriculture in generating exports is particularly crucial. It was estimated that 95 per cent of the total value of all commodity exports from Sudan came from agriculture. Exports comprise mainly of cotton, peanuts, sorghum, gum arabic, sesame seeds, sugar cane, livestock (cattle, sheep, and camels), which together make up about 95 per cent of export earnings. No strategy for meeting Sudan's foreign debt obligations can succeed without a substantial increase in agricultural exports.

The livestock resources of the country, believed to be the largest in Africa, also is an important part of the agricultural sector which serves as major source of draft power and animal products such as milk, meat, hides and skins. The country's soil and water resources have high potential, so is the fish production, all of which are indicated to be not exploited fully.

Sudan's industry : As already mentioned, many industries in Sudan are based mainly on agricultural products. Types of industry product include textile, cotton ginning, edible oil, soap, sugar, etc.

About a third of Sudan's land area is considered suitable for some form of agricultural use; but only a fraction of this land is currently under cultivation.

And, the agricultural production and productivity levels of the country are very low, due to various reasons. Natural and man-made calamities, such as flood, insect infestation, crop diseases, soil degradation and high rate of fertile soil loss by soil erosion, deforestation, drought, desertification are the major causes. Due to many factors, including the lack of good information about environment, sources of water, prevalence of diseases, etc., it is difficult to make gainful and right decisions at the right time.

The deficiencies of the agricultural sector became more acute in the last decade or so, and since 1985, the country is no more able to support itself in food supply and generate agricultural raw materials for the expanding industries in the country. Because the growth of agricultural production became much slower than the population growth, the country could not withstand the shock of the slightest environmental disasters and misfortunes with its poor subsistence agricultural base. High degradation of the natural resources of the country due mainly to soil erosion, deforestation, and over cultivation, is spreading at an alarming rate endangering the country's principal natural resources potential for growth and well being.

Agriculture, however, is still the backbone of the economy of the country as much as before with all its shortcomings and decline. The present figures indicate that :

- About 90 per cent the labour force of the population is concentrated in agriculture and related activities.
- About 95 per cent of country's export earnings is come from agricultural products.
- More than 75 per cent of the country's gross domestic product is from the agricultural sector.

The government sought to encourage private investment in both agriculture and industrial sectors, particularly in activities that might generate exports. The Sudan government has formulated a number of policies and programs that are geared towards recovery of the agricultural sector. The current strategies include :

- (1) To rehabilitate and modernize the existing viable agricultural corporations operating irrigation schemes and to diversify non-viable ones and transfer production responsibility to the present tenants;

- (2) To limit the horizontal expansion of mechanized farming and to concentrate efforts on increasing productivity of existing farms;
- (3) To introduce structural improvements of traditional rain-fed farming sector, with a view to enhancing its role in agricultural development.

Regarding food security, the government has designed the following strategies :

- Increasing the production of sorghum, horizontally and vertically, depending on mechanized farming besides support of the traditional rain-fed food production sector;
- Expansion of wheat cultivation in the northern region besides vertical expansion through schemes for irrigation in the Gezira and providing the required basic inputs;
- Expansion of cultivation of oil seeds within the irrigated schemes, introducing cultivation of sunflower under the Rahad Scheme; and
- Directing investment to horticultural projects and legumes for exports.

Diversification of agricultural production will help to :

- Increase food production;
- Diversify exports;
- Supply inputs to industry, which will help the development of agro-based industries.

1.4.2 Justification

Although much is being achieved in the agricultural sector in Sudan, it is still far from the optimum expected, given the rate of investment in this sector since 1989. The variance between the planned and actual growth, a characteristic of Sudan's economy can be attributed to a number of factors. However, one of the most outstanding of such factors is lack of provision of adequate, reliable information to planners, managers, and decision makers. This, many times, has resulted in large amounts of the scarce resources being wasted on unviable projects. At a micro level, managers in firms have often adopted wrong options due to lack of adequate information. In the case of imported technology, lack of information has many times led to import of inappropriate machinery (e.g. for mechanical harvesting), or dealing with incompetent and unscrupulous firms.

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We live in an era of information explosion. This has been a result of considerable investment in research by almost all countries of the world, a sign of the importance they now attach to scientific and technical knowledge as an economic resource. There is need for every country to have in place a system that is capable of handling this information in its totality, analyze it, process and disseminate it to those likely to make best use of it for the benefit of their respective countries, in particular, and humanity as a whole in general. And this must be done efficiently and at minimum cost. Information users include planners, researchers, managers, investors, decision makers, entrepreneurs, politicians, farmers, and others who are in one way or other involved in development activities.

Sudan needs assistance to develop information handling capabilities. If this help is forthcoming, a number of groups will benefit. For example, scientists will be better able to keep up to date with the current development in their respective areas of specialization, and the aid agencies will be able to monitor which projects are operational, successful or otherwise. They will be able to avoid duplicating work which is either in progress or already completed. Planners will be able to study the long-term effects of their decisions and

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administrators to make more optimal allocation of scarce resources.

The national information system for agricultural development constituting an important and integral component of the national development information system should act as a growth point and be provided with sufficient funds to enable it to benefit from the use of modern technology so that it can provide effective and efficient information services. Once such a system has been developed, its capacity can be augmented further to provide a wider range of services to the community.

1.4.2.1 The Need for Access to Agricultural Data and Information

Agricultural information is a resource which when organized and used efficiently, contributes substantially to the socio-economic development of the nation.

Typical situations in Sudan for which information support is needed are :

- conservation and exploitation of natural resources;
- development of land use plans;

administrators to make more optimal allocation of scarce resources.

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- conservation and exploitation of natural resources;
- development of land use plans;

- siting problems for specific enterprises of land use practice;
- assessment of food/nutrition production.

Much of the information required for comprehensive planning and decision-making includes both natural resources data and socio-economic data which must be presented to the user in an easily usable form and format.

This study is meant to show the need and propose a plan for the development of a national agricultural information system, applying modern information technologies, and capable of rendering specialised information services at both micro and macro levels. At micro level, I refer to a system that is geared to giving support to computerised management information within the enterprises; and at macro level, a system that aims at full use of information technology at the national level.

1.5 SIGNIFICANCE OF THE STUDY

Agriculture is an important sector of the national economy and an integral part of the life of people in developing countries. Sudan's economy like any developing country, depends to a large extent on agricultural

resources. Several categories of people are involved in agricultural development and they do not have adequate access to information e.g. planners, research workers, decision makers, extension workers, farmers, etc. They require different types of information services, and information should be analyzed and packaged to make it convenient to different user groups. Since such systems and services are very weak at present, the National Centre for Research is proposing the development of a National Information System Network in Sudan, and Documentation and Information Centre is collaborating in preparing a plan.

The study will show areas of information needs at the national level and will suggest measures to meet those needs. This study should be useful to planners, researchers, agricultural workers, politicians, decision makers, governmental authorities and other institutions, and user groups, by drawing their attention to the role of information and information technology in the economic development of a country. Information professionals in Sudan are among those most likely to benefit from this study, especially when the ideas and suggestions in this thesis are implemented, by showing how information services can be enhanced and made more productive to the nation through adopting modern technologies, and new

information management strategies. Furthermore, the study will establish a plan for the development of a national agricultural information system and services and prepare a plan for a national agricultural network. It is also expected that the present work can be a useful contribution and of practical value to the National Centre for Research (Khartoum) and to Sudan as a whole, in the long run.

CHAPTER 2

METHODOLOGY

2.1 DATA COLLECTION

The research required an extensive assessment of existing agricultural information services (i.e. the state of production, use and handling of the information). Therefore, different techniques of data collection have been used in order to facilitate fast collection of data in the limited time and finance available. In order to achieve the objectives of the study both primary and secondary data have been used. The primary data were obtained through questionnaire survey, interview, and observation, whereas the secondary data were largely collected from the different agriculture institutions and literature reviews.

- 1) Questionnaire survey was carried out in various institutions including agriculture, livestock and fisheries, research centres, government offices, parastatals, private sector firms, and agencies, to identify information needs, information sources, and to examine :
 - Government policies relating to information and information services;

- Cooperation and coordination between research institutes and the agricultural sector;
- Satisfaction with the existing system i.e. analyzing user satisfaction of the services of the existing information centres.

Three types of questionnaires were prepared for this purpose : The first type of questionnaire to be completed by libraries and information units of agricultural institutions (see annex 1); and the second one by agricultural information users especially researchers, lecturers, graduate students (B.Sc. to Ph.D.), extension workers, decision makers, etc. (see annex 2); the third one was specially prepared for agricultural experts to collect information on their publications (as sources of information) and order to prepare their profiles (see annex 3).

2) Interviews with the librarians, heads of agricultural information service units, and with end users such as planners in the agricultural sector, managers of agricultural projects, financiers of agricultural projects, and researchers were arranged with a view to identifying their information needs, sources, products and services offered and gauging their

expectations from the national information system, their willingness and commitment to cooperative activities for realization of a network of information service units and on other related issues, to supplement the data gathered through questionnaires, to clarify some of the questions, and to overcome some of the limitations of the questionnaire method.

- 3) Personal site visits were made to the agricultural libraries and agricultural information service units of selected institutions to observe their actual and potential service capacity and physical facilities (space, furniture, purposefulness of the buildings for the function, etc.) to supplement the data gathered through questionnaire.
- 4) The information gathered through questionnaire, interview, and site visits was supplemented by a literature survey of articles in different academic and professional periodicals, books, theses and dissertations, reports, and other types of publications, all related to the field of agriculture and information services, to study the principles and practices in agricultural information services and information networking with the view to developing a framework for evaluating the Sudanese situation.

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2.2 INFORMATION USERS

Various concepts relating to "information users" as applied in this work are briefly explained below.

2.2.1 Users

Provides a measure of the relative number, categories and types of information users and indicates their information need.

2.2.2 User Groups

It is assumed that the "larger the number and diversity of user groups the more important and complex the information needs". (Montviloff, 1990. p. 144).

In Sudan information users range from the sophisticated specialist professional, researchers, politicians, administrators, academicians, educators to the citizen at large or generalist users, all of whom may be involved in one way or another in development related activities in particular sectors e.g. agriculture, industry, finance, etc. Even the illiterate and semi-

literate farmers, villagers, and people at the grass roots play significant roles in the development of the country.

In general, agricultural libraries and information service units are mostly used as study areas. A greater percentage of library users are students (under- and post-graduate), academic staff, and researchers and that academic libraries were mostly used during or near examination period. The quiet atmosphere of libraries and information services units seems to attract readers. It is common to find students referring to their own texts and exercise books. Reference service is rarely used to do assignments. This could be due to outdated materials in the libraries. But the absence of a library use culture cannot be ruled out. This, accompanied by staffing problems defeats the whole purpose of establishing library services. With the improvement of library services, attitudes and practice towards use of libraries and information centres may change.

2.3 SURVEY

2.3.1 Agricultural Organizations/Institutions Surveyed

All agricultural institutions located in Khartoum and dealing with agricultural information services as their major or minor function were surveyed through questionnaires and personal visits. Questionnaire 1 (see annex 1) was distributed to 60 agricultural institutions/organizations known to possess libraries, documentation centre, or information service unit, and questionnaire 2 (see annex 2) was distributed to 150 persons (researchers, college graduate students and lectures, managers, etc.). Forty five replies were received to questionnaires 1, and 95 to questionnaire 2. Thirty persons were interviewed. During the interview discussions different questions were raised depending on the qualification and the nature of work of the interviewee. A checklist of the questions used during the interviews is given in annex 4. Almost without exception, those interviewed appeared to be well aware of the importance and usefulness of a national agricultural information system and network and its potential contribution to Sudan's development. The organizations surveyed are listed in annex 5, the categories of institutions/organizations surveyed are :

- Higher education institutions in agriculture and environmental studies (12)
- Research institutes/centres (24)
- Development agencies (5)
- Information and documentation centres (3)
- Non-governmental organizations (1)

A detailed analysis of data on agricultural information users and their needs and agricultural organizations/institutions, education, research, etc. from the questionnaire survey, interviews, and literature review is given in chapter 4.

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CHAPTER 3

BACKGROUND INFORMATION ABOUT SUDAN

3.1 INTRODUCTION

This study focuses on proposing a plan for a national agricultural information system for Sudan and a strategy for its implementation. This sectoral information system will be an integral part of an overall national information system. The information systems that constitute the total national information system, will have to fit into the socio-political, socio-economic and socio-cultural environment in which they operate and also respond to the dynamic changes that take place in the environment. The planning, designing and development of the information systems, including sectoral ones, must take into account the elements of the environment, namely Sudan. Further, the information system plan should be compatible with and eventually integrated into the national socio-economic plan. This calls for collection of information about and description of the country, especially its geographic location, climate and vegetation, population, planning and development, and economic situation.

3.2 GEOGRAPHIC LOCATION

Sudan, with an area of 2.6 million square kilometres, is the largest country in Africa and extends from about latitude 4°N in the south to latitude 22°N in the north. It is bordered by eight countries: to the north by Egypt and Libya, to the west by Chad and the Central African Republic Zaire and to the south by Uganda and Kenya while Ethiopia and the Red Sea make up the eastern boundary. The country is mainly composed of extensive plains of ironstone soils in the south, clay in the central parts and sand in the north and west. There are only a few mountainous areas of which the principal ones are the Imatong in the south, Jebal Marra in the west and the Red Sea Hills in the east (Danida, 1989, p. 8).

In 1991 a federal system of government was inaugurated whereby Sudan was divided into nine states (Welayates), namely : Khartoum, Central State, Kordofan, Darfur, Northern State, Eastern State, Bahr El-Ghazal, Upper Nile, and Equatoria, which were subdivided into 66 provinces and 218 local government areas (UNDP, 1991, p. 3).

3.3 CLIMATE AND VEGETATION

Temperatures in Sudan are generally high; ranging between 30°C and 40°C in summer and between 10°C - 20°C in winter. Maximum temperatures exceeding 45°C are frequently experienced during March, April and May in Khartoum, the capital city. Minimum temperatures of less than 4°C are experienced during the winter months of December, January and February especially in the northern region and in parts of Darfur.

Rainfall decreases from about 1200 mm in the southern savannas to practically no rain in the desert in the north. The main rainy season is July-September but occasional showers fall in May/June particularly in the higher rainfall areas in the south. The Red Sea Hills receive monsoon rains during the months of October and November. Rainfall exhibits a wide range of inter annual variability, from about 20 per cent in the south to 100 per cent in the north. The main drainage system is south-north as the flow of the River Nile and its tributaries.

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The wide range of variation of the principal climatic factors, particularly rainfall, coupled with soil variation is responsible for the diversity of the vegetation cover not only in its composition by species

but also in the size and density of plants. The general picture is, however, a gradual succession from desert scrub with scattered low bushes in the north, passing through low rainfall savannah and ending at the high rainfall savannas in the south. Whereas the low rainfall areas are dominated by acacias the higher rainfall areas are covered with broad-leaved trees. The herbaceous plants also show similar trends in that they are short and sparse in the dryer areas and gradually become taller in the wetter areas. The vegetation, thus, shows no clear-cut boundaries except where there are changes in soil, topography or drainage as indicated below.

The main soil types show distinct variations of species particularly in the low rainfall areas. Whereas the famous gum tree Acacia senegal dominates the tree component in the sandy soils of western Sudan, the clays of east and central Sudan are covered with Acacia mellifera and Acacia seyal. The ironstone soils of southern Sudan, on the other hand, bear mainly broadleaved trees.

Vegetation along water courses also shows, in many cases, distinct variations from the surrounding areas. Acacia nilotica forms dense groves on the alluvial deposits along the banks of the river Nile and its

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tributaries. The large seasonal water course in Darfur bear dense covers of Acacia albida. Mountain areas - Imatong, Jebal Marra and the Red Sea Hills - also bear vegetation covers which vary considerably from those of the surroundings, primarily due to the modification of climate by the altitude.

The diversity of climate and soils which resulted in the wide range of plant communities outlined above is in itself a blessing for Sudan because it enables the people to practice a wide range of economic activities. For example, the desertic eco-systems of the Northern Region offer favourable conditions for irrigated production of wheat, citrus fruits, legumes and dates. The clay plains in east and central Sudan are suitable for the production of cotton, sorghum and sesame while the sands of the west provide millet, groundnuts and gum arabic. The ironstone soils of the south are able to provide a wide range of products such as timber, coffee, tea, pineapple, mangoe, cassava and maize. Another important aspect of this diversity lies in the animal production. While the central savanna belt is favourable for cattle, sheep and camels are happier in the dryer climates of the north. Goats on the other hand, seem to do better in the dry mountainous areas.

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3.4 POPULATION

The population of Sudan was enumerated at 20.56 million by the February 1983 census, and, according to World Bank estimates, is increasing at an annual rate of 2.9 per cent. According to UN estimates, the population was 25,204,000 at mid-1990s. At the 1983 census, about 71 per cent of the population resided in rural areas, 18 per cent in urban and semi-urban areas and the remaining 11 per cent were nomadic. The population is concentrated in Khartoum State and the Central State, where population densities were respectively 55 and 28 per sq km, compared with 3.6-6.8 per sq km elsewhere. Agricultural development in the two most populous regions created employment opportunities and this led to the doubling of these populations between 1956 and 1973, compared with rises of between zero and 50 per cent elsewhere. There are local concentrations of population in the Nuba mountains and higher densities than average in better-farmed parts of the southern and Darfur regions (Europa Publications, 1993).

The ethnic origin of the people of Sudan is mixed, and the country is still subject to significant immigration by groups from Nigeria and Chad, such as the Fulani. In the south the Nuer, the Dinka and the Shilluki

are the most important of the Nilotic people. The Arab culture and language predominate in the north, which includes the most populous provinces and the capital, Khartoum. The capital, Khartoum, had a population of 476,218 at the 1983 census. It is the main administrative, commercial and industrial centre of the country. The neighbouring cities Khartoum North and Omdurman had 341,146 and 526,287 inhabitants respectively, thus creating, with Khartoum a conurbation of more than 1.3 million inhabitants.

As communications are very poor and since Khartoum is at least 1,000 km away from 80 per cent of the country, the influence which Khartoum exerts on the rest of the country is small.

3.5 PLANNING AND DEVELOPMENT

The first Development Plan was a 10-Year programme for 1961/62-1970/71. It was followed by a Five-Year Plan, covering 1970/71-1974/75. Nationalizations in 1970 meant that this plan was rapidly revised, and in 1974, as targets (including an average annual GDP growth rate of 7.6 per cent) failed to be realized. The plan was extended to June 1977. The Six-Year Plan for 1977/78-

1982/83, was abandoned at the onset of the problems which still confront the economy.

In 1978 the plan was tacitly suspended and replaced by a series of short-term 'rolling' programmes which were designed to restore some balance to the economy - with particular emphasis on the expansion of exports. The last in the series, the three-year public investment programme covering 1983/84-1985/86, was announced in October 1983, but was hindered by the government's moves to Islamize the economy during 1984. The programme, which envisaged a total expenditure of £S (Sudanese pound) 2,404 million, was suspended after the overthrow of the Nimeri regime in April 1985. There were no more attempts to implement a co-ordinated policy until the introduction, in August 1987, of an economic recovery programme. This was successfully completed and was replaced in October 1988 by a three-year medium-term recovery programme, the priorities of which were the reform of the exchange rate and trade policy, the reduction of the budget deficit and subsidies, the promotion of exports and a privatization programme.

The present government formed in July 1989 presented a three-year National Economic Salvation Programme to coincide with the 1990/1991 budget. Efforts to reform the

economy were to include a reallocation of resources towards agricultural and other productive sectors, and a refinement of the Investment Encouragement Act to create a more conducive investment climate for the local and foreign private sector.

Measures to attract investment included the removal of the government monopoly in all areas except oil exploration, as well as liquidation with full or part privatization of government parastatals. Other measures announced included a review of the banking system, export liberalization and price decontrol, and introduction of a Social Solidarity system to cushion the effects of economic restructuring for low-income groups. In August 1990 the government announced that it was implementing four measures under the National Economic Salvation Programme, namely :

- cuts in government expenditure;
- increases in tax revenues;
- a reduction in imports; and
- wage freezes and widespread job cuts.

In May 1991 the government announced that, in order to encourage production, it was lifting restrictions on the price of farm products (Europa Publications, 1993).

3.6 ECONOMIC SITUATION

3.6.1 Agriculture

Agriculture is the major economic activity of the Sudanese people, of whom about 80 per cent are engaged in crop production and animal husbandry. In 1986 the agricultural sector contributed to 35 per cent of the GDP, a significant reduction from the 54 percent in 1965. The principal food crops are sorghum and millet, and the cash crops are cotton, groundnut, sesame and gum arabic. The main animal wealth is composed of cattle, sheep, goats and camels. Rainfed cropping, both traditional and mechanised, covers about 5.45 million feddans (20 mill.ha.) while irrigated agriculture covers about 4.5 million feddans (1.9 mill.ha.).

Traditional rainfed agricultural production systems are shifting cultivation, sedentary livestock herding, nomadic herding and firewood collection. Small-scale irrigated farming is also practised within the traditional sector by the use of simple local water lifting technologies such as buckets (delu), animal drawn water wheels (sagia), simple levers (shadof) or merely by gravity. More detailed information about agriculture is given in chapter 1.

3.6.2 Forest Resources

The forest resources of the Sudan cover about 204 million feddans (85 mill.ha) and are mostly woodland savanna. Their distribution is such that about 60 per cent are in the southern regions whereas the remaining 40 per cent are found in the southern parts of the northern regions. Woodfuel is the major forest product of which northern Sudan consumes about 21 million cubic meters annually (Danida, 1989).

The forest sector in Sudan has four separate subsectors including :

- Gum arabic production which provides the bulk of the world's gum arabic.
- Industrial wood production, growing stock located in the south, accounts for 60 per cent of the national resources.
- Shelterbelt plantations situated in Gezira on the irrigation schemes and at various places along the Nile.
- Shrub forest of the north and west and Gezira rainfed areas, continuously being reduced by a variety of forces the most important of which is mechanized farming (Robinson, 1987, p. 105).

Forest resources are being depleted by cutting down of trees for firewood and clearance for cultivation. The total growing stock of forest resources in northern Sudan in 1986 was estimated at 871 million cubic meters. The annual allowable cut, which is estimated at 29 million cubic meters and the annual consumption at 37.5 million cubic meters, show an over-exploitation of 8.5 million cubic meters. The greatest problem is faced in the area within 500-600 km around Khartoum where the forest resources are annually being over-exploited by about 10 million cubic meters. Some sources estimated the total growing stock in Sudan as being 1332 million cubic meters, of which only about 32 per cent occurs in north Sudan, (World Bank, 1986).

3.6.3 Animal Resources

The main animal production systems are the sedentary and the nomadic. The livestock population was estimated in 1983 to be composed of 21 million heads of cattle, 20 million sheep, 14 million goats and 2.8 million camels. But, there is difficulty in obtaining accurate information on animal numbers for several reasons. The animals are scattered over a very large area and most of them are continually on the move in search of grazing land and water. Also many herders are unwilling to

disclose their wealth either to avoid taxation or due to some local mythology.

The livestock resources of the country, believed to be the largest in Africa, also is the second most important part of the agricultural sector which serves as a major source of draft power and animal products such as milk, meat, hides and skins. Livestock is herded around villages on the natural rangelands and crop residues for the whole year. Now the animals are reared in three distinct production systems; the nomadic, settled and modern. The first two are traditional production systems while the last is a modern one which is heavily dependent on imported or cross breeds of animals. The modern system is relatively new but is expanding fast particularly in the vicinity of large urban centres such as Khartoum and Wad Medani. The nomadic and the semi-nomadic systems use large areas of land during the different seasons. Herds are driven from the wet season grazing areas in northern and central Sudan to the dry season grazing areas in the southern parts of these regions. Some stock routes were recognized in the past but have now disappeared mainly because of the increasing land use pressures.

Productivity and herd take-offs are, however, low. Because the herds are owned by the tribes who regard their herds as a mark of wealth and are reluctant to sell animals. Consequently the number of animals brought to market is far below the potential and the quality is generally poor. The predominantly social rather than economic motivation for herd ownership must be seen as a major constraint in the development of livestock products processing industries. It also has some other implications since it has encouraged overstocking leading to desertification in large areas of the country.

3.6.4 Fisheries Resources

Fisheries resources in Sudan are marine resources on the Red Sea coast, that is 480 km (= 300 miles), as well as riverine or fresh water resources, from the River Nile, in addition to the Blue and White Niles and their tributaries (that is a total of about 4000 miles). The total surface area of both marine and fresh water resources is about 21 million acres (i.e. about 3.5 per cent of the total surface area of Sudan).

The white Nile is one of the important fisheries resources especially along the Jebel Aulia Reservoir and the Sadd Region. Recently Lake Nubia after the

construction of the High Dam has become one of the important resources (Ali, 1980, 55-56).

It is estimated that about 10,000 fishermen are engaged in the inland fisheries operating around 300 boats and 2000 canoes. The main contributors are the subsistence fishermen, followed by artisans while the least developed is the commercial sector.

Traditional capture fisheries cannot meet the market demands and hence, aquaculture development became a supplementary source of increased fish supplies in Khartoum province where fish is in great demand (Danida, 1989).

3.6.5 Other Natural Resources

Sudan is also endowed with several other natural resources in many parts. Petroleum is found in the south, Darfur and Kordofan, while it is still being explored in other regions. Fair amounts of iron ore, copper, sulphur, rock salt and natural gas are also present. Other resources which offer prospects for development include wildlife, bees honey and, of course, the natural plant associations which provide rangelands and habitats for wildlife and bees (UNDP, 1991).

In terms of income, the subsectoral shares are estimated at one-third livestock, one-fourth each rainfed traditional agriculture and irrigated agriculture, one-eighth rainfed mechanized agriculture, and about five percent forestry and fisheries.

3.6.6 Industry

Agricultural crops support several industries, such as that of sugar, canned and packed foodstuffs, edible oils, confectionary, flour mills, kenaf sacks, and many other small industries. Industries based on animal products include tanneries, leather and shoe industries and that of woollen carpets, milk processing, ivory and bone works. The main forest products industries are sawmilling, carpentry and joining works, ropes and fibres and particle board. Other important related industries are that of soap, cosmetics, pottery, brick burning, lime, paints and textile (Danida, 1989).

The ginning of cotton encouraged the beginning of industry in Sudan in the early 20th century. With the expansion of cotton production, the number of ginning factories has increased, with the Gezira Board alone operating the world's largest single ginning complex, on which rehabilitation work was started in 1985, as part of

the 10-year improvement programme for the scheme. There are 25 spinning and weaving mills, the majority of which were built in the 1970's. The country is not yet self-sufficient in basic cotton cloth, however, owing to a disparity between spinning and weaving capacity. Cotton seeds are partly decorticated, while exports of cotton-seed oil and oil cake are increasing. Groundnuts are also partly processed, with oil and cake dominating exports of groundnut products. Minerals (copper, iron, mica, chromite and, more recently, gold), which constitute less than 1% of exports, are exported in the crudest form.

With the exception of enterprises producing cement, soap, soft drinks and vegetable oils, large-scale manufacturing of import substitutes started in Sudan only after 1960. This is reflected in the manufacturing sector's contribution to GDP, which in 1989 totalled only 8%. By 1986 the public sector included the four sugar factories, three tanneries, a number of food-processing plants, the two cement works and the spinning and weaving mills, as well as joint-venture participation in the Port Sudan tyre factory (with a Republic of Korea company) and in the fertilizer plant south of Khartoum (with a US company). All state-controlled enterprises in the manufacturing sector operated with varying and increasing degrees of inefficiency.

The present government has proclaimed an 'open-door' policy to the private sector. It announced in April 1990 that private local and foreign investors would be invited to purchase loss-making state corporations, which were estimated to owe more than £S 1,000 million to the central bank. The National Economic Salvation Programme, unveiled in June 1990, named several parastatal bodies in the agricultural sector and many others in the industrial, hotel, transport and communication sectors which would be sold or emerge as joint ventures. Further privatization plans were announced (by the Minister of Finance, Abdel Rahim Hamdi), in July 1991. Private investors would be offered shares in Sudan Airways, Sudan Shipping Lines (SSL), tanneries, banks and hotels. Scandinavian, US and Arab companies were reported in mid-1992 to have made bids for the state of telecommunications company, while a British company had expressed an interest in Sudan Shipping Lines.

In March 1992, in an attempt to attract foreign investment, the government announced that it would establish four free-trade zones : at Port Sudan, Juba, Janaynat (in western Sudan) and at Melot (in central Sudan) (Europa Publications, 1993).

CHAPTER 4
AGRICULTURAL INFRASTRUCTURE IN SUDAN

4.1 INTRODUCTION

The study required an assessment of existing agricultural information facilities (i.e. the situation of production, use and handling of information) in Sudan. The proposed agricultural information system as mentioned in the preceding chapter, should support the effective and efficient planning, programming and management of the agricultural resources and related infrastructure in the country. It implies that a knowledge of the existing infrastructure for agricultural development in Sudan is necessary in drawing up plan for the national agricultural information system. Therefore, this chapter presents a detailed analysis of data on Sudan's existing infrastructure in relation to agricultural education, research, extension services, organizations and institutions, documentation and information services and transportation and communication, in an attempt to identify the needs of those target groups for information services and the gaps or inadequacies of the existing information facilities to support those need. The data have been derived from literature review, questionnaire survey, on site observations, and interviews.

4.2 AGRICULTURAL EDUCATION

It is assumed that more education, and more educated people mean a greater capability to generate and use information as well as more intense information activities in this area (Montviloff, 1990, p. 139).

Agricultural education is available at various levels and with a fairly good geographical spread, at vocational, intermediate and university levels. At the university level it is offered in 6 universities, but in December 1989 the present government (Revolutionary Council) declared a revolution in higher education, and in November 1990 the Ministry of Higher Education in implementing the Council's direction established six new universities, and allowed colleges which offered three-year diploma courses to offer, in addition, a five year technical B.Sc. program (detailed information about agricultural education institutions is given below). At the upper intermediate level of post-secondary diploma, agricultural education is provided at the college of Abu Haraz and Abu Naama, Yambio Agricultural Institute, and Fisheries Training Institute. At the lower intermediate level of secondary education, it is given in four agricultural schools, and vocational training is given in five centres. University level education lasts 5 years

leading to a B.Sc. degree and also there are M.Sc. and Ph.D. degree programmes. The Upper intermediate level takes 3 years leading to a Diploma; the lower intermediate level requires 4 years leading to an agricultural secondary school certificate, and vocational training lasts for various durations ranging from a few months to 3 years depending on the training programme (Gebre-Ab, 1988, p. 36).

University education is academic and provides generalized skills, whereas upper intermediate level training is technical and provides specialized skills. Vocational training is given by the Ministry of Agriculture, Natural and Animal Resources. The agricultural secondary schools are administered by the Ministry of Education, while the upper intermediate level institutions as well as the universities are organized under the umbrella of the Ministry of Higher Education and Scientific Research.

4.2.1 University of Khartoum, Faculty of Agriculture

The University of Khartoum's Faculty of Agriculture was established as a School of Agriculture in 1938 and became a faculty in 1956. Its activities were mostly teaching until the mid-fifties when some of its staff

started contributing to agricultural research (Edris, 1975). The Faculty has eight departments, namely, Agricultural Botany, Agricultural Engineering, Agronomy, Animal Production, Biochemistry and Soil Science, Crop Protection, Forestry, Horticulture, and Economics and Rural Development (Ministry of Higher Education and Scientific Research, 1993). And now there is a plan to upgrade the Forestry Department to become a Faculty of Natural Resources, to include range management. The Faculty has 76 staff members. The intake for the year 1992/1993 was 375 students. It offers a five year B.Sc. in Agricultural Science and in forestry program, and offers 2-year M.Sc. in Agricultural Science, Economics and Rural Development, and M.Sc. in Forestry program.

4.2.2 University of Khartoum, Faculty of Veterinary Science

The Faculty of Veterinary Science was established as a School of Veterinary Science in 1938 and became a faculty in 1956. It has Departments of Anatomy, Animal Husbandry and Livestock Production, Microbiology and Parasitology, Pathology, Physiology and Biochemistry, Preventive Medicine and Veterinary Clinical Studies. It has 64 staff members and the total number of students is 600. The intake for 1992/1993 was 150 students. The

Faculty offers a five year B.Sc. in veterinary Science and 2-year M.Sc. in different specializations program.

4.2.3 University of Khartoum, Faculty of Animal Production

The Faculty of Animal Production was established in 1981, as the Institute of Animal Production, became a faculty in 1993. The Faculty has the following Departments : Animal Nutrition, Animal Breeding, Poultry Production, Dairy Production, and Meat Production. The faculty has a staff of sixteen, of whom fourteen have Ph.D. and two M.Sc. degrees. The intake of students is 100 per year. It offers a five year B.Sc. in Animal Production and Tropical Animal Production course, and 2-year M.Sc. in Animal Production and in Tropical Animal Production program as well as Ph.D. program in Animal Production.

4.2.4 University of Khartoum, Institute of Environmental Studies (IES)

The Institute of Environmental Studies was established in 1979. It has four sections, namely : Fresh Water Ecosystem Management; Arid Land Management; Coastal Zone Management; and Urban and Regional Management. The

service and support units include Environmental Monitoring and Analytical Lab; Cartography and Reproduction Unit; Computer, Documentation and Printing Unit; Field Support Unit; and a specialized library supervised by a librarian.

The Institute focuses on natural resources management, and links up several development sectors. It offers M.Sc. Environmental Studies and carries out basic research using multi-disciplinary teams drawn from several faculties within the University of Khartoum as well as specialists in government departments (El Khalifa, et-al, 1989). The Institute offers short training courses in natural resource management as well as consultancy services, and admits twenty students per year. It has eight faculty staff members : 6 with Ph.D., 1 with M.Sc. and 1 teaching assistant, in addition to twenty five part-time teachers. The Institute issues the following publications : Environmental Monographs Series; discussion papers; research reports; workshop proceedings; books and a newsletter (Sudan Environment, 3 times a year).

4.2.5 University of Khartoum, Development Studies and Research Centre (DSRC)

The DSRC was established in 1976 as a post-graduate institute within the Faculty of Economic and Social Studies. The DSRC at present offers - apart from the programme of short courses - a twelve-month Diploma in development studies, a twelve-month diploma in regional development and planning, and an eighteen-month Masters course in development planning. Each year the number of applications greatly exceeds the capacity of the centre to fulfil the existing demand for post-graduate studies in development planning in Sudan.

In October 1986 the DSRC launched a new programme of short In-Services Training Courses. The principal aim of the programme is to give people working at the regional and sub-regional levels an appreciation of the main methods, techniques and categories of information and data required for the identification, appraisal, monitoring and evaluation of development activities and projects to be undertaken in their agencies and districts.

The programme consists of fourteen different course packages including rural development and planning; data management and analysis; project identification and planning; etc. and four courses on computer applications. The courses were developed jointly by the staff of the University of Khartoum, the Institute of Social Studies, the Hague and experts from selected government ministries and organizations outside the University (DSRC, 1992, p. 2).

The Centre has a full time academic staff complement of seven Ph.D. and one teaching assistant and a large number of associate and part-time staff members. The Centre issues a monographs series and a discussion paper series. The Centre has a good specialized library with four staff members : 1 M.Sc., 1 higher diploma, and two technicians; photocopying and computer facilities.

4.2.6 University of Gezira, Faculty of Agricultural Sciences

The Faculty of Agricultural Science of the University of Gezira was established in 1976 and has the following six departments : Crop Sciences, Horticulture, Crop Protection, Agricultural Engineering, Animal Sciences, Environment and Natural Resources, Soil and

Water Science, and Extension and Training. The Agricultural Economics Department is with the Faculty of Economics and Rural Development, and the Food Department is with the Faculty of Science and Technology (Ministry of Higher Education and Scientific Research, 1993). The Faculty has a staff of sixty five, forty one of whom have M.Sc. and Ph.D. degrees and twenty four are teaching assistants.

4.2.7 Sudan University for Science and Technology

Established in 1975 as the Khartoum Polytechnic, the Sudan University of Science and technology has farms in Shambat, Soba, and Kuku. The staff number forty, 11 of whom have Ph.D., 19 have M.Sc., 8 have B.Sc. degrees and 2 have Diplomas. The University has three divisions :

1) The College of Agriculture and Food Technology, at Shambat (formerly Shambat Institute of Agriculture) : was established in 1954 by the Ministry of Agriculture to offer a 2 year course in agricultural training for students who had received 12 years of general education. The Institute operated with the two-year system until 1963 when the duration of the course was extended to three years to allow for more emphasis on the practical aspects of training. In 1973 the Institute

was taken over by the Ministry of Higher Education and in 1975 it was incorporated into Khartoum Polytechnic. In 1990 Khartoum Polytechnic developed into the Sudan University for Science and Technology. The Department in 1990 started a course programme leading to the Bachelor of Technology in Agricultural Science in addition to the previous programme. The total number of students is 588.

2) Department of Forestry Science and Wood

Technology, at Soba : was established by the Forest Department in Khartoum as early as 1946 under the name Forest Rangers School to offer two-year of forestry training following eight years of general education. In 1960 the School was upgraded to the Forest Ranger College when the two-year Forest course was upgraded to train students who had received 12 years of general education leading to the Diploma in Forestry. The college moved to its present premises at Soba in 1964 and continued to be run by the Forest Department until 1973 when it was taken over by the Department of Higher Education in the Ministry of Education.

In 1975 the Former college became Department in the College of Agricultural Studies of Khartoum Polytechnic. In 1977 the course was extended to three years. As mentioned earlier, in 1990 Khartoum Polytechnic developed

into the Sudan University of Science and Technology (World Bank, 1986, p. 39). The staff members number fourteen, one of whom holds a Ph.D., 6 M.Sc., 4 Diploma, and 3 B.Sc. (teaching assistant). The total number of students is 127 (all males).

3) Department of Animal Science and Technology : started with the assistance of the Royal Dutch Government as part of its Technical Aid to Sudan. The Department was originally known as the Veterinary Training Institute. When it was established in 1973 under the administration of the Ministry of Agriculture, it offered a 2-year course on Veterinary Hygiene and Animal Production.

In 1976 it was incorporated into Khartoum Polytechnic (later the Sudan University of Science and Technology) becoming one of the Department that make up the College of Agriculture. The staff number 22, 2 of whom have Ph.D., 16 M.Sc., 6 B.Sc., and 2 Higher Diploma.

4.2.8 University of Juba, College of Natural Resources and Environmental Studies

The College of Natural Resources and Environmental Studies was established in 1977. It offers a five-year course in forestry. Other specializations include Animal Science, Crop Science, Earth Science, Fisheries and Wildlife Management. The University awards the degree of B.Sc. Honours degree (World Bank, 1986, p. 37).

4.2.9 Abu Haraz College of Agricultural and Natural Resources

The College of Agricultural and Natural Resources was established in 1976, providing three-year training in agriculture at post-secondary diploma level. The college has the following nine departments : Botany, Crop Production, Animal Production, Crop Protection, Soil Biochemistry, Horticulture, Agricultural Engineering, Agricultural Economics, and Agricultural Extension. In 1990 the college became affiliated to Gezira University (Ministry of Higher Education and Scientific Research, 1993, p. 41).

4.2.10 Abu Naama College for Agricultural and Natural Resources

The Abu Naama College for Agricultural and Natural Resources was established in 1978 in the central region with funds from the World Bank, providing three-year training in agriculture at post-secondary diploma level. It was upgraded to a five-year technical B.Sc. in 1990. The College has eight divisions : Botany, Chemistry and Soil, Crops, Horticulture, Animal Production, Agricultural Engineering, Agricultural Economics and Extension, and Crop Protection (Ministry of Higher Education and Scientific Research, 1993, p. 39, 56). The intake for 1992/1993 was 150 students.

4.2.11 Yambio Institute of Agriculture, at southern region

The Yambio Institute of Agriculture was constituted in 1950 from an Agricultural Training Centre which had been in existence to serve an integrated agricultural development project in Equatoria by training intermediate level field staff. During the period of civil disturbance between 1955 and 1972, the activities of the Institute came to a complete halt. With the assistance from UNDP/FAO, the Institute again became operational in 1975.

At the same time it decided to introduce a forestry course at technical level and the first batch of students was accepted in 1977. Since 1978, USAID has also assisted the Institute. The Forestry Department of the Institute offers a two-year course leading to the award of a Diploma in Forestry (World Bank, 1986, p. 40). Presently, the Institute is not operational due to war in the southern region.

4.2.12 New Universities having Agricultural and Veterinary Colleges

The present government encourages a higher education in the country, therefore, there are a number of new universities established within the last two years. The following are the newly established universities and faculties of agriculture and veterinary science :

- El-Skark University, Faculty of Agriculture and Natural resources, in New Halfa;
- El-Fatih University, Faculty of Agriculture, in Darfur region;
- Faculty of Marine Sciences and Fisheries, in Port Sudan;
- Kordofan University, College of Natural Resources and Environmental Studies; and

- Bhr El-Gazal University, Faculty of Veterinary Science (Ministry of Higher Education and Scientific Research, 1993).

4.2.14 Agricultural Secondary Schools

Training at lower intermediate level in agricultural secondary schools was started with two schools in 1971 in New Halfa and El Taha, followed by the establishment of a third school in 1975 in Um Dab Ban and a fourth one in Burgeig in the first half of 1980s (Gebre-Ab, 1988, p. 43).

The position occupied by agricultural training within the educational system may be indicated by a comparison of its size of enrolment in the different levels of education. The total intake for 1992/93 in all faculties and colleges related to agriculture, veterinary sciences, marine sciences and fisheries, natural resources and food sciences was 4188 students. The total intake in all other disciplines for the same academic year was 21834 students (Ministry of Higher Education and Scientific Research (admission result), 1993), that is about 20 percent are in the Agricultural Sciences.

Overall, it is found that agricultural education occupies an important place in science and technology education at the post-secondary level of both degree and diploma courses.

Thus, broadly viewed, agricultural education may be said to have started in the country with the university level followed by upper intermediate and lower intermediate levels successively.

4.3 AGRICULTURAL RESEARCH

It is assumed that higher the support to research the more intense will be the generation and use of information (Montviloff, 1990, p. 139).

The beginnings of agricultural research in the Sudan dates back to 1902 when the earliest experimental farms were established, first at Shendi (Nile Province) and at Kamlin (Gezira Province). In 1903 two more experimental farms were established at Rumbek and Wau in southern Sudan. In the same year the famous Welcome Tropical Research Laboratory was established mainly for control of diseases and insect pests which affect both man and animal. In 1904 Shambat Unit (Khartoum) was established to conduct agronomic research on crops such as wheat and

cotton. In 1904 the first agricultural research department was founded with the main objectives of improvement of quality of crops and their protection from pests and diseases.

As would be expected, the evolution of agricultural research was, on the whole, closely related to trends in agricultural development, which was largely based in the years following the completion of Sennar Dam (1925-1948) on the production of long and short staple cottons. For this reason the history of agricultural research during this period was essentially the history of cotton research. Hence, the establishment of the Gezira Station in 1918 at Wad Medani was the result of the promising performance shown by the cotton crop at Barakat and Tayba since 1911 (Agricultural Research Corporation, 1987). Today research is conducted in all areas of agriculture.

The National Register of Current Research (issued by DIC, NCR) gives the percentage of research projects dealing with agriculture for the period 1982-1983 as 60.92 percent, and for the period 1985-1988 as 68.6 percent of the distribution of research projects by field of science. Table 1 and 2 below show the comparisons between agricultural research and research in other disciplines.

Table 1 : Distribution of agricultural research and other research projects by sectors during the period 1982-1983

Special -zation	Sectors					
	Res. Cent.	Higher Ed.	Minist. & Public Organiz.	Foreign Inst.	Total	%
Agric. Science	641	65	27	42	775	60.92
Math & Physics	5	26	13	27	71	5.58
Medicine	27	56	25	6	114	8.96
Social Science	10	28	57	60	155	12.19
Enginee. & Tech. Science	13	40	32	19	104	8.18
Total	697	249	158	178	1272	
%	54.8	19.6	12.4	13.2	100	

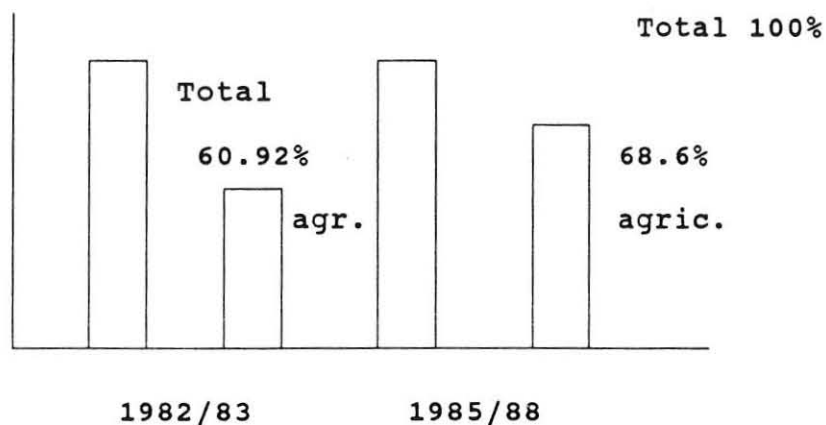
**Table 2 : Distribution of agricultural research
and other research projects by sectors during
the period 1985-1988**

Special -ization	Sectors					
	Res. Cent.	Higher Ed.	Minist. & Public Organ.	Foreign Inst.	Total	%
Agric. Science	799	66	33	31	896	68.6
Math & Physics	16	34	29	11	90	6.9
Medicine	13	28	20	13	74	5.7
Social Science	10	18	29	8	65	5.0
Enginee. & Tech. Science	14	6	19	6	45	3.4
Total	868	204	158	76	1306	
%	66.5	15.5	12.1	5.8	100	

KEYWORDS :

Agric. = Agriculture
 Res. cent. = Research centres
 Ed. = Education
 Minist. = Ministries
 Organ. = Organization
 Inst. = Institution
 Enginee. = Engineering
 Tech. = Technology

Figure 1 : A bar chart showing Agricultural Total Research 1982/83 and 1985/88 in comparison with other disciplines



The tables indicate clearly the concentration of the current research effort in the agricultural sector. And it is clear that the agricultural research (both plant and animal) is about 60-68% of the total.

4.3.1 Ministry of Agriculture, Natural and Animal Resources

The bulk of agricultural research is actually conducted within the Ministry of Agriculture, Natural and Animal Resources. The Ministry of Agriculture is responsible for national agricultural policy and supervises activities in crops, livestock, fisheries, pasture, forests and wildlife. The Ministry includes more

than fourteen departments and about seven semiautonomous corporations: Agricultural Research Corporation, the Gezira Scheme, El Rahad Agricultural Corporation, New Halfa Corporation, Mechanized Agricultural Corporation, Jebal Marra for Rural Development.

4.3.1.1 Agricultural Research Corporation (ARC)

The ARC is a semi-autonomous national research body directly responsible to the Minister of Agriculture, Natural and Animal Resources. Almost all of applied agricultural research in the Sudan is now the responsibility of the ARC which was created by the Agricultural Research Corporation Act of 1967 to investigate the scientific basis of crop production in the Sudan with a view to producing maximum yields of crops with minimum cost.

In 1975 the research functions of the Food Processing Centre (presently Food Research Centre), Fisheries and Marine Biology, Forestry, Range and Pastures, and Game and Wildlife were transferred to the ARC. ARC's main focus is to carry out applied research to solve problems facing agricultural production and to provide realistic technology to improve and sustain productivity in the agricultural sector.

The geographical mandate of ARC covers the whole of Sudan through a network of 17 stations and centres widely spread throughout the country. These include stations of different sizes each of which serves a defined ecological zone. A number of testing sites serve as outreach to the main stations. The scientific disciplines in research stations and centres include : soil science, agronomy and crop physiology, botany and plant pathology, entomology, breeding, horticulture, statistics and agricultural economics and food technology, forestry, fish, wildlife, range and pasture. In addition, the Corporation runs various specialized centres which were transferred to it in 1975 these are :

1) Food Research Centre - Shambat (FRC) : was established in 1965 with FAO/UNDP assistance as part of the Department of Horticulture, Ministry of Agriculture, FAO being the executing agency. The objectives of the centre include : study current and potential markets, foreign and domestic for fresh and processed fruits and vegetables, cereals, oil crops, meat and meat products and local marketing methods; study traditional foods and handling methods with the view to improve them; and provide technical guidance to the food industry. The centre has three functions : research, training, and

extension. The Centre has the following sections : Canning Technology; Dehydration Technology; Post-Harvest Physiology; Grain Technology; Food Processes; Engineering and Maintenance; Biochemistry and Nutrition; Food Microbiology; Food Economics and Marketing; Animal Products; Oils and Fats; and Meat technology. FRC's contributions include commercialization of research and development results, such as, in the establishment of industries for ripening and degreening of banana and oranges and cold storage of different fruits and vegetables, canning and dehydration factories, modern sorghum mills and mechanical bakeries (Edris, 1975, p. 10).

2) Fisheries Research Centre (FRC) - El Shagara : the first experimental aquaculture was established at El Shagara in 1959. FRC (El Shagara) is one of the research institutions under the director of ARC. It has four units : at El Shagara, Port Sudan, Lake Nubia and Kosti. Previously, affiliated to the Fisheries Administration, fish research was separated in 1975 and placed under ARC. Research emphasis is on fish breeding and fresh water culture in reservoirs, rivers and ponds with respect to suitable types of fish, feeding habits, methods of catch, etc. (Balarin, 1988).

3) Forestry Research Centre - Soba : was established as part of the Forest Research and Training Institute, with the support a Forest Research and Education Centre Project during the period from early 1962 - to early 1968. The project was funded jointly by the government and UNDP and executed by FAO. The facilities established for research included offices for professional staff, a wood technology laboratory, library and documentation centre, darkroom, nursery and 36 ha of irrigated arboretum. It has three units : at Soba, Gezira and El Obeid.

Within a few years following the end of UNDP/FAO project, it was increasingly felt that forest research was receiving inadequate financial support. In 1975 the FRC (Soba) was transferred from the Forest Department of the Ministry of Agriculture, Natural and Animal Resources to become a component of the ARC, the headquarters and most of the older and larger components of which are at Wad Medani. ARC is run by a council or management board that is directly responsible to the Minister of Agriculture, Natural and Animal Resources.

The centre is carrying out eleven priority research programs. These are : desertification control, genetic resource conservation of threatened tree species;

agroforestry; gums and exudate; tree seed improvement; wood biomass for energy; wood science; silviculture and management; bamboo; land reclamation; enrichment of range with fodder trees (World Bank, 1986, p. 1).

The Centre's buildings at Soba include houses for 5 staff and 9 labourers, six offices, library and herbarium rooms, a general laboratory currently used for seed processing and storage, and a wood technology complex comprising two offices, a laboratory, two woodworking rooms and a covered bay. Some facilities are shared with the Training Centre. In most cases, these buildings are in a poor state of repair, and there is shortage of laboratory space and equipment. For example, seed handling and research equipment and facilities are needed. And library materials and equipment are grossly inadequate.

4) Range and Pastures Research Section : started in 1950 as part of the Range and Pasture Department in the Ministry of Animal Resources. In 1975 it was transferred to become a component of ARC. Activities of this section cover the ecology of natural pastures, pasture composition, conservation and reseeding. Currently, studies concentrate on varieties, agronomic practices, and harvest of important irrigated forage crops. Western

Sudan Research Stations are expected to lead the work on natural pasture and fodder.

5) Game and Wildlife Section : is concerned with collecting base-line data on wildlife population, their habitats and the degree of use in wildlife areas. Specific studies cover areas, such as, range evaluation, forage quality, intensity of use, trend of animal numbers, distribution, migration patterns, feeding habits, breeding and diseases.

The scientific disciplines in research stations and centres include : Soil Science, Agronomy and Crop Physiology, Botany and Plant Pathology, Entomology, Breeding, Horticulture, Statistics and Agricultural Economics, Food Technology, Forestry, Fish, Wildlife, Range and Pasture.

The publications section of the ARC is concerned with collection, revision, editing and printing of all scientific reports from stations and centres of the ARC. Currently the regular reports issued by the Corporation are :

- Annual report of the Gezira Research Station and other stations.

- Annual report of Kenena Research Station
- Annual report of Hudeiba Research Station

The section also publishes annually a list of scientists and senior administrators and their activities. Miscellaneous publications are also issued. Some efforts are underway to issue extension bulletins on important crops.

In addition the Corporation represents the national liaison and input centre for the International Information System for the Agricultural Sciences and Technology (AGRIS). It also serves as a centre for Current Agricultural Research Information System (CARIS) of the FAO.

4.3.3 Veterinary Research Administration (VRA) - Soba

Veterinary research in Sudan started since the beginning of the twentieth century. Veterinary Research Administration at Soba was established in 1913 as part of the Veterinary Services Department. Research is being conducted in bacteriology, biochemistry and nutrition, pathology, etc. There are many Veterinary Research Centres scattered throughout the country, in Nyala and El Obeid (western region), Kassala (eastern region), Sennar

(central region), Malakal, and Juba (southern region) (Craig, 1991, p. 401). The main objective of these centres is investigation and research in disease endemic in their respective areas. The main activities include : vaccine production, in the past, most of the vaccines in use were imported. Now all the essential vaccines are produced locally, thus saving a considerable amount of foreign exchange; examination of pathological specimens; investigation and research; and training.

4.3.4 Research Conducted by Universities

The University of Khartoum comes under the auspices of the Ministry of Higher Education and Scientific Research. Faculties of Agriculture, Veterinary Science, Science (Department of Botany), Economics and Social Studies, and Hydrobrological Research Unit undertake research connected with agriculture, animal production and related socio-economic problems.

The bulk of research conducted by the Faculty of Agriculture, University of Khartoum, and the Faculty of Agricultural Science, University of Gezira has been linked to post-graduate studies programs. These cover a range of disciplines including breeding, weed science, animal production, soil science, mechanization, socio-

economics, forage crops and agro-forestry. The research included crops such as cotton, wheat, sorghum, groundnuts, sugarcane, citrus, vegetables, forage legumes, forage sorghum and gum arabic.

4.4 AGRICULTURAL EXTENSION SERVICES

Research results have little developmental value unless communicated to the end users. Therefore, extension services in Sudan had developed prior to 1958 as part of the irrigation and rainfed schemes.

The extension services branch is the main information intermediary in the agricultural system. Its basic function has been to provide technical and managerial advice, information and skills to farmers. The ultimate goal is to improve husbandry practices and farmer-efficiency with a view to increasing output and in the long run create a large pool of self-reliant and viable farmers especially in the rural areas. Agricultural extension services are offered by different administrative departments of the Ministry of Agriculture, Natural and Animal Resources as well as by large agricultural schemes, agricultural production corporations and private agricultural companies. Transfer of results of research to the farms and farmers is

feasible in case of the modern sectors, such as, the Gezira, Rahad, Blue Nile, White Nile and New Halfa schemes that have extension services, and also schemes of the Public Agricultural Production Corporation. Here, research achievements are received by managements of these schemes and applied directly as in the case of distribution of improved seeds of high yielding varieties to farmers or air spraying of recommended insecticides or through persuasion by the field inspectors or by compulsion by threatening eviction of uncooperative farmers. The real challenge occurs when attempts are made to transfer new knowledge to the hundreds of the thousands of small-scale traditional farmers. The only problem is that shortage of oil and transportation, the number of extension workers is not enough to cover all farms. Efforts of the agricultural extension services are limited. The existing bodies need much strengthening to cope properly with this task.

The drought and famine that took place in Sudan between 1983-87 have promoted many nongovernmental organizations to work in Sudan, thus offering extension services in agriculture and forestry as part of their activities. Moreover, many development projects have extension work components such as agricultural development of South Kassala, of Western Savanna, and

South Kordofan Rural Development Projects, Rural Development of El Obeid Project and Rural Development of Um-Kadada Project.

Flow of new information from research centres now occurs through direct correspondence, annual agricultural meetings and conferences and publications.

4.4.1 Veterinary Extension Department

The Veterinary Extension Department was established in the seventies under the General Administration for Public Services of the Animal Resources Administration. With a staff of sixteen, the extension services are weak due to inadequacy of personnel, facilities and budget. There is no link with research.

4.4.2 Agricultural Bank of Sudan

The Agricultural Bank of Sudan was established in 1957 as the first agricultural credit institution in Sudan. Its new building, financed by World Bank, was opened in 1992. One of the departments of interest to this study is the Extension and Rural Stores Department established under the Operation and Agricultural Credit Sector. From 1976 to December 1992, with funds from

Denmark and Holland, FAO executed a project in which the Agricultural Bank, Gezira Research Station of ARC and Gezira Scheme were involved. The objectives of the project were to secure efficient delivery of farm fertilizer and related inputs to optimize the operation of Rural Stores Network of the Agricultural Bank of Sudan (Agricultural Bank of Sudan, 1988).

The extension work has been given additional emphasis since January 1992 through establishing the Extension and Rural Stores Department and the appointment and training of an additional fifty extension specialists. In each of the branches of the Bank there are at least two agricultural specialists who are responsible for extension work in their region.

4.4.3 Forestry Extension Service - Forest National Corporation

The main objective of the Forestry Extension Service is to create an awareness within the people of Sudan of the benefits of forests and trees both in providing essential products for their daily needs and in protecting their environment. These products may include fuelwood, building poles, fruit, food and fodder, etc. The environmental benefits include protection of the

soil, crops and water supplies, shade for man and his livestock, and control and prevention of desertification. It aims to develop an appreciation of the forest and natural resources of Sudan and the proper attitudes and interest to obtain knowledge and skills to manage develop and protect on a day to day basis these life sustaining resources (World Bank, 1986. 79).

During the drought years of 1981-85 and the famine in 1984-85 it was realized that the loss of soil fertility resulted in crop failure and famine. It was also realized that more trees have to be planted, more natural forests have to be reserved and fuelwood energy has to be saved. As a result of all these, more emphasis was given to forestry extension service; and it has facilitated donors' contributions to the forestry extension sector.

4.4.4 Non-governmental Organizations (NGOs)

The drought and desertification and famine that took place in Sudan between 1983-1987 prompted many non-governmental organizations to work in Sudan, thus offering extension services in agriculture and forestry as part of their activities. Among the most important NGOs offering agricultural extension services : Concern,

Care International, Save the Children Federation, Oxfam U.K. and Ireland.

4.5. INTERACTION OF RESEARCH AND EXTENSION WORKERS

Whereas there has been close interaction between extension workers and farmers, there has been no institutionalized formal liaison between extension and research. The gap is widening. The only links between the two have been through a number of committees.

4.6 OTHER AGRICULTURAL ORGANIZATIONS

4.6.1 The Arab Organization for Agricultural Development (AOAD)

The AOAD provides technical assistance to its twenty-two Arab Member States. AOAD headquarters in Khartoum comprises of four main Departments dealing with Crop Production; Animal Production; Economics; Financial and Administrative Departments; and two sections on technical cooperation; and information and publications in addition to the Arab Centre for Agricultural Documentation and Information.

In formulating the national strategy for food security in the region, AOAD has identified one hundred fifty three projects and programs in the areas of grains, oilseeds, livestock and sugar production that shall enhance food self-sufficiency in the region by the year 2000, Of these projects thirty two related to Sudan. They include nine projects of grain and oil seed production, eleven projects for livestock and poultry production and one project for fish catchment and production. However, for many reasons these programmes have not been implemented as scheduled (The League of Arab States, 1991).

4.6.2 Arab Authority for Agricultural Investment and Development (AAAID)

The establishment of the Arab Authority for Agricultural Investment and Development came as a direct response to the global threat of hunger, malnutrition and the general food insecurity situation that prevailed in the world during the seventies. AAAID was established in 1976 as a regional Pan-Arab Investment and Development institution with the following main objective : to develop the agricultural resources of the Contracting States, with particular emphasis being laid on the provision of the maximum amount of food-stuff to the

Contracting States and increasing the exchange of agricultural products and inputs between such States.

The Authority's activities, include investment in agricultural production and related activities; and in particular, land reclamation, plant, animal and fish production, pastures, forests and other agricultural resources, transportation, storage marketing, exporting and processing of agricultural produce and animal and fish production and their inputs including materials and machinery necessary for agricultural production.

The AAAID activities started in 1978 by launching the first investment plan (1978/83) in the Sudan which was selected for the operations of the Authority in its first five years. Without prejudicing its investment activities in the host country, AAAID is currently embarking on various studies in other Member countries with the aim of identifying relevant viable investment activities in those countries (AAAID, 1987).

4.7 TRANSPORTATION AND COMMUNICATIONS

For a country as vast as Sudan, economic growth in general, and agricultural production in particular, can be constrained by inefficient transportation and communication systems. In fact, it has been argued that transportation is the major bottleneck for development and disaster relief in Sudan.

Access between the country's main part and the rest of the country is now clearly inadequate. The two major modes of transportation in Sudan are by road and rail. Historically, railways have been the major mode of transportation. Only over the last few years has road transportation become more important. The efficiency at which the railway system operates is low; and there are extremely poor communications in the rest of the country and between the different regions. The effects of this state of affairs are pervasive; it seriously hampers the expansion of agriculture in the countryside.

The railway network was first introduced for military purpose and linked Egypt with Sudan through the Halfa-Khartoum route. This route was the main avenue for Sudanese foreign trade prior to the Anglo-Egyptian conquest. After the construction of the harbour at Port

Sudan, the hinterland was linked to Port Sudan from Atbara. Another line from Khartoum was established which runs through Gezira, Sennar and El Gederaf to Port Sudan. Lately, an extension has connected Sennar with El Obeid through Kosti, extended to Nyala in Darfur, and continued down to Wau in the South. The railway sector has witnessed development since 1968/69. This is made up of a single track and a break in the line in a certain area in the country, especially in the rainy season, will isolate it from other parts of the country (Zahlan and Magar, 1986, p. 38).

The total length of railways in operation in 1991 was 4,725 km. The main line runs from Wadi Halfa, on the Egyptian border to El Obeid via Khartoum. Lines from Atbara and Sennar connect with Port Sudan. There are lines from Sennar to Damazine on the Blue Nile (227 km.) and from Aradeiba to Nyala in the south-western province of Darfur (689 km.), with a 445 km. branch line from Babanousa to Wau in Bahr El Ghazal province (Europa, 1993, p. 841).

Sudan railways has been incurring heavy losses, working to low capacity and has been unable to meet demands particularly of the recent famines and war requiring large freight capacity to move food and stocks.

Road transportation has gained a greater share of the volume of traffic due to a recent expansion in the construction of various highways. Port Sudan has been connected with Khartoum via Gedaref and Medani. Khartoum has been connected with Sennar, Singa and Kostî. In the west new paved roads have connected Nyala, Kas and Zalengi. These roads allow transportation in all climatic conditions. Previously most of these roads were impassable during the wet season. The number of vehicles has increased rapidly and these are run mostly by small private independent owners. The number of big trucks and large transportation companies has also increased. More than 90 per cent of private goods are transported by road from or to Port Sudan.

River and air transportation and pipeline carry the rest of the freight. River freight traffic is small in relation to the number of navigable streams in Sudan. The major river line connects Juba with Kostî. Another line operates in the Northern Region and yet others are seasonal, operating on the Blue Nile (Zahlan and Magar, 1986). The total length of navigable waterways served by passenger and freight services is 4,068 km, of which approximately 1,723 km is open all year. From the Egyptian border to Wadi Halfa and Khartoum navigation is limited by cataracts to short stretches but the White

Nile from Khartoum to Juba is almost always navigable. Port Sudan, on the Red Sea, 784 km from Khartoum, and Suakin, are the only commercial seaports (Europa, 1993).

The main characteristic of freight traffic is its seasonality. The bulk of goods transported is agricultural produce. Since agricultural production is seasonal, there is heavy pressure on transportation after the harvesting period. To distribute traffic movement evenly over the year storage facilities are needed. Another characteristic of the traffic movement is its special direction, which is mostly from or to the port, Internal integration especially in freight movement, is weak.

4.8 CONSTRAINTS AND LIMITATIONS IN AGRICULTURAL RESEARCH AND EXTENSION SERVICES

On examining the current situation of research and extension services we find that :

- 1) There is a lack of adequate communication facilities, such as a radio communication system to link research stations, substations and centres, especially those in remote areas.

- 2) The research centres and stations suffer from high turn-over, equipment which are more than twenty years old, and weak links with government and private sector.
- 4) No link exists with extension work, the relationship between extension services and research is weak and efforts in this regard is based on personal initiatives
- 5) Poor training, and limited opportunities for training abroad.
- 6) Lack of a clear research policy and also there is lack of national research programmes to guide and facilitate research.
- 7) The main constraints are buildings, there being inadequate space in offices and labs.
- 8) Lack of effective linkages among research units and inappropriate technical packages.
- 10) Poor and inadequate facilities in labs, fields and offices equipment and supplies, farm machinery and transport vehicles for extension services.

4.9 AGRICULTURAL INFORMATION SERVICES

4.9.1 Information Generation

It is worth noting that various scholars have started playing their role. More literature, both published and unpublished is being produced. The use of cyclostyled materials for teaching and reference purpose is a common phenomenon now in teaching institutions, including universities. Research findings are now commonly used for planning various projects. The initiative taken in coordinating the research activities carried out by various research institutions and university faculties in different subject fields is proving beneficial.

All agricultural research and higher learning institutions and development ministries generate agricultural information. The main output of the research station/centres throughout the country is annual reports, miscellaneous publications, pamphlet, journals, monographs, discussion papers; workshop proceedings, books, newsletters, etc.

4.9.2 Information and Development

Agricultural information is the hub of agricultural development and production. Agriculture is a dynamic and progressive field. As such, the availability of current and up-to-date information on scientific and technological advances is a pre-requisite for agricultural development. Many governments including those of the developing countries are beginning to realize that agricultural information is important to development.

The final report of the Unesco National Information System Intergovernmental Conference in 1974 noted that, "Government, especially those of developing countries, are realising that economic and social advance is dependent on the rapid improvement of existing national resources, and that the related science and technology (which also include agriculture) is heavily dependent on a strong and fast flow of socio-economic information of all kinds.

However, for information to play a key role in development, it must be used. The agricultural sectors need information on :

- **Agriculture** : Self-sufficiency in food production is now the cornerstone of Sudan's economic policy. For this policy to succeed we shall have to be innovative in the field of agriculture. Given that we have abundant information on better agricultural methods, harvesting, irrigation and food preservation, then we should consider ourselves duty-bound to have access to such information and disseminate it not only to those of our patrons who are already established farmers but to aspiring farmers as well. There should therefore be closer liaison between our agriculture research stations, and institutions and information centres throughout Sudan in the dissemination of this vital information.

- **Fisheries** : We need information about better trapping methods such as Fish Aggregating Devices (FADs). The use of FADs has the effect of boosting production and raising fishing efficiency; better fish preservation methods; conservation and protection of fisheries resources; and construction of better and safer canoes and boats.

- **Forestry** : Better methods of conservation and protection of forestry resources, etc.

- **Livestock** : We need information about better methods of breeding, preservation of animals

products (dairy products), conservation and protection of animal resources.

- **Rural areas** : Sudan is not only in Khartoum and Omdurman. Sudan is in the villages where more than 80 percent of Sudanese live, who are employed directly or indirectly in some or the other kind of agricultural activity, accounting for over 75% of the Gross Domestic Product (GDP) and major earning of the government revenue. Any talk of "development" whatsoever will be out of place until it is discussed in the context of the rural population.

The secret of rural development lies in setting up small scale industries where locally available raw material can be used to get value added products. For over a hundred years raw materials are being exported from Sudan in spite of the fact that value added products made out of this raw materials are in demand in neighbouring countries and overseas. Instead of exporting cotton, Sudan should be able to export sewing thread, cotton socks, cotton undergarments, cotton gloves, and several other items of apparel. Instead of exporting sesame seed, sunflower seed, cotton seed and groundnuts, Sudan should be able to export edible oil produced from these materials. Oil cake obtained as a by-product from

the expelling process may also fetch good revenue. These are only a few examples. Unfortunately, it is the weakness of the information sector responsible for shifting of the profits from Sudan to foreign countries which import Sudanese produce in raw form.

In agriculture our concern is to employ new methods of farming, use of agricultural engineering, use of appropriate manure and better seed, adoption of convenient means of irrigation, etc., with the objective of getting quick and better yields. The implication is to utilize the researches accomplished at the agricultural research stations and other research institutions. A call for proper research coordination activity is also implied. All these activities need strong information backup. We simply cannot produce or sell without information on market demand.

"It is assumed that agrarian priorities are likely to generate specific patterns of information needs" (Montviloff, 1990, p. 140).

4.9.3 Agricultural Information Institutions

Information institutions provide a measure of the relative numbers, size and capacity of the information infrastructures in the country and indicate the intensity of the economic activities devoted to information (Montviloff, 1990, p. 141).

4.9.3.1 The National Information System

Several efforts have been made to create a national information system. In response to a request from the National Documentation Centre (Recently renamed Documentation and Information Centre), a Unesco Consultant visited Sudan in the 1970s to advise on the establishment of a national information system. Following the consultant's recommendations, which were discussed in a national conference, the National Council for Research (NCR) (Recently renamed National Centre for Research) endorsed the establishment of a National Committee for Information (documentation, library, and archives) Services. The terms of reference of this body and its proposed four advisory committees, covering special libraries and scientific information, university and higher education, general libraries and archives services. Unfortunately, the interest and enthusiasm

created in the proposed national committee has abated with a change of the top officials of NCR. Low priority was given to the new committee, with the result that no resources, human, physical or financial were given to enable it to get off the ground.

Although ten years later, meetings have taken place to prepare proposals for national information policies and to activated the National Committee for Information Services a number of obstacles continue to hinder the development of a national information system and policy. First of these is the inadequate number of qualified and trained personnel available, due mainly to the brain drain to the rich oil producing countries. Then there is the pressure on resources arising from a scarcity of funds, especially foreign currency. A more surmountable obstacle is the lack of a unified job classification scheme stipulating the types and levels of responsibilities, the necessary qualifications and salary ranges for each category. There is also the lack of an organization or institution to look after, coordinate and standardize technical procedures, or offer assistance in the form of centralized services, financial aid or technical advice. It should also be noted that national development plans do not include the information sector. Also there is a lack of a policy to guide the systematic

development of the information sector or the purchase of computers (Wesley, 1990, p. 32).

4.9.3.2 The Documentation and Information Centre (DIC)

The Documentation and Information Centre (DIC), formerly the National Documentation Centre is one of the units of the National Centre for Research. The Centre was established in 1974 with assistance from UNDP/UNESCO in the first two years of its creation, and assistance from the Ford Foundation and IDRC during the last five years.

The centre's activities are as follows :

1) Collecting, processing and disseminating information on published research findings, dissertations, reports, studies and conference papers, as well as on current research, using microcomputers and micrographics. In addition to normal procedures for acquiring local sources, foreign sources relevant to Sudan, documents which exist in single copies available in other institutions, are microfiched and added to the Sudan collection.

2) Two publications are produced regularly from two of the databases. The publications are the **National Register of Current Research** of which three volumes were issued

covering the years 1983 to 1988. The second publication is Sudan Science Abstracts which presently comes out twice a year, of which thirteen volumes have been published. The next issue for 1993 is expected shortly.

3) Information services are offered utilizing the library resources, national database (bibliographic databases) forty per cent of which relates to agriculture. Another database gives information on on-going research projects in all subject fields including agriculture. The Centre receives international databases, is the focal point for INFOTERRA (International Information Centre for the Environment), PADIS (Pan-African Development Information system), CEHANET (Centre for Environmental Health Activities Network), INIS (International Nuclear Information System) and Unesco/UNISIST, and also receives databases on CD-ROM, such as, MEDLINE, CABI, AGRICOLA, AGRIS, TROPAG and RURAL, POPLINE and ERIC (Wesley, 1990, p. 31).

4.9.3.3 Main Agricultural Libraries, Documentation Centres and Information Services Units

"It is assumed that the more numerous the centres, the better the information reference sources." (Montviloff, 1990, p. 141).

Information for the agricultural sector and rural population is a vital requirement. Libraries and information services units and documentation centres involved in this area are the following :

4.9.3.3.1 Shambat Agricultural Library

The Shambat Agricultural library, a branch library of the Khartoum University library, was established in 1938 along with the establishment of the Faculty of agriculture. It serves three faculties : Agriculture, Veterinary science, and Animal Production. The library has a collection of about 43,000 publications. The number of journals that the library was able to renew for 1993 is about 18. The library is used as an academic library as well as a national agricultural library, with a rich Sudan collection containing M.Sc. and Ph.D. thesis on agricultural subjects.

A library with such a rich collection of books, current journals and a collection of back volumes, thesis and dissertations, serving three faculties has a staff of only three paraprofessionals and four library attendants. It suffers from shortage of funds to purchase new books, periodicals and new equipment, e.g., computer, microfiche apparatus, photocopier, etc., needed for providing better

services to its clientele. Now it requires to be assisted financially for rehabilitation and reconstruction with better furniture, ventilation, lighting equipment and shelving expansion, to meet the requirements of the teaching staff, post- and under-graduate students in addition to the research workers spread all over the country, carrying out research work on plants and animals.

4.9.3.3.2 Agricultural Research Corporation (ARC)

Library, Wad Medani

The Agricultural Research Corporation library was the first to be established in the Sudan. It started functioning in 1906 in Khartoum then moved to Wad Medani in 1930 to back the research being carried out in the Gezira area, where the Gezira scheme is located. Many seekers of information travel to it for information, particularly about the Gezira scheme. Now the main library has a collection of 1000 books, 1000 reference books, 20,000 booklets and about 250 periodical titles bound in 14000 volumes. It has a branches in almost all of agricultural research stations/centres throughout the country, but the degree of development of these services and facilities varies between centres. The staff includes nine persons, two of whom are university graduates, six

technicians and one typist. Major objectives of the ARC library are to serve the information needs of first and foremost, the research officers at the station, all heads of various departments, divisions, sections, district agricultural officers and their counterparts, as well as the extension agents.

In addition, the ARC library represents the national liaison and input centre for AGRIS (FAO). It also serves as a centre for Current Agricultural Research Information Systems (CARIS) of the FAO. The library published the Sudan National Bibliography of Agriculture, volume 1, 1975-1983, (131 p.), extracted by S.A. Nasir (El Nusieh) from Agrindex.

4.9.3.3.3 Food Research Centre Library, Shambat

The Food Research Centre library is a branch of Agricultural Research Corporation library. It was established in 1965 with the establishment of the centre. It has a large collection of books, however, for a long time there has been no new addition of books and journals. The library is managed by three paraprofessional. The type of publications produced in the centre are pamphlets and the Sudan Journal of Food Science and Technology.

4.9.3.3.4 Gezira University Library

The main library of the Gezira University serves three faculties of Science and Technology, Agricultural Sciences, and Economics. There are two branch libraries, one of which is for Medicine and the other for Education. The total library collection is 53,000 books, of which 23,000 are in Arabic. The library receives 20 agricultural periodicals, and 20 journals relating to the health sciences. But the journal subscription have not been renewed for 1993.

The library has a staff of twelve of whom one is an M.Sc., 3 hold higher diploma, 4 B.Sc., one middle diploma, and 3 high school graduates.

4.9.3.3.5 College of Agriculture and Food Technology Library

The College of Agricultural and Food Technology library was established in 1961 with the establishment of the college. It is a branch library of the main library of Sudan University for Science and Technology. The total collection of books is about 7,800 items; journals not

renewed since 1983. The staff number 4, one of whom holds a higher diploma, one a middle diploma and others are library attendants.

4.9.3.3.6 The Ministry of Agriculture, Natural and Animal Resources, Documentation, Information and Follow up Department

The library of the Ministry of Agriculture, Natural and Animal Resources, named Documentation, Information and Follow up Department exists in name and is largely inoperative. There is no classification scheme used for organizing the information materials, a fairly extensive collection in various forms. The library was established in 1976 to furnish agricultural experts and research workers with technical information. Without qualified/experienced librarians, the library never developed, on the contrary, it went backwards. Many books disappeared, no standard technical treatment was adhered to. Many times Ministers themselves put emphasis on its development, then the ministers were changed. It receives a few free journals and does not subscribe to any. The budget is small and even that is not utilized. The library needs better building, computers and funds to renew journals and buy new books, and also needs qualified librarians to reorganize it.

4.9.3.3.7 University of Khartoum Library - Sudan
Collection

Sudan Collection is a unique collection of writings on Sudan, among which there is a good collection of Sudan agricultural documents. The University is one of the legal depository libraries for Sudanese publications.

4.9.3.3.8 The Central Archives Library

The Central Archives library has a good historical and up-to-date collection of Sudan agricultural documents. It is also one of the legal depository libraries for Sudanese publications.

4.9.3.3.9 The Veterinary Research Administration Library

The Veterinary Research Administration library was established in 1913 with the establishment of the centre. It has a staff of one professional librarian (Ph.D.), one university graduate and two technicians. The library collection includes about 1500 books and pamphlets and used to receive 109 periodicals but now reduced to 36 periodicals due to paucity of funds. —

4.9.3.3.10 The Arab Centre for Agricultural
Documentation and Information

The Centre, one of the units of the Arab Organization for Agricultural Development, was established in 1983. The aim of the centre is to link sources of information on agriculture in the Arab World and to coordinate collaboration between them and the international information systems. This will allow the flow of information between Arab countries and provide guidance for the efficient resource allocation of investments in agriculture.

The Centre collects, processes, stores, and disseminates both documentary and non-documentary information using modern technology. It coordinates the output of the sectoral network for agricultural information as part of the Arab information network. The collection consists of 26,000 books, 1100 current journals 3,000 technical reports, 6,000 government publications, and 8845 microfiche. The centre has an HP3000 and several other computer and microfiche equipment and photocopying facilities. The staff of 15, includes 6 B.Sc., one M.Sc., one middle diploma holder, 7 high school graduates.

4.9.4 Information Resources Available and Processing

4.9.4.1 Information Sources

Reference and Loan Services : In all of these libraries, documentation and information services units, reading services (on the spot and on loan) is the major function. Conventional reference materials are available, though few in number in most of the libraries. Some of the units were reported to be giving reference service to farmers and policy makers within the government.

Database Search on CD-ROM : Only a few of the centres provide such search facilities and they are not offered at the research centres and stations.

Current Awareness Services : Only a few of the units have selective dissemination of information services for their users, individual or corporate.

4.9.4.2 Physical Facilities and Equipment

Buildings : Among the libraries and documentation centres located in Khartoum only a few have good library buildings and others have no purposely built and well furnished library facilities. Most of the institutions have a one room, not satisfactorily furnished and somewhat crowded library. Among the agricultural colleges

surveyed some have purposely built library units, but are not well furnished and organized. Others are very small, have no space to serve the growing number of students and staff.

Photocopying services : All agricultural college libraries surveyed have no photocopying services and very few documentation centres and information services units offer this service. Reprographic equipment in general are inadequate. Duplication and binding equipment are found only in some institutions, those producing publications (e.g. annual reports, journals, etc.)

Micrographics : Only a few of the organizations are doing their own microfilming. The rest, those that have the facilities, depend mainly on commercially produced microfilm/microfiche.

4.9.4.3 Human Resources

There was a general shortage of staff, adequately trained in agricultural librarianship.

4.9.4.4 Technical Processing and Vocabulary Control

Tools

The majority of the library and information services units use the Dewey Decimal Classification (DDC) scheme

and some use the Universal Decimal Classification (UDC) scheme. Some libraries use Agrovoc for both classification and indexing. Other specialized libraries like Institute of Environmental Studies library use Infoterra (thesaurus). Anglo American Cataloguing Rules is commonly used, particularly in the institutions that use the DDC scheme. Some libraries and information service units do not use any of these classification schemes.

4.9.4.5 Application of Information Technology

Concerning the use of information technology (computers) the survey result shows that most agricultural libraries have no computers especially academic libraries. Some units have computers of different capabilities. The types of computer systems available are mostly IBM compatible. Table 3 shows the number of organizations having computer facilities. Most of those having computers, use them mainly for word processing, and data analysis as in the Economic and Statistics Department of the Ministry of Agriculture, Natural and Animal Resources, and the computer unit in the Forest National Corporation. Only a few use computers for information processing and retrieval such as, the Documentation and Information Centre of NCR; and the Arab

Centre for Agriculture, Documentation and Information. They use CDS/ISIS and MINISIS respectively. The use of computers for publication purposes is now growing in some institutions.

Table 3 : Number of organizations having computer system

Type of computer system	No. of organization
IBM family	15
HP family	2
NCR family	2
Toshiba	3
Compaq 236	1
Portable	2
Mainframe	1

4.9.4.6. Publications

All agricultural research and higher learning institutions and development ministries generate agricultural information, although it is not possible to estimate exactly the quantity, type and form of publications. The majority of these publications produced in the country are research reports, progress reports, discussion papers, working documents, pamphlets, bibliographies, proceedings of conferences and workshops,

newsletters, annual journals, etc. Usually agricultural information is produced in report form (textual) and some in numeric data form, especially by the Economics and Statistics Department, Ministry of Agriculture, Natural and Animal Resources. Some research institutions produced journals like Sudan Journal of Food Science and Technology, Sudan Journal of Veterinary Research, Sudan Sylva, Sudan Science Abstract, and Annual bulletin of Animal Resources Statistics. Others publications include survey reports, consultancy reports, government publications, feasibility studies, Agricultural year book, current agricultural statistics, etc.

4.9.4.7 Cooperation with other Organizations

The cooperation is mainly in the area of exchange of locally produced publications. Formal interlibrary loan arrangement/agreements among the agricultural libraries and information service units do not exist nor has there been any attempt made in this regard so far. However, Some of agricultural libraries and information services units had already established linkages with AGRIS, CARIS, CABI, AGRICOLA, ILCA, WHO, INIS, INFOTERRA, etc.

On the other hand ARC serves as a national AGRIS/CARIS input centre. This could mean better opportunity for more agricultural literature to be collected at the ARC and at all agricultural research centres. DIC has already established cooperation with PADIS, ILCA, INFOTERRA, INIS, etc.

The common communication mechanism for whatever little interaction exists among these units is visits in person and through correspondence. No formal (national) common forum, such as meetings, workshops or publications purposely designed to develop interaction among them exists.

4.10 AGRICULTURAL INFORMATION NEEDS : SURVEY RESULTS

Questionnaire 2 was analysed, data computed and the results tabulated. The results are tabulated in the following tables :

Table 4 : Nature of work

Nature of work	Number	%
Researchers	45	47.4
Teaching/academic	20	21.0
Students	15	15.8
Extension worker	11	11.6
Consultancy	4	4.2
Total	<u>95</u>	<u>100</u>

According to the above findings the major agricultural information user groups are researchers, instructors followed by postgraduate students.

Table 5 : Currently conducting research

State	Number	%
Yes	45	47.4
No	50	52.6
Total	<u>95</u>	<u>100</u>

Table 5 indicates that less than half of the 95 respondents are currently conducting research.

Table 6 : Information system available

State	Number	%
Yes	75	78.9
No	20	21.1
Total	<u>95</u>	<u>100</u>

Close to 80 per cent of the 95 respondents indicated that there was a library or information service unit in their respective institution.

Table 7 : Reasons for not having library facility

State	Number	%
- Lack of need	0	0
- Lack of management awareness	0	0
- Shortage of fund	15	15.8
- They do not know	5	5.2

Shortage of funds appeared to be the major reason for not having a library in their institution.

Table 8 : The purpose of using the library

State	Number	%
Books	80	84.2
Journals	15	15.8
Total	<u>95</u>	<u>100</u>

The majority of respondents indicated that they used the library/documentation centre for borrowing books. And only a few of them (16%) used the library to keep abreast with developments in their fields as indicated by the low use of periodicals.

Table 9 : Information services provided

Services provided	Number	%
- Current Awareness Services	0	0
- SDI	0	0
- Online searches of data bases	06	6.3
- Reference services	85	89.5
- CD-ROM services	04	4.2
Total	<u>95</u>	<u>100</u>

Table 9 indicates that a majority of the institutions provided references services, and none provided Current Awareness Services or Selective Dissemination of Information (SDI). Provision of online and CD-ROM searching services in a few institutions have been noted.

Table 10 : Satisfaction with services in their institutions

State	Number	%
Yes	30	31.6
To some extent	50	52.6
No	15	15.8
Total	<u>95</u>	<u>100</u>

Over fifty per cent of the respondents were only partially satisfied with their institution's

library/documentation services. Close to 16 per cent indicated dissatisfaction with the services available. They all used other libraries close to their institution or place of work.

Table 11 : Does inadequate information facilities hamper their work?

State	Number	%
- Does not hamper my work	0	0
- Hampers it but not seriously	65	68.4
- Seriously hampers it	0	0

Only 65 of the 95 respondents answered this question. All of them indicated that inadequacy of the services affected their work in one way or another.

Table 12 : Getting materials from other sources through their library

State	Number	%
Yes	5	5.3
No	90	94.7
Total	<u>95</u>	<u>100</u>

Data in table 12 indicates that the majority (about 95%) of the 95 respondents do not get materials through their library. The few who did get materials through

their library mentioned that it took more than a month, and some of them commented that it was easier to travel to other libraries to get what they wanted rather than waiting for it to be obtained through their own library.

Table 13 : Frequency of using other library

State	Number	%
Frequently	6	6.3
Sometimes	53	55.8
Rarely	31	32.6
Not at all	5	5.3
Total	<u>95</u>	<u>100</u>

According to the above findings, only 6% of the 95 respondents frequently (at least once a day) used libraries of other institutions.

The primary reason of infrequent use of other units appears to be lack of convenient transport to the relatively distant centres (84.2%). The second major reason in this connection is the lack of awareness of what information sources are available and the services provided in other institutions/units (15.8%).

In response to question 21 (what materials they wished to add to the library collection), the suggestions varied according to the tasks the user group performed.

Information needs within a category of users also varied in several dimensions, depending on the role, function, activity, subjects of interest, stage of work, etc. they were involved. For instance, researchers in agriculture, needed more information about current research and developments usually available in current journals from abroad, from researchers in other countries, etc. Almost all respondents (95) emphasized that they wanted current journals and latest books, because most of the books in their library were out of date.

4.11 CONSTRAINTS AND LIMITATIONS OF EXISTING AGRICULTURAL INFORMATION FACILITIES

On examining the development of agricultural libraries, documentation centres, and information services units in Sudan, we find that all libraries irrespective of size face similar problems though of different degrees of severity. There is a long way to go before effective library services can be realized in agricultural colleges and research institutions. Inadequate supply of reading materials especially current journals and periodicals and shortage of both trained and untrained staff is a common feature. However, the position differs from place to place depending on the

initiative of the head of the institution as well as that of other members of the staff and the sources of funds.

Space and basic equipment (e.g. photocopiers, etc.) is another problem which renders library services ineffective. The space allocated for some library use differs from stores to semi- or purpose-built buildings. Only a few institutions have purpose-built, but there are more library users now than when the buildings were built. The enrolment in all universities has gone up and the reading facilities are not adequate. Although there are several agricultural libraries, documentations centres and information services units within agricultural organizations, there is no national machinery for coordinating their activities. As a result many of them are not aware of the holdings of other institution. This pathetic situation does not augur well for development.

The present state of agricultural information services already described shows clearly that the existing organization of agricultural information services is not adequate for the country's needs and the pace of development for enhancing the capabilities is very slow. Some of the specific reasons for the slow development of agricultural facilities and services are:

- 1) Lack of adequate funds (both in local currency and foreign exchange) for regular acquisition of new materials and dissemination of information.
- 2) Information manpower is completely inadequate both in quality and quantity i.e. there are no professional posts for librarians or information specialists in the establishment.
- 3) Poorly motivated staff.
- 4) Inadequate physical infrastructure.
- 5) Absence of legislation to serve as a basis for the systematic development of the agricultural information system (i.e. collection, processing, and dissemination of agricultural information).
- 6) There is a lack of coordination and cooperation between different agricultural libraries and information services units.
- 7) Use of information technology in information handling is minimum.
- 8) Lack of an information policy to guide the systematic development of the information sector.
- 9) Lack of a unified classification scheme in the library and information sector stipulating the types and levels of responsibility and the necessary qualifications and salary range for each category.

- 10) Some libraries are very poorly operated e.g. in some there is hardly a catalogue to guide users to the collection.
- 11) Lack of public awareness in general about the role of agricultural information facilities in national development planning and implementation of projects.
- 12) Libraries are mainly used by academics and students i.e. information is used to some extent for development and solving problems. However, user sensitization has not yet been carried out effectively.
- 13) Absence of standards, systems and tools to handle information.

All the above factors and many others mentioned elsewhere in this work call for a national agricultural information system to be developed with the documentation and information centre at the hub of the network, to promote access and utilization of information by all those involved in agricultural development. Suffice it to say that the government having recognized the importance of a well developed, organized and fully equipped information system as a tool for socio-economic development, is taking corrective action to rectify these shortages.

Past experiences of many countries indicate that almost all of the above shortcomings and drawbacks can be addressed by establishing a network of information units by coordinating their resources and activities.

CHAPTER 5

NATIONAL AGRICULTURAL INFORMATION SYSTEM AND NETWORK : PLANNING

5.1 INTRODUCTION

A national information system is basically a network of existing information resources together with new services for identified gaps, so coordinated as to reinforce and enhance the activities of the individual units and thus enable specific categories of users to receive the information relevant to their needs and abilities (Atherton, 1977, p. 17). Management of national systems implies a policy plan to define priorities, a problem-oriented coordination of resources, and a systematic but flexible approach to information problems.

Networking is a generic term encompassing a range of cooperative activities. The goals of any network are to share resources, whether these be materials, functions or services, and to make these resources available to all potential users. When we talk of the national agricultural information network for Sudan, we normally think of the existing information units to be linked together with a mechanism for resource sharing facility.

I have mentioned elsewhere in this study that we have in Sudan various groups who generate vast quantities of useful information which can be used for decision making and implementation of projects. There is therefore a valid requirement for close liaison between those whose function is to disseminate information and those who need the information. However if this system is to operate for the good of both the rural and urban population, we must seriously think in terms of district agricultural information complex as an important link in the national information and documentation network for Sudan.

5.2 INFORMATION POLICIES AND PLANS

As national and international awareness of the value of information grows, policy makers must ensure that the world's professional and specialized knowledge is fully and properly used in guiding social and economic evolution. At all stages, policy on the development of information services should be part of a nation's scientific, technical and economic planning and policy (Atherton, 1977, p. 20). Several developing countries have embarked on the planning of national systems and networks. Governments willing to allocate funds for this purpose can establish governmental or government-chartered agency to exert professional leadership, to stimulate and

coordinate the development of information resources and development.

An agency responsible for a national system or network of information services works with and advises executive and legislative bodies on setting up budgets, preparing legislation, and providing leadership for information developments. Usually, a substantial programme must be launched to build up the staff and strengthen the collection of the several institutions most directly concerned - universities, technical institutions, productivity centres, export promotion centres, development banks, central statistical institutes, book production centres, and the like. Such a national agency would also coordinate efforts with foreign assistance agencies, international agencies, charitable foundations and other voluntary organizations.

A national scientific and technological information policy can encourage the publication of the results of all indigenous, non-proprietary scientific and technical research, development, and applications. It can promote the coordination of data centres and library services and the improvement of abstracting and indexing services, translations and information transfer networks (Atherton,

1977, p. 20). Therefore, in Sudan there is a need to formulate a national policy on information systems and services.

A national policy is required to ensure the harmonious implementation and operation of information resources, services and system e.g. timely access to relevant information to meet the different needs of users throughout the society, coordination and compatibility of the overall national information system, better complementarity and compatibility between the various legislations concerning the provision of information, better responsiveness to the implications of new information technology developments and more effective participation in regional and international information systems and networks (Montviloff, 1990, p. 11).

5.3 OBJECTIVES OF NATIONAL INFORMATION SYSTEM AND NETWORK

5.3.1 General Objective

The general objective of the agricultural information system and network for Sudan is to provide library and information services to meet the specific needs of institutions and individuals for information,

and to support national development generally. Since no one library, documentation centre or other information services can be self sufficient, it must operate as part of a national and international network.

Neelameghan (1991, p. 10) states the overall objectives of the various information systems and networks are more or less similar, for instance:

- To improve awareness concerning new developments and applications among the participating entities (countries, institutions, individuals) in their respective areas of interest;
- To transfer knowledge and expertise among the participating entities and to implement the concept of Technical Cooperation among Developing Countries (TCDC);
- To serve the information and data needs of researchers, decision makers, administrators, other professionals and para professional and all those who are involved in one way or the other in development programmes and activities in participating entities;
- To facilitate information and data flow, exchange, sharing and access among the participating entities in their respective areas of interest;

- To stimulate and/or support the establishment and operation of information systems and services at the national, regional and international levels for the effective dissemination of information and data;
- To promote the effective use of information, data and research/study results through the improved use of information products and services;
- To develop and/or strengthen information infrastructures, information handling capacity, the production, marketing and dissemination of appropriate information products services in and among the participating entities.

5.3.2 Specific Objectives

The specific objectives of the system and network are the following :

- To allocate responsibilities to participating organizations for building up strong information resources, conventional and non-conventional documents, data, and databases for providing services in the disciplines that are directly or indirectly related to agriculture.

- To prepare a national Union Catalogue of periodical publications, technical reports, government reports, theses, and such other material not easily accessible to users.
- To establish a national referral service to direct users to appropriate sources (expertise, research projects, databases, documents, organizations, etc.).
- To coordinate information activities among members, to share resources, undertake joint projects and minimize duplication of effort. etc.
- To strengthen or establish or advise/assist in the establishment of an information centre at each node of the network (participating organization).

5.4 NEED FOR NATIONAL AGRICULTURAL INFORMATION SYSTEM AND NETWORK

Information is a national resource. To take full advantage of this resource a properly structured information system is required (Wesley, 1993). Information sources and services are dispersed in innumerable generating agencies, libraries, documentation and information centres access to which is complex and

difficult (Atherthon, 1977). This dispersal calls for a mechanism for coordination, that is, a coordinated national information system.

Organizations involved in research and development activities, especially in agriculture and related sciences, are growing in number and complexity. As a result, a vast amount of information is generated in the respective fields. The volume of information generation is increasing at an exponential rate which calls for a system for its effective and efficient management and utilization.

Users need to have access to relevant, reliable and timely information which to facilitate gainful decision making, planning, plan implementation, research, and development. With the current rate of growth of documents and the rising cost and diminishing budgets of the library, documentation and information centres, it is not possible for any one of them to be able to supply its users with all the required information in time. It is therefore necessary to pool resources through networking.

Cooperative approach has become significant at national, regional, and international levels. At the national level the cooperative approach (networking) in

information is stated to be mainly to exploit maximally the country's information resources to meet the national information requirements by bringing together information sources and services within the country as well as outside of it (Creech 1982; Boadi 1984).

Increasing cooperative effort among countries of a region or those belonging to a regional alliance is seen as a possible means of sharing information resources, expertise, etc. especially where common areas of interest and concern can be identified (Neelameghan, 1991).

There are also other potential advantages that call for networking of information systems and services units like the ones listed by Wesley (1993). Information networking is needed to :

- 1) provide mutual support to participating units
- 2) reduce unnecessary duplications of efforts
- 3) maximize accessibility, sharing and use of available resources
- 4) achieve common objectives unattainable by any centre alone.
- 5) Meet the different and complex information needs of users.

There are also other potential advantages like the ones listed by Akhtar (1990) and others, namely, "better utilization of existing scarce resources, capacity to reach greater number of users, and greater economy and efficiency of operation." He also indicates other activities that networking are aimed at : "improve exchange of information and communication between researchers or specialists in a given area; compile and disseminate information produced in a particular region on a given area of knowledge; provide integrated information for different economic sectors, and create a wider base of information for poorly defined sectors."

Another important element promoting networks is developments in Information Technology (IT). On the developments of IT, Neelameghan (1991, 8) stated that :

"The developments have facilitated flow of and access to information and data more particularly within and among developed countries and the newly industrializing nations and to some extent in the Third World countries."

The possibility of fast access to remote information resources through IT applications has given rise to the establishment of networks at national, regional or international levels.

All the above factors and others call for establishing a national agricultural information system and network.

5.5 TYPES OF NETWORK

Networks may be categorized into five types :

- 1) Decentralized input of data from national centres, centralized processing and generation of information products and decentralized access to and/or production and use of information products. In this framework, there may be regional centres receiving and processing inputs from national centres, inputting the consolidated regional data/records to an international centre, and providing regional services and products, thus constituting a sort of regional or sub-regional network within the larger network.
- 2) Mainly centralized operations - collection, processing, preparing databases, providing

information products and services from a centre. National and sub-regional centre may obtain the products and services to provide national sub-regional services.

- 3) Systems and centres more or less operating independently, but have common interest, and exchange information and data.
- 4) Essentially mechanisms/arrangement/programmes for cooperation and coordination of information activities in and among members or participating countries and for supporting such activities as well as subnetworks and specialized networks.
- 5) Combination of two or more of the above types (Neelameghan, 1991, p. 10).

5.6 NETWORK ACTIVITIES

- 1) **Cooperative acquisition** : The first step to be undertaken by a library or documentation centre that wishes to participate in a national network, is the acquisition function. A library's first responsibilities is towards its local clientele. However information explosion and financial limitations may lead to cooperative schemes of acquisition that aim at full subject coverage on a national scale, elimination of unnecessary

duplication of materials especially less frequently used ones, as well as extending the range of available materials. Subject specification is another area of cooperative acquisition, which may even facilitate the compilation of subject bibliographies.

Basic requirement in cooperative acquisition is substantial funding from "reliable and on regular basis" for each participant either to make direct contributions in the joint purchase or to fulfil responsibility of building collections and services in assigned specially area. Major purposes include comprehensive national coverage to avoid wasteful multiplication of information sources, and rational use of financial resources in a national context.

- 2) **Inter-library lending and National Union Catalogues**
: Interlibrary lending is facilitated by the availability of union catalogues and directories of resources to identify items and locate holding libraries. Periodical articles need to be photocopied in order to prevent wasteful duplication and secure optimum use of foreign exchange.

- 3) **Exchange of publications** : Subscribing libraries may make arrangements to exchange publications amongst themselves as a cheaper way of acquiring materials relevant to the needs of their communities or publication with local emphasis.
- 4) **Cooperative resource training** : Training, mainly in the country for developing basic skills in modern information handling and in technical aspects of network activities. Librarians, information officers, documentalists and other information scientists in each resource centre (node), should contribute to the determination of their requirements, and in designing the courses for training in information work. They are to make sure that all personnel in each resource centre have been trained to use common norms and standards, for example, the same classification scheme, the same software for information storage and retrieval, etc.

5.7 FACTORS AFFECTING THE DEVELOPMENT OF A NATIONAL AGRICULTURAL INFORMATION NETWORK IN SUDAN

Among the many factors which affect the establishment of agricultural information network in Sudan include :

- 1) Geographical setting : The long distances between the various library and information centres constitute a very serious constraint to information resource sharing in Sudan.
- 2) Outside Khartoum area most agricultural institutions are scattered at great distances from each other. Moreover, apart from the network of research stations within the Agricultural Research Corporation and those within National Centre for Research, these special libraries are largely uncoordinated.
- 3) Transport and telecommunication facilities are not yet sufficiently developed to make it possible for one institution to refer easily to another in order to obtain information or library material.
- 4) The state of the economy : Sudan's economy has not fared as well as most Sudanese would have wished. This has obviously affected the smooth operation of many libraries and information centres in the country as budgets were cut, often resulting in loss of manpower, reduced services and reduced acquisitions of reading materials, etc. Under these circumstances, one would normally expect closer cooperation among information centres. This is unfortunately not the prevailing case. What actually happens is that as resources become

scarce, the tendency is for many libraries and information centres to restrict their facilities and services for the exclusive use by patrons of their institutions. Several reasons are advanced for this, such as high postal charges, lack of photocopying materials such as paper, etc.

- 5) Human factors : Any kind of cooperation stands or falls by the human resources available and the personal attitudes of those involved. Unless there is trust and mutual respect on the part of those concerned, no information resource sharing can take place.
- 6) Lack of national information policy : It cannot be overemphasized that the absence of coordination at the national level often entails wasteful duplication of work, on the one hand, and on the other leaves many gaps in the provision of information, thus making it difficult to concentrate investment on the provision of information in areas of national economic and social importance (Unesco, 1985).

The absence of any form of national development policy to coordinate information activities in Sudan is therefore undoubtedly the most serious constraint to the smooth provision of development-oriented information

services through resource-sharing (in the country).

These considerations point to the urgency of developing a network of libraries and documentation centres services. Such a system could ensure a more efficient access to and distribution of information sources throughout Sudan.

5.8 PROPOSAL FOR COORDINATION AND COOPERATION OF INFORMATION RESOURCES

For strengthening the agricultural information services, the constraints mentioned in the previous chapters need to be minimized, if not completely eliminated. It has been mentioned that agricultural information sources are varied and extensive. In each of the institutions generating or using agricultural information, there is a need to strengthen or establish an agricultural documentation/information centre or unit. The information centre should collect, process and organize information in conveniently accessible and usable form.

We can only cope with information explosion by cooperative, and not by individual effort, by pooling of material resources and human skills. The utilization of

technology that would be beyond the reach of individual units becomes possible through the sharing of resources. Attracting national and external assistance through the provision of better services that result from rationalization and pooling of resources and hence provision of improved services. On the issue of resource sharing, Mishra (1985, 6) stated that :

"Resource sharing is a need based concept founded on sound principle of 'give and take policy'."

Coordination of the diverse contributions is vital. Resource sharing and exchange of information will become possible through normative action. And this should be a first step in tackling the problems.

The libraries and documentation centres of core interest to agricultural development are those of the following organizations:

- 1) The Ministry of Agriculture, Natural and Animal Resources, Documentation, Information and Follow up Department;
- 2) Agricultural Research Corporation;
- 3) Sudan's Agricultural Colleges;
- 4) Veterinary Research Administration;

- 5) Forestry Research Centre;
- 6) Fisheries Research Administration;
- 7) The Documentation and Information Centre, National Centre for Research;
- 8) Institute of Environmental Studies; and
- 9) Arab Organization for Agricultural Development, the Arab Centre of Agricultural Documentation and Information.

With regard to these agricultural libraries, the following objectives can be specified :

- 1) There should constitute a network based on :
 - (a) Union catalogue of serial publications, indicating the holding libraries and with a formal agreement to make available items for study in situ or on loan, or photocopies of papers, subject to the prevailing library rules; and
 - (b) the regular issue of accessions lists by all agricultural libraries and documentation centres.
- 2) A common bibliographic format to be adopted for all bibliographic citations in accessions lists.

- 3) A longer-term aim should be to computerise cataloguing, and accession list production. This, of course, would presuppose the availability of computers to input records for bibliographic search and to merge records from other libraries.
- 4) Each library to be staffed by a trained librarian, with further staff support as necessary. Adequate provision to be made for career structure and career development through further training, visits, etc. This is essential if progress is to be made in promoting inter-library cooperation.
- 5) Library policy in each case to be along active rather than passive lines, aimed at positive service to library users and providing the widest practicable range of services, making full use of interlibrary cooperation.
- 6) An association or other forum for agricultural librarians and users should be established to exchange experience and views on library matters, promote collaboration, give professional corporate identity, act as a collective body to represent agricultural information services in dealing with institutional and other bodies, and promote technical development and high standards generally.
- 7) The needs of outstation research workers should be considered, an early objective being to revive the

photocopied contents page and document back-up service provided by their stations. There may also be a demand for such a service to be extended to other libraries.

With regard to the coordination of the agricultural libraries in a national system for Sudan, the agricultural libraries should be integrated into the planned National Union Catalogue for Sudan.

Full liaison should be maintained with the Information and Documentation Coordinating Committee and all the agricultural libraries and with any moves to establish a national information policy for Sudan.

In practical terms, coordination of agricultural information resources is perhaps best approached through coordination of the agricultural libraries into a national system.

5.8.1 International Cooperation

It is assumed that the intensity of international relations is linked with the possibilities of international information transfer (Montviloff, 1990, p. 139).

In many developing countries there are information centres and services in agriculture, many of which participate through their respective national and/or regional focal points/nodes in international cooperative information programmes, such as, FAO's AGRIS and CARIS. There are also "centres of excellence" in specialized areas of agriculture supported by international organizations and providing high level information support to research in the respective specializations (Neelameghan, 1991, p. 15). Some agricultural libraries and documentation centres in Sudan have already established cooperation with FAO, and this allows the flow of agricultural documents. Other libraries that have not yet established such cooperation, can share resources with those who have.

5.9 REQUIREMENTS FOR ESTABLISHING NATIONAL AGRICULTURAL INFORMATION NETWORK

It is very important to identify and select components of a network in order to establish/strengthen information networks. For any network to get off the ground, there are certain essential prerequisites. Without these, it is virtually impossible to achieve viable resources sharing:

- 1) There must already exist an infrastructure of well organized libraries and information centres. If these organizations are poorly managed, then the network will also operate inefficiently i.e. without a good organizational structure, the network cannot function effectively.
- 2) There must be sufficient resources to share and the institutions must have finance to continue to build up and develop these resources. If the demand is for articles from foreign journals, then these journals must be available and their subscriptions maintained, before any interlending system is established. Information resource sharing is the primary interest in establishing networks.
- 3) There must be agreed upon information service guidelines, manuals, etc.
- 4) There must be agreed upon processing guidelines (e.g. formats).
- 5) There must be locating tools, so that what resources there are can be found. These tools may be union catalogues, union lists of serials, or in the case of referral services, directories of libraries or of expertise. To maximize the use of a country's locally produced resources, bibliographies, indexes and databases of the resources are essential.

- 6) Establish a national agricultural information system Coordinating Body to implement the policies, plans and programs for the development of the national agricultural information network and to ensure that library and information services are developed in a way that they are compatible with and integrated into the national information network.
- 7) A good communication system is essential for any network. For online information networking, advanced telecommunications are necessary. Even the most basic interlending system cannot work without an adequate postal system and a photocopier.
- 8) An overall national information policy can provide framework to facilitate cooperation. The national information policy would generally recognize the need for cooperation as a way of optimal utilization of information resources. Although cooperation between various information services and units can take place in the absence of a national information policy, however, a national information policy will enhance and harmonize such cooperation.
- 9) Finally, any network will only be as good as the personnel that run and manage it. Networks often flounder not just because there is a dearth of

professionals in the information field, but because of attitudes of the professionals to cooperation. The status of information professionals within a country also affects the calibre of staff and their commitment to the service ideal.

5.10 ROLE OF INFORMATION TECHNOLOGY IN A NATIONAL INFORMATION NETWORK

Computers have a definite role to play in a national information network in Sudan. Libraries and documentation centres will firstly need to form a network formally or informally on the basis of the parameters mentioned in the preceding section. This will then be the basis for a computerized network. A good starting point would be the compilation of a machine readable union catalogue. Several cooperative ventures will stem from this catalogue, include interlibrary lending, bibliographic checking, etc.

A nation wide network linking all the libraries and documentation centres of Sudan is possible with the modern technology, but it will require careful planning, choice of hardware and software. The availability of CDS/ISIS software free of cost from Unesco has enabled the creation of several local/regional databases.

Computerization makes retrieval of information about documents as well as entering of information about documents into the system easier. Computerization will make the exchange of databases between libraries much easier if they use the same software (e.g. CDS/ISIS). It will be possible to develop "national databases" on any topic in specialized centres and at the same time make these databases available to any library, that wants to have a copy.

Whether or not a software like CDS/ISIS is the right system to be used in Sudan, is something for discussion; but the choice of the same software for use in all the information service centres in the country, will be a decisive step towards establishing a national agricultural information system for Sudan. This would also be an important step towards fulfilling the information needs of researchers and development planners in the agricultural sector of the country.

5.11 PLAN FOR ESTABLISHING NATIONAL AGRICULTURAL INFORMATION SYSTEM

With the efforts toward development planning and strategic programming, in practically all countries of the world, and more particularly in the developing countries that attained political independence during the past few decades, the value of information to development is being recognized in an increasing measure. The impact of the ever-increasing volume of information - scientific, technical, social, economic and legal - is a global phenomenon. The profusion of information requires entire networks and clearing houses to manage it effectively and efficiently for the benefit of society. A viable information system, such as the proposed agricultural information system for Sudan will have to deal with the tasks of identifying users and sources, selecting methods and technologies, funding, staffing, and establish facilities, promoting the use of information, and providing appropriate services that are cost-effective and cost beneficial overall.

The information required for comprehensive planning and decision-making includes both natural resources data and socio-economic data which must be presented to the user in an easily usable form and format.

Agricultural information is thus a resource which when organized and used efficiently, can contribute substantially to the socio-economic development of the nation.

5.11.1 Organizational Structure of National Agricultural Information System

At the national level there are many sectors, which are of major importance to socio-economic development and which should, therefore, be accorded priority from the early stages of the development of National Information System. These sectors include:

- Agriculture;
- Industry and trade;
- Health;
- Social welfare;
- Economy;
- Education, etc.

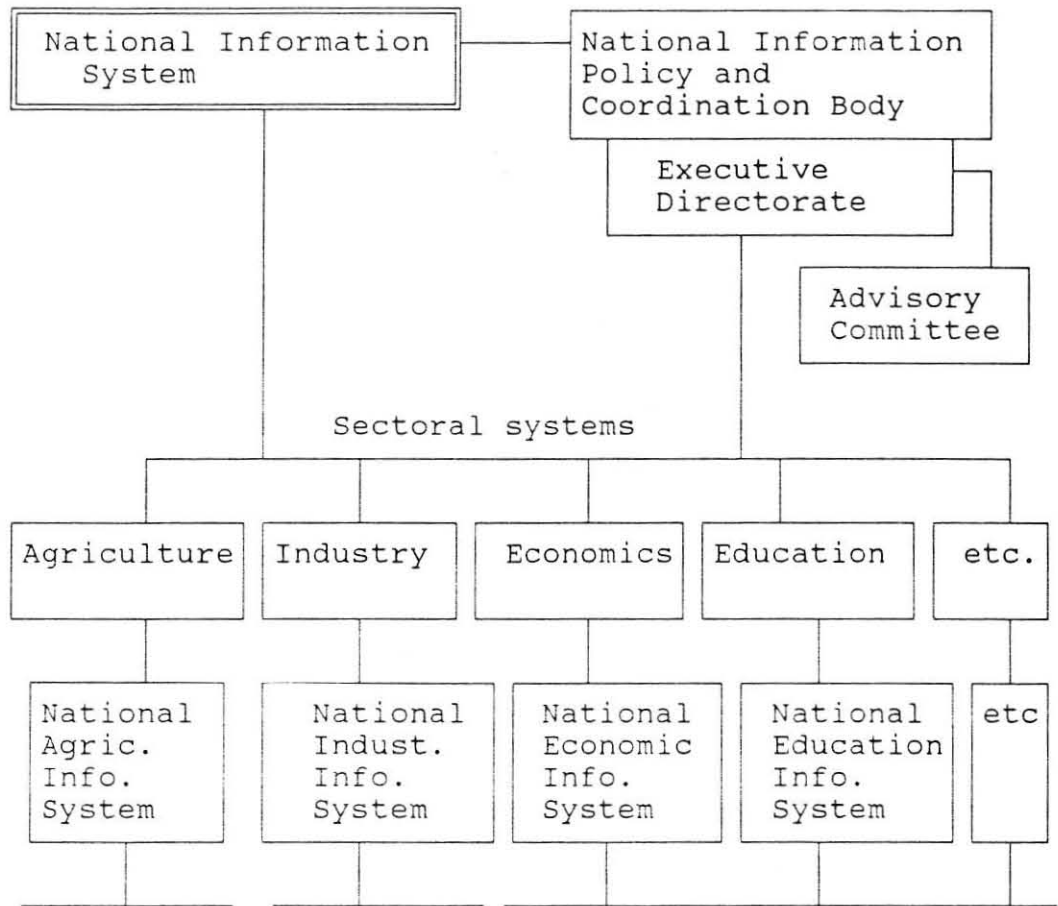
At the national level it is recommended to establish a National Information Policy and Coordinating Body (NIPCB) which will be concerned with the formulation of and implementation strategies for an overall national policy on information systems and services in Sudan. This

body will also be concerned with the development of the National Information System of the country as a whole, covering all matters related to information and data in textual, factual, numerical and graphical forms, recorded in conventional and non-conventional media; information and data sources, systems, networks and services of different types including data banks, data bases, library systems and services, documentation centres and services, information clearing facilities, referral centres and services, information analysis, consolidation and repackaging centres and services, the information industry; and information and data handling in both conventional ways as well as through the application of modern technology (Neelameghan, 1989; Montviloff, 1990).

The NIPCB will be responsible for coordinating all participating sectoral information systems (e.g. agriculture, industry and trade, economy, health, social welfare, education, etc.). For each sector there should be a sectoral national information policy and coordinating body concerned with the formulation of the sectoral information policy, strategies for its implementation and development of the information infrastructure for the sector. The sectoral policy should be compatible with the overall national information policy.

My study focuses on the agriculture sector information system which would be a subsystem of the national information system. The formation of a national agricultural information policy and coordinating body (NAIPCB) is recommended. Figure 2 shows national agricultural information system within the national information system structure.

Figure 2 : Organizational Structure of National Agricultural Information System within National Information System



Keywords :

Info. = Information
 Agric. = Agricultural
 Indust. = Industrial
 etc. = Others

5.12 NATIONAL AGRICULTURAL INFORMATION POLICY AND COORDINATING BODY

5.12.1 Structure

The national agricultural information policy and coordinating body (NAIPCB) will be concerned with the formulation of the agriculture sectoral information policy, strategies for its implementation, in the development of the national agricultural information systems, services, and network. NAIPCB should be placed as high as possible in the government structure, e.g. Office of the Minister for Agriculture, Natural and Animal Resources.

5.12.2 Functions

NAIPCB will have three major categories of functions: a policy function entrusted to an interministerial group; an executive function entrusted to an Executive Directorate, the national agricultural documentation and information centre, in the present case, and advisory function entrusted to a Technical Advisory Group.

5.12.2.1 Policy Function

NAIPCB's policy group should preferably be composed of ministerial level representations from the relevant sectors, including agriculture, rural development, economics and planning, communications and mass media, statistics, and science and technology. It should meet at least twice a year to review the activities of the national agricultural information system, consider new policy proposals, the budget and programmes of the system, establish priorities and deal with major policy issues concerning the development of the national agricultural information system.

5.12.2.2 The Executive Function

As mentioned above the executive functions will be performed by an Executive Directorate constituting the executive arm of the NAIPCB. The National Agricultural Documentation and Information Centre (NADIC), in addition to being the national focal point of the national agricultural information system will also serve as the Executive Directorate. The sectoral information system should be headed by an Executive Director of the rank and status of Secretary to the Government (e.g. The Ministry of Agriculture, Natural and Animal Resources), supported

by competent professional staff and appropriate administrative and secretarial staff. The Executive Directorate (in NADIC) should liaise with all organizations participating in the national agricultural information system, information units for the most part but also universities (agricultural colleges and institutes), publishers, government officers, the mass media and others. An important function of the directorate is to coordinate the activities of these participating units, ensure implementation of agreed upon norms and standards in information handling, data flow and exchange, etc. (See also chapter 6 on the functions of NADIC).

In brief, the principal functions of the Executive Directorate will include the following :

- Defining the objectives for agricultural information programme. These would be formulated in relation to the broad sectoral development objectives and to the more specific objectives of the organizations containing agricultural resource centres in order to make them user oriented.
- Identifying information priorities for the agricultural sector and phasing them into the

program of activities covering a period not longer than that of the 5-year national development plan.

- To realize the stated objectives.
- Coordinating information systems activities, and providing administrative and technical guidance.
- Promoting the formulation of standards, working procedures, principles, etc. required to strengthen the performances of the components of the system as may be necessary.
- Coordinating, planning, and assisting organization of training courses and workshops for the staff of different agricultural institutions on various aspects of information work.
- Assigning responsibilities to different institutions and organizations constituting the national agricultural information system.
- Promoting the introduction and use of new information technologies.

The Directorate will receive and consider projects, programmes and plan of activities relating to system development and networking, education and training of professionals and users, norms and standards, suggested

by the participating units. The Directorate will solicit funds and prepare long range plans and yearly plan of action and budget for consideration by NAIPCB. In general, the Directorate will implement, in cooperation with appropriate organizations, the plan and the yearly programmes for the development of the national agricultural information system.

5.12.2.3 The Advisory Function

The Advisory function will be performed by a Technical Advisory Committee (TAC) consisting of experts in different areas of data and information handling, and representatives of information user groups. (agricultural development, academic and professional organizations, and the information industry). TAC will in general advise and assist the Executive Director in ensuring the effective implementation of the policies and decisions regarding the development and management of the information systems, services and activities. The Committee should be free to set up small task forces to examine particular problems and make proposals. The national agricultural focal point, NADIC should be represented on TAC so that it can provide link between centres and perform effectively its stimulation, guidance, and harmonization functions in accordance with the suggestions of TAC.

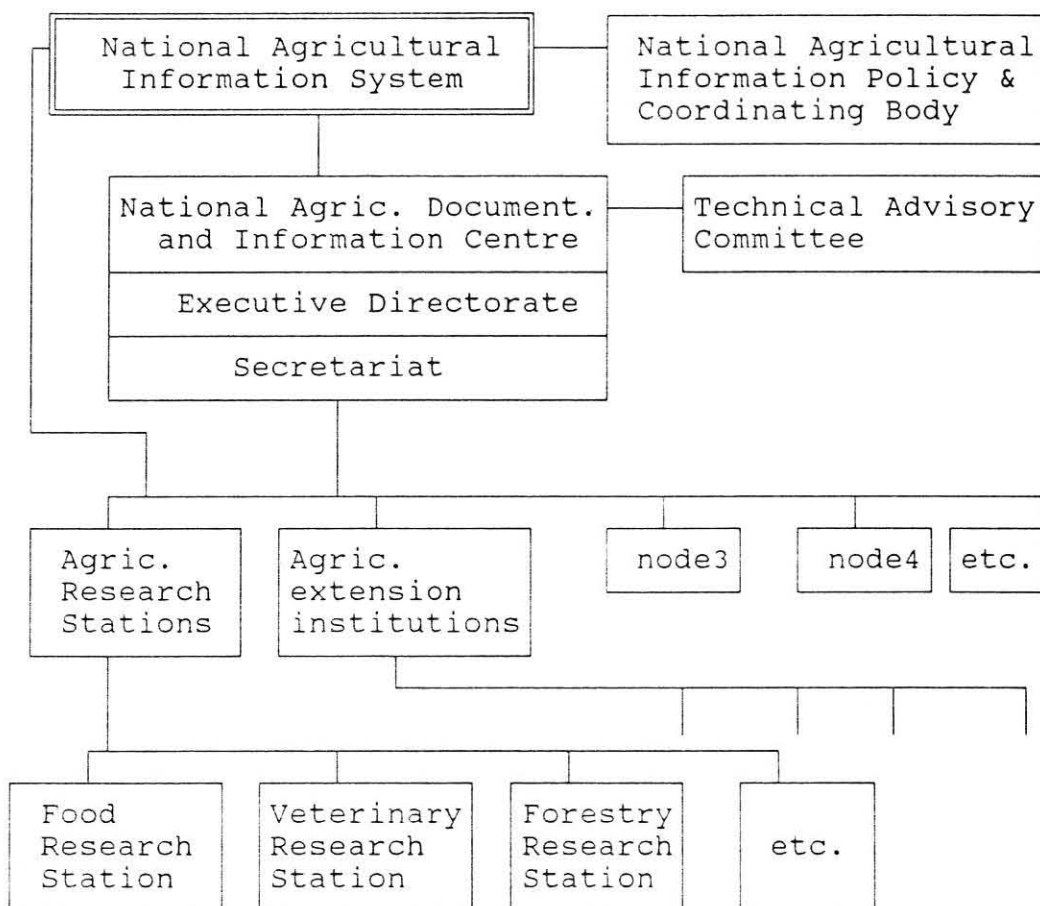
5.12.2.4 Secretariat

The Executive Directorate located in the National Documentation and Information Centre (NADIC) will provide secretariat facilities for the NAIPCB.

5.12.2.5 Budget

The NAIPCB should be allocated adequate funds to be managed by the Executive Directorate. Apart from maintaining the Executive Directorate and convening of the meetings of the body, of the working groups and of TAC, the major items of expenditure would be the support given to agricultural information system development, systems interconnections and networking, education and training of information specialists and users, and research and development projects in the information field. The national agricultural information system should be made self-supporting although there may be external funding at the initial stages of implementing the plan. Assistance may be sourced from Unesco, UNDP, FAO, IDRC, etc. Some of the services, such as, photocopying, online searches and specialized data services may be charged for. Figure 3 shows the proposed organizational structure of the national Agricultural information system.

Figure 3 : Organizational Structure of National Agricultural Information System



KEYWORDS :

Agric. = Agricultural
 Document. = Documentation

As noted in figure 3, the Executive Directorate of the NAIPCB will be in the National Agricultural Documentation and Information Centre (NADIC). Design and development of national agricultural information network and NADIC as a national focal point discussed in chapter 6.

CHAPTER 6

NATIONAL AGRICULTURAL INFORMATION NETWORK

6.1 NETWORK DESIGN AND DEVELOPMENT

6.1.0 Initial Steps

A preliminary step towards establishing the national agricultural information system, the government of Sudan should give priority attention to the rehabilitation of the library and information units in agricultural organizations and institutions in the country. The government should perceive the establishment and operation of the national agricultural information system as one of its important functions and commit the necessary resources for the purpose. Preparing, establishing, and ensuring proper management of such a system must be part of government's economic and social development policy i.e. the plan for national agricultural information system and services be incorporated into the national rehabilitation and development plan.

The National Agricultural Information Network for Sudan can be initiated (based on the existing resources and situation), with selected areas of activities, basically to address areas necessary to bring about overall improvement of the agricultural information services of the country and to prepare the ground for further and wider cooperative activities.

The first step in the establishment of the network should be the selection of network activities, that is, identification of possible areas of cooperation, e.g. cooperative acquisition to build sufficient and relevant resources, followed by cooperative processing schemes, so as to facilitate efficient and effective resource sharing, etc.

The second step should be the identification of participants, the selection being based on criteria that have proved workable in the past. Cooperative schemes need strong leadership, unrelenting effort and capability to initiate and move forward. It is, therefore, better to begin with a few capable and willing institutions and individuals, taking the lead, and putting the initial energy and resources into the scheme.

6.1.1 Network Design

Systems design should be based on relevant principles. Some of the principles on which the design of the national agricultural information network may be based are as follows:

- 1) The National Agricultural Information Network should be developed as an information service-oriented facility rather than as a resource-oriented one. That is, national agricultural information network is not basically designed to merely augment library collections or enhance foreign periodical subscriptions
- 2) The National Agricultural Information Network should be built on a decentralized basis. Decentralized development will help to strengthen the participating nodes in the development planning and research centres in country, to provide their respective user clientele with appropriate specialized services.
- 3) Each organization (node) should have autonomy to set up its structure and operations to satisfy its user communities within the framework of the national agricultural information network and the guidelines for operation of the network. The

guidelines will be prepared by national agricultural information network working group (advisory group) constituted by representative of network participating nodes.

6.1.2 Structure of the Network

Networking is a means of achieving defined goals. Accordingly, the identification of members has to be based on how best to achieve these goals. The identification should take place in the context of existing macro-structures and the members selected in a manner that allows the influencing of these structures. In other words, it is necessary to understand the layers and levels of these structures.

The structure of a network depends on the purpose for which it has been set up. A substantial degree of informality in relations is called for to facilitate the free flow of communication, ideas and messages. With networks composed of institutions and involving major organized tasks in applied research and training, more formal relationships may be required. Regardless of its purpose, the strength of a networks' structure, in the final analysis, lies in its ability to be flexible enough to avoid any set of rigidly defined relations.

The structure of the information/data service at each participating organization depends on the complexity of the activities of the organization. The structure should be such that each department has direct access to the service.

6.1.3. Network Configuration

The organization of a network depends on different factors, the important ones include :

- Number of members (network participants);
- Geographical location of nodes;
- Type of functions carried out by members (whether they carry out similar or different functions);
and
- Type of language and/or culture.

A planned development of the network should give emphasis to these factors in selecting the network organizational structure (model). Network model can be centralized, decentralized or a combination of the two. Under each network organization, different structures are possible.

The structure of networks can be in different patterns, such as, star network, hierarchical network, distributed network, etc. and combination of the different arrangements (simple structure) is also possible.

As mentioned earlier, a practical step in organizing agricultural information network will be to start with a few selected organizations which are concerned with agricultural development. The organizations to start the network could be the well established ones with financial support, for example, some of the organizations mentioned in chapter four, who are willing to participate in the network. Among the network participants one may be selected as the Focal Point. The Focal Point of the network should be in Khartoum State between Soba and Shambat because most agricultural libraries and agricultural information service units are located in this region. The focal point will be the National Agricultural Documentation and Information Centre (NADIC). The objectives and functions of NADIC are detailed in section 6.2. Until the centre is established, its functions will be performed by the Documentation and Information Centre (DIC) of the National Centre for Research (detailed information about DIC is given in

section 4.9.3.2 in chapter 4). This interim arrangement is for the following reasons:

- DIC playing a critical role in the whole process of information resources sharing and networking in Sudan.
- DIC is acting as the local focal point for regional and international information networks, such as, INFOTERRA, PADIS, CEHANET, AGRIS, etc.
- DIC created national databases, about 41% of this database is related to agriculture.
- Its location : DIC is located in the centre between Soba and Shambat where most of the agricultural information units are located and the road is good.

Technical assistance may need to be provided to some of the participating nodes in preparing for the various network operations. An early action to be initiated will be to create an information base to facilitate referral services e.g. directory of institutions, information sources and services, union catalogues, etc. using appropriate agreed upon norms and standards.

6.2 NATIONAL AGRICULTURAL DOCUMENTATION AND INFORMATION CENTRE (NADIC)

6.2.1 Objectives of the Centre

The main objective of the National Agricultural Documentation and Information Centre (NADIC), which will provide the Executive Directorate for the NAIPCB and serve as the national focal point of the national agricultural information system, is to improve the availability and distribution of conventional and non-conventional technical, scientific and development information in the agricultural sector to support Sudan's agricultural services, research and planning. In order to implement these objectives, the following activities are proposed:

- 1) Identify, collect, select, abstract and index all worthwhile documents related to Sudan agriculture.
- 2) Arrange with participating centres to input in agreed upon forms and formats bibliographical details of all publication generated, abstracts of papers from selected periodicals, serials holdings, etc. and develop and maintain in collaboration with participating centres within system, referral databases e.g. profiles of agricultural institution,

agricultural information systems databases, and services, agricultural experts, ongoing agricultural research projects in Sudan; union catalogue of serials, teaching aids specialized materials, microform, etc.

- 3) Develop and maintain appropriate databases based on inputs from the participating centres as well as of materials in its own collection, and records downloaded from regional and international databases.
- 4) Prepare and publish retrospective and current series of the Sudan Agricultural Abstracts (SAA).
- 5) Provide researchers, planners, administrators, advisory staff, etc. of the Ministry of Agriculture, Natural and Animal Resources with Selective Dissemination of Information and documents featured in the SAA.
- 6) Microfilm and maintain a comprehensive collection of all documents announced in both current and retrospective issues of the SAA in order to ensure that good quality copies of the documents are permanently available at the centre.
- 7) Identify the information input required to support various sectors of national development plans.

- 8) To advise, when called for, any participating node, on the administrative arrangements, organizational structures, skilled manpower and the technology required for providing the necessary services.
- 9) NADIC should serve as a liaison between participating organizations on the one hand and government agencies having overall responsibility for agricultural development, on the other. Linkages and communications between NADIC and participating organizations may take several forms: through mail, exchange of publications, etc.; and direct contacts through person-to-person visits, meetings, conferences, seminars, workshops and training sessions for participants of the system.
- 10) For coordinating acquisition policies, after assessing the collections and serial holdings of the participating units and based on ministerial agreements, NADIC may assign responsibilities to different participating organizations for acquiring comprehensively information materials e.g. reports, periodicals, bank volumes, databases, etc. in selected fields of specialization. The objective is to ensure availability in the country most of the frequently used information sources in agriculture and related fields.

6.3 ORGANIZATIONAL STRUCTURE OF NADIC

The proposed national agricultural documentation and information centre (NADIC) will be in the Ministry of Agriculture, Natural and Animal Resources, or in Agricultural Research Corporation. NADIC's location should be at a high level, in the organizational hierarchy of the body and report directly to the highest level official therein, e.g. director or director-general, minister, as the case may be.

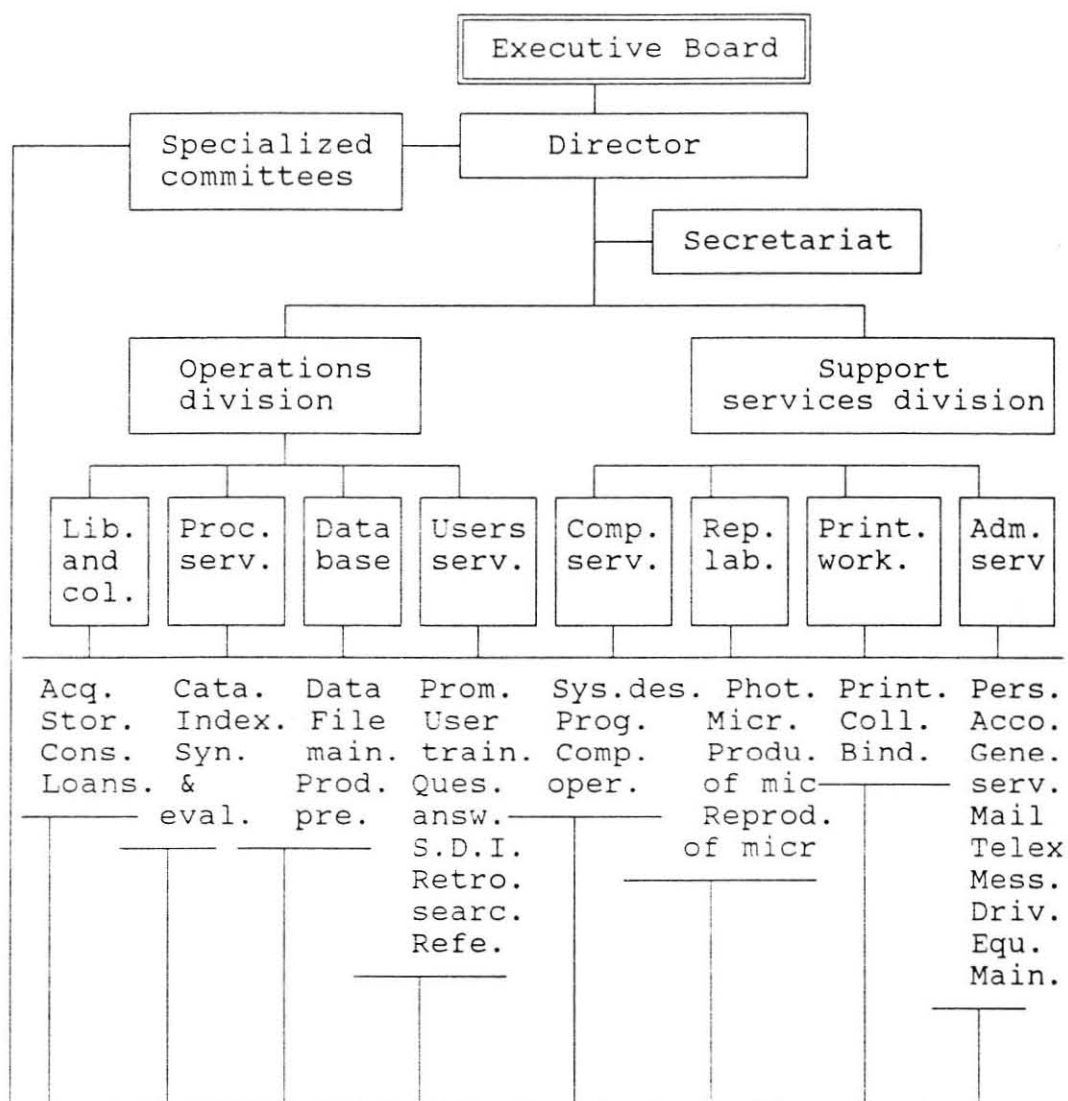
Beckman (1982, p. 154) pointed out that the rationale for placing the centre as high as possible within the hierarchy of the institution is based on the following considerations :

- To encourage a sympathetic managerial attitude and the acceptance and full use of information centre services;
- To keep the needs and achievement of the centre constantly in front of senior management;
- To obtain sponsorship by members of the senior executive; and
- To relate budgetary requests to financial management of the institution.

The components and organizational structure and objectives of NADIC should be carefully formulated. The selected structure should minimize effort i.e. each operation (collection, processing service, data bases, users services, etc.) should serve directly for as many subsequent operations as possible and everything needed for each service provided should be quick and easy to obtain. Each section should be given a clearly defined role that is logical and interesting (Guinchat and Menou, 1983).

It is essential for each staff member to have a sufficiently clear and detailed description of the unit's structure and mode of operation to know where he/she fits in, what his/her functions and responsibilities are, and how and why. The proposed organizational structure of NADIC is given in figure 4.

Figure 4 : Proposed Organizational Structure of National Agricultural Documentation and Information Centre (NADIC)



Keywords :

Lib	=	Library	Adm.	=	Administrative
col.	=	collection	Acq.	=	Acquisition
Proc.	=	Processing	Stor.	=	Storage
serv.	=	services	Cons.	=	Conservation
Comp.	=	Computer	Cata.	=	Cataloguing
Rep.	=	Reprographic	Index.	=	Indexing
lab.	=	laboratory	Syn.	=	Syntheses
Print.	=	Printing	eva.	=	evaluation
work.	=	workshop	main.	=	maintenance

Prod.	=	Product	Coll.	=	Collation
pre.	=	preparation	Bind.	=	Binding
Prom.	=	Promotion	Pers.	=	Personnel
train.	=	training	Acco.	=	Accounting
Ques.	=	Question-	Gene.	=	General
answ.	=	answer	Mess.	=	Messenger
Retro.	=	Retrospective	Driv.	=	Drivers
searc.	=	searches	Equ.	=	Equipment
Refe.	=	Referral			
Sys.des.	=	System design			
Prog.	=	Programming			
oper.	=	operation			
Phot.	=	Photocopy			
Micr.	=	Microfilming			
Produ.	=	Production			
mic.	=	microfiches			
Reprod.	=	Reproduction			
micr.	=	microforms			

Source : Guinchat and Menou (1983, p. 301).

6.4 RESPONSIBILITIES OF NETWORK PARTICIPANTS

It is important to identify the functions and services that will be provided by the focal point (coordinating organization) and participating organizations (nodes). The participating organizations take part by :

- Performing their normal activities and services to their respective clientele;
- Following and respecting the guidelines formulated for documentation and information processing for the network;

- Gradually implementing the rationalization measures agreed upon; and
- Coordinating their efforts and also contribute by modernizing their activities or undertaking new ones in accordance with the national system's development programmes.

Each participating organization through coordination and cooperation with each other, should be responsible from the following services to their respective clientele:

- Referral Services
- Reference services
- Selective Dissemination of Information
- Current Awareness Service
- Data services
- Information analysis and consolidation services and products
- Document delivery
- Online access/services.

Participating organizations and NADIC should jointly plan and implement the following activities :

- Organizing and supporting training programme
- Database construction
- User sensitization, etc.

6.5 COMMON NORMS AND STANDARDS FOR CATALOGUING, INDEXING, etc.

In order to facilitate information resource sharing, data exchange, and user-friendliness of systems among the participating nodes in the network, it is desirable to use compatible formats (data entry, data structure and processing, output, etc.), whether the information products and services are fully or partially computerized or operated manually. Several widely accepted norms and standards are now available for cataloguing, indexing, and data exchange. For example : MARC format for cataloguing; AACR2 Code for cataloguing; CCF/B for bibliographic description; CCF/F for factual records, description of institutions, information systems, projects and experts; International Development Information Network (IDIN) format based on the CCF; MIBIS for bibliographic records; ISO 2709 for data exchange; and other ISO standards for documentation and computerized information storage and processing.

The software used should be able to implement the above standards, codes, etc. For instance, the ISIS family of software, ISIS, (Unesco) for IBM main frame computers; MINISIS (IDRC) for HP 3000 series of minis, Micro/ISIS (Unesco) and MINISIS version H for microcomputers, are proven software packages widely used in textual databases and information retrieval that can implement the above norms and standards. There are programmes available to convert from one format to another e.g. CCF to MARC and vice versa; and for conversion of ISIS to MINISIS, and MINISIS to Micro/ISIS format. The systems can be operated on a network configuration (LAN and WAN). International thesauri and vocabulary control tools such as thesauri that are developed and supported by international organizations are available for the fields of Agriculture, Development, Environment, etc., such as, FAO's Agrovoc (for agriculture and related fields); OECD's Macrothesaurus (for socio-economic development subjects); Unesco-IBE thesaurus for Education etc. These are available in printed and machine-readable form and are being used in a large number of information systems.

These thesauri can be used with softwares mentioned above. For Micro/ISIS there are Pascal interfaces for enhancing its user-friendliness at search and retrieval

(e.g., SISA.PAS); use of thesauri and classification codes for online vocabulary control at data entry (e.g., VOCON.PAS); and others. Some of these are briefly described in Appendix 1.

The participating nodes including NADIC should preferably choose norms and standards for cataloguing, indexing and data processing and software from among those mentioned above to facilitate cooperative networking, information exchange and resource sharing.

6.6 ENSURING OPTIMUM COOPERATION AND INTERACTION AMONG COMPONENTS OF THE NETWORK

Some of the principles and methods of ensuring cooperation among the participants in the network are :

- 1) Sharing - each unit should have something useful to give to others. It is not "I join so that I get, but I give so that I receive," attitude.
- 2) Multiple cooperation - it is a shared responsibility where each contributes to the network and benefits from sharing of the resources.
- 3) Mutual benefits - both for librarians and users e.g. skills, knowledge, access to information, etc.

- 4) Start network with a small number of cooperating centres which agree to cooperate on a formal basis to accomplish specific services and tasks.
- 5) Agree on the objectives of the network and the joint action necessary to achieve those objectives.
- 6) Involve cooperating centres, through network committee action, in preparing written work plans and getting participants' commitment for their implementation.
- 7) Enhancing the effectiveness of cooperation through formalization of relationships which also allow for flexibility.
- 8) Securing adequate resources, administrative capability and efficient communications.
- 9) Provision of a legislative basis for realization of the network.
- 10) Organizing training activities needed to implement network programs and procedures adopted for the network.
- 11) Commitment to network standards, procedures, policies and activities.
- 12) The key to the success of networks lies in the participants themselves, in the support they provide, in their willingness to surrender a certain amount of self-sufficiency, and in their

determination to make the program succeed (Wesley, 1993, p. 107-108).

6.7 IMPLEMENTATION STRATEGY

An implementation strategy is a prerequisite for success in meeting the objectives and goals of the network.

The existing information resources, facilities and services will be utilized, their deficiencies corrected and, if and when necessary, new systems and services will be supported. The national agricultural information system is conceived as an integrated cooperative and decentralized information network, coordinating and linking the activities of different agricultural organizations and institutions. The system will be expected to provide timely access to and make available pertinent and reliable information and data to users.

Various steps to be taken for implementing the network have been briefly described in the preceding sections. These are summarized below.

1) **Formation of the National Agricultural Information Policy and Coordinating body (NAIPCB)** (See section 5.12 in chapter 5).

2) **Subsystems and Participating Nodes**

Identification, selection, assigning responsibilities for various functions, services, etc. (see section 6.4 in this chapter).

3) **Common Norms, Standards, Software, etc.**

The need for and some of the widely used documentation standards, software packages, etc. are mentioned in section 6.5 in this chapter.

4) **Human Resources Development**

The national agricultural information system and network will contribute to human resources development in two ways :

1) Information resources, data bases and services are to be developed in the fields of manpower employment, education, etc., considered to be priority areas in the national development plan,

there will also be data bases of profiles of experts information field (both national and international); and

- 2) A number of activities (e.g. continuing education courses, upgrading of training programmes) for enhancing the capacity and competence of library, documentation and information units management personnel necessary to plan and perform the activities of the system (See section 6.4).

5) Introduction of New Technology

The nature and capacity of the chosen system must depend on an analysis of each centre's requirements - the number, size and characteristics of the data bases to be entered, the forms of output required, the number and location of terminals, the degree of local data processing to be done, etc.

6) User sensitization

Programmes are to be developed to sensitize decision makers, planners, executives, researchers, extension workers, people at the grass roots involved in the agricultural sector development in Sudan about the value

of information, sources, how to define precisely their information needs and to use information systems.

The following methods and media may be used :

- Use of public media, - radio, TV, newspapers - in conjunction with group activities organized locally and nationally.
- Conferences and courses : to bring a package of information to a group of specific users and to introduce these users to experts in the specific areas concerned.
- Extension services : organized use of informal personal contacts to transfer information (especially "best practice") and to define specific user needs, they occur most widely in agriculture.
- Semi-popular periodicals or bulletins to general or specialist audiences bringing information and information sources to the attention of a wide audience on a continuing basis (Atherton, 1977).

The most effective mechanism is personal contact, but it can only work to real effect when it is operating within a deliberate infrastructure of linkage.

CHAPTER 7

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 SUMMARY AND CONCLUSION

Sudan's future is dependent on having literate and informed Sudanese who participate fully in building the nation's economy. They need to receive relevant information in the most efficient and fast manner to achieve their development goals.

Relevant, timely and up-to-date agricultural information is a prerequisite for planning, decision making and research activities in Sudan. There must be efficient and effective mechanisms for harnessing not only locally available information but also the information available or obtainable elsewhere. There is a need for well trained library and information science professionals to manage the information services efficiently and disseminate the required data and information to all the players in the agricultural arena namely, researchers, policy makers, planners, executives, input distributors, extension workers and farmers. Adequate resources should be allocated to ensure continuous acquisition of scientific, technical,

economic, and other source materials. Advanced computer technology has made it much easier to access larger and richer data bases in agriculture.

The availability of a number of databases both in machine-readable form and in printed form commercially or free from international corporative programmes (e.g. AGRIS. CARIS, etc.) and the increasing participation of developing countries in international agricultural information networks, stress the role of agricultural information in bringing about rapid and sustained agricultural development, especially in dominantly agricultural countries like Sudan.

Setting up a well organized national agricultural information system and network will improve the control and management of information. The information professional has to make important decisions at both the strategic and management control levels. It is not possible to achieve all objectives simultaneously, therefore, priorities must be established and resources allocated accordingly.

Information can be a vital resource only when its value is duly recognized, properly handled and used. It is the users that give information its practical meaning

and value. Its proper organization and efficient access are key factors in this respect. Efficiently managed information service units are essential to carry out effective information generation, acquisition, processing, storage and dissemination. Information service units need to be strengthened and new ones set up as required to support development programmes and projects. Their responsibility in providing timely, reliable and readily usable information can provide "proper guidance to the direction of development " .

In Sudan a number of research institutions, higher education establishments, development agencies and other agriculture-oriented organizations are engaged in agricultural research, development and related activities. Each institution usually focuses on specific areas and types of research or development activities according to its institutional mandate. When effectively used, agricultural information acquired and exchanged directs efforts of the institution by keeping its researchers and development workers informed about what is being done, what has been done, what remains to be done, and what should be considered while carrying out their various activities. For these and related purposes, each institution maintains some kind of information service unit geared towards meeting mainly specific

information needs for supporting the performance of its statutory and public service functions. These units obviously differ from each other in such aspects as size of collection, organization, financial support, services provided, etc.

As part of a total package to improve the agricultural situation in Sudan, the government should increase its support for the agricultural information services. A central unit charged with production and dissemination of research information should be established; and information service units and libraries in agricultural research institutes and stations should be improved. The conditions of service of information service personnel should be improved to motivate the workers in these facilities. The decision to increase the foreign exchange allocation for acquisition of scientific information resources will be a difficult one to take given that there are other equally important sectors competing for the limited foreign exchange cake. All the same it has to be taken.

As part of the strategy to improve the agricultural information services the respective government agencies should encourage establishment of appropriate networking

to facilitate effective flow of agricultural information among researchers within and without the sub-region.

Efforts should be made by all elements of the national information system, to cooperate and coordinate their services with the view to establishing a more formal resources-sharing programme.

7.2 RECOMMENDATIONS

7.2.1 Needs of Agricultural Information Services

The information needs of users vary according to the area of their specialization, their functions, and the tasks they perform in particular work environments. Information needs within a category of users also vary in several dimensions, depending on the role, function, activity, subjects on interest, stage of work, etc. they are involved. For instance, researchers in agriculture, need more information about current research and developments usually available in current journals from abroad, from researchers in other countries, etc.

After examining agricultural information service, and the problems and needs expressed by agricultural libraries and information service units and their users (see section 4.10 in chapter 4), the following are the basic aspects to be provided for :

- 1) Adequate documentary sources in number and quantity, especially periodical publications.
- 2) Information personnel development especially in agricultural information services
- 3) Appropriate equipment and physical facilities for users, for information and documentation work, storage space, materials movement and display, and for photocopying, etc.
- 4) Establishment of a cadre of library and information manpower is one step towards securing the provision of skilled manpower.

7.2.2 National Agricultural Information Network

The National Agricultural Information Network development requires the provision of :

- 1) Information technology equipment to facilitate information processing and transfer.

- 2) Information manpower development especially personnel trained in modern methods of information handling, and training of trainers.
- 3) Photocopying service to facilitate information resource sharing guided by a well articulated national policy on information systems and services.
- 4) Agreement upon norms and standards, and guidelines for the harmonization and standardization of hardware and software in order to minimize problems of systems incompatibility.
- 5) Appropriate coordinating bodies and information policies at the national level as discussed in section 5.12 in chapter 5.
- 6) Information services in the respective participating nodes supplemented by national level services provided by NADIC to minimize duplication of efforts in research projects, and other development activities.
- 7) User sensitization to the value of information and orientation to enhance their skills to make them aware of relevant sources of information and in the use of information products and tools.

7.2.3 Suggested Services

- Production of national agricultural bibliography (by NADIC) and subject bibliographies as locally requested (see section 6.2 in chapter 6).
- Production of union catalogues of serials and other specialized materials to facilitate interlibrary loans(see section 5.6. in chapter 5).
- Reference and information services
- Retrospective searching (see section 6.4 in chapter 6).

7.2.4 Publishing Domestic Documents

There is need to prioritize the kind of materials to be produced such that the scarce resources can be optimally utilized. The government printery should be well equipped, and it can give a helping hand to the private sector. Sometimes because of many procedures involved, government publications are delayed. It is recommended that action be taken and funds given to stimulate production and distribution of reports and technical literature including scientific journals. Technical publishing should be encouraged, and training programmes in publishing, distribution and marketing must be developed and coordinated.

7.2.5 Manpower Training

The utility of national information resources and services is based on the presence of qualified personnel handling it at all stages (acquisition, processing, distribution) and all levels (para-professional, professional and administrative). There is an urgent need for an accelerated training of information workers both in number and quality, even though, the physical and financial resources for such plans and programmes are limited in comparison to the need. Career development opportunities in the information field do not receive all the support they deserve from the national authorities.

In summary, the following should be kept in view by national authorities. The necessity to :

- Recognize the importance for the country's future economic and social development to promote the information manpower training programmes and facilities;
- Be aware of national manpower requirements (number, qualifications, etc.) in the various categories in the context of a rapid changing society;

- Encourage the institutionalization of the educational programmes in the field of information;
- Maintain the status and salary scales of the different categories of information workers on parity with those of other comparable professional and technical services in the country.

APPENDIX 1 :

COMPUTER-ASSISTED VOCABULARY CONTROL

Information retrieval covers a wide range of systems and activities, but in this study I shall be concerned mainly with computerized information retrieval systems. The objective of any information retrieval system (i.e. catalogue, index, or data bases) is to enable one to retrieve records, surrogates or actual information that have been entered and organized in the system. The cataloguing and indexing processes create a description of a document or information. Successful retrieval depends on the ability of the searcher to express, in the search language of the system, the specific information need of the user, and then achieve precise match between the search terms in the structured search expression and the terms and/or structured index used to describe the information content/subject represented by the record. To assist in these processes, that is, indexing the information sources/subject(s) represented by the surrogate in the database, identifying and expressing users information need as specifically as possible, overcoming problems of synonyms, homonyms, etc. and maintaining consistency in these exercises, it is usual to use a vocabulary control tool, such as, a scheme for

classification, a subject headings list, a thesaurus or its variations, covering the subjects/information content of the data store.

Since the early 1980's, there has been renewed interest in the development and application of vocabulary control tools, particularly thesauri. This interest in thesaurus-making led to the development of different thesaurus software to facilitate the design, development, and maintenance of thesaurus and its variations. Such work has been facilitated by advances in microcomputers which made the tedious and time consuming task of thesaurus development easier and effective. Thesaurus is a tool, specially adapted to both the items to be retrieved and to the needs of the people wanting to retrieve them.

In chapter 6, some machine-readable thesauri covering agriculture and related fields, e.g., AGROVOC and MACROTHESAURUS, were mentioned. These can be manipulated using Micro/ISIS and can be maintained and updated as necessary using the software and programmes written in CDS/ISIS Pascal language - Thes.pas, Thes1.pas, Thes2.pas, Theshi.pas are examples of such programmes. The thesauri can be interfaced with MicroIsis databases. The Theshi.pas programme has capabilities

similar to those of Thes.pas/Thes1.pas/ Thes2.pas. Additionally, in the display of the thesaurus terms, the level of the hierarchy is indicated (see section 1.4.1). Other CDS/ISIS pascal programmes recently developed enable using/interfacing the thesaurus for online user query analysis, search expression formulation, etc at the information retrieval stage and also at the cataloguing/indexing stage to select appropriate vocabulary. Some of these are described briefly below.

1. AGROVOC

In recognition of a long-felt need for reference material, the Commission of the European Communities (CEC) and FAO took joint action to sponsor, the preparation of AGROVOC, a multilingual thesaurus in English, French, German, Italian and Spanish.

The objective of AGROVOC, which contains a structured vocabulary of agricultural terms, is precisely to promote better dissemination of the results of agricultural research and in particular, to permit the more effective retrieval of bibliographic data included in the International Information system for the Agricultural Sciences and Technology (AGRIS), coordinated by FAO.

1.2 SCOPE OF AGROVOC

The scope of AGROVOC is much wider than the mere compilation of agricultural terms : It provides a synthetic view of the whole field of food and agriculture. The basic concepts and the relationships between them are clearly expressed in the various language equivalents, and without lengthy dictionary definitions.

The subject scope of AGROVOC is wide, covering that of AGRIS which has itself defined as the "scope of the sphere of interest of FAO". This broad coverage of the world's agricultural literature may be summarized by listing the main subject categories into which the AGRIS scope was partitioned in the document AGRIS Classification Scheme :

- * General Agriculture (including Research)
- * Geography and History
- * Education, Extension and Advisory Work
- * Administration and Legislation
- * Economics, Development and Rural Sociology (including Marketing)
- * Plant Production (including Meteorology, Soil Sciences and Plant Sciences)

- * Protection of Plants and Stored Products
- * Forestry (including Wood Technology)
- * Animal Production (including Animal Sciences, Feeds and Veterinary Sciences)
- * Aquatic Sciences and Fisheries
- * Machinery and Buildings
- * Natural Resources (including Water Management)
- * Food Sciences
- * Home Economics
- * Human Nutrition
- * Pollution
- * Auxiliary Disciplines (including Mathematics and Documentation)

1.3 CONSTRUCTION

The CEC's software package named ASTUTE was used to compile the thesaurus, so that all the language versions have their structure in common. The ASTUTE programmes validated the thesaurus data on formal and logical levels, generated reciprocal relations and hierarchical structures, and provided prints-out of monolingual versions and trilingual indexes of the thesaurus. The hierarchical structure was given a final check using the modified INIS thesaurus maintenance software.

1.4 CHARACTERISTICS

1.4.1 Relationships

The thesaurus unit is the descriptor. With ASTUTE, a maximum length of 35 characters is possible in a line, so that few descriptors have had to be abbreviated or truncated. The types of relationships between descriptors, and the symbols used to represent them in the thesaurus, are as follows :

Type of relationship	Reciprocal cross-reference	Symbols
1. Preferential relations	USE USED FOR	USE UF
2. Hierarchical relations	BROADER TERM NARROWER TERM	BT NT
3. Associative relation	RELATED TERM	RT

BT1, BT2, etc. and NT1, NT2, etc. indicate the hierarchical level of broader or narrower terms, respectively, relating to the descriptor. Descriptors or non-descriptors may also be supplemented by a scope note, the purpose of which is to explain, define or limit the meaning of the term to which it is applied.

Descriptors are arranged in **word blocks** showing the full structure for each alphabetical entry, or in other words, the network of relationships established between the entry term and other terms in the thesaurus. The work block displays the complete hierarchy, up to permitted maximum of seven levels.

EXAMPLES :

1. AGROVOC

FIBRES

MFN 1175

- FIBRES
- NT MANMADE FIBRE
- NT NATURAL FIBRES
- NT 2 ANIMAL FIBRES
- NT 3 SILK
- NT 3 WOOL
- NT 2 PLANT FIBRES
- NT 3 HARD FIBRES
- NT 4 COIQ
- NT 4 SISAL
- NT 3 SOFT FIBRES
- NT 4 ABACA
- NT 4 CANNABIS
- NT 4 COTTON
- NT 4 FLAX

<SpB>[Next] B[ack] F[irst] P[age] S[elect] T[erm select]
Q[query] ? [Display query] A[dd relation] D[elete]
X[exit].

1.5 MAINTENANCE AND UPDATING OF AGROVOC

One of main applications of AGROVOC is its use in the subject control of AGRIS. It follows that, as an integral component of an operational system, AGROVOC needs to be maintained at an operational level. A thesaurus is not a static listing of terms : it has to be able to respond to the constant changes to which information is subject. Therefore AGROVOC will not only be maintained by the AGRIS computer programmes, but it will constantly be updated as needs arise. One aspect of this updating consists feedback from AGRIS National and Regional Centres, instructions for which are given in the manual : AGRIS Guide to Indexing (FAO-AGRIS-23). AGROVOC is being integrated into MicroIisis databases.

2 MACROTHESAURUS

The Macrothesaurus for information processing in the field of economic and social development is a trilingual (English, French and Spanish) thesaurus of descriptors for the indexing and retrieval of documents and other information on the subject of economic and social development.

2.1 PURPOSE OF MACROTHESAURUS

The macrothesaurus is primarily designed for individual organizations and networks wishing to index material acquired by libraries and documentation centres, and for the corresponding retrieval of such material. While many applications will be manual, an increasing number of units are becoming computerized and many will have access to various software packages specially developed for use in bibliographic and documentary databases. The Macrothesaurus is suitable for use with such packages, and attention is drawn to the IDIN Manual published by OECD which provides guidance on setting up a bibliographic database within the framework of the Anglo-American Cataloguing Rules (AACR2) and Unesco's Common Communication Format (CCF).

Second, the macrothesaurus may be used as a terminological guide for the standardization of index entries, such as subject headings.

Third, wherever an on-line search is conducted of bibliographic databases (particularly those involving free text) the macrothesaurus may be used as a search aid, together with other subject-related vocabularies.

2.2 SUBJECT SCOPE

The subject area is economic and social development, hence the core areas are :

- International co-operation and international relations;
- Economic and social policy and planning;
- Economic conditions, research and systems;
- Institutional frameworks, including law, politics and government, and human rights.

All of these topics are treated in some depth and impinge on virtually all types of human activity, a fact which is reflected in what ISO 2788 calls fringe areas. These are culture and society, education and training, agriculture, industry, trade, transport, public finance

and banking, management, labour, demography and population, health and the sciences. All of these fringe areas can be recognised as the specializations of other agencies such of FAO, WHO, ILO, etc., whose thesauri may be consulted if a greater level of detail is required.

2.3 STRUCTURE

The structure of a thesaurus is provided by its classification which identifies the BTs, NTs, and RTs.

2.3.1 The Alphabetical Thesaurus

The alphabetical Thesaurus is the main component and it is here that all the preferred terms are shown, together with their relationships, notes on their use and the subject category to which each is allocated.

2.3.1.1 Synonyms

The Macrothesaurus includes three instances where the instruction to **USE** another term is indicated:

- i) Where a true synonym exists;
- ii) Where a term is considered to be too specific for inclusion in the thesaurus as a preferred

term and the user is directed to a generic term;

- iii) Where a near-synonym exists and distinction is unnecessary.

2.3.1.2 Hierarchical Relationships

In general these broader [BT] and narrower [NT] relationships are either :

- i) Genus/Species,
- ii) Whole/Part, or
- iii) Instances

Wherever a term has Broader Term(s) [BT] and Top Term(s) they will be indicated. Plus sign (+) will be used to show hierarchical levels of Top Terms : the more signs there are, the higher is the Top Term in question.

2.3.1.3 Associative Relationships

These include all those relationships which are not hierarchical, and guide the user to related terms [RT] where the underlying concept may be of interest.

2.3.2 Hierarchical Display

This list is automatically generated, and displays the entire chain in any hierarchy, whereas the Alphabetical Thesaurus displays the terms are immediately Broader and Narrower (as well as the Top Terms).

EXAMPLE :

2. MACROTHESAURUS

COTTON

- COTTON/COTON/ALGODON/
- BT INDUSTRIAL CROPS
- BT OILSEEDS
- BT SOFT FIBRES
- BT TEXTILE FIBRES
- RT COTTON INDUSTRY

TEXTILE INDUSTRY

- TEXTILE INDUSTRY/INDUSTRIE TEXTILE/INDUSTRIA TEXTIL/
- BT INDUSTRIAL SECTOR
- BT LIGHT INDUSTRY
- NT COTTON INDUSTRY
- NT ROPE INDUSTRY
- NT SILK INDUSTRY
- NT WOOL INDUSTRY
- RT CARPETS
- RT CLOTHING INDUSTRY
- RT FIBRES
- RT SPINNING
- RT TEXTILE WORKERS
- RT TEXTILES
- RT WEAVING

RURAL DEVELOPMENT

DEVELOPMENT RURAL/DESARROLLO RURAL

- BT REGIONAL DEVELOPMENT
- + ECONOMIC AND SOCIAL DEVELOPMENT
- RT RURAL AREAS
- RT RURAL ECONOMY
- RT RURAL PLANNING
- RT RURAL-URBAN DISPARITY

2.3.3 Permuted Index of Compound Terms

This list is also automatically generated and is a secondary aid to check, for example, the range of nouns that have been qualified by preceding words and thus scattered in the alphabetical sequence.

3. CDS/ISIS PASCAL PROGRAMMES

3.1. RECOM.PAS is a CDS/ISIS Pascal program designed to facilitate checking duplicate entries (records) in a database. For example, when inputs are received from different sources at a central unit on diskettes, the program can check for possible duplicates. It also permits modification of the master database as well as the incoming records. Checking duplication can be based on data in up to twelve fields, of which two may be unindexed fields.

RECOM.PAS can also be used for checking of consistency in data entry (e.g. name of person, corporate body, conference, class number, descriptor, etc.).

3.2. SISA.PAS (which includes MOPAC.PAS, SISA.PAS, NEWSDI.PAS, ILOAN.PAS, REPORT.PAS) are CDS-ISIS Pascal programs designed to enhance the user-friendliness of the system at the search and retrieval phase and provision of certain services.

MOPAC is a simple single menu facility for online search of MicroIisis library catalogue database by personal, corporate, and conference name(s), title words, subject keywords and class number, with on-screen help.

SISA.PAS (System Interface Search Assistance) is menu-driven providing for selection of appropriate database(s) for search based on on-screen information about databases and concurrent multiple database search; index-based, thesaurus-based, and free text searching using boolean, adjacency and other operators; on-screen help in search formulation; help option for detailed tutorial about the program and MicroIris search language; and facility to browse, select and save displayed records, and to review user/system search performance on each query in each database used.

Service Utilities option facilitates searching a serials union catalogue and generation interlibrary loan request in predefined format; and SDI service with user feedback option; and quick generation of various indexes, catalogues, current awareness bulletin, etc. for a given database by selecting appropriate option from a screen menu.

Manuals for end-user and database manager are available.

3.3. VOCON.PAS is a Pascal interface program for use with MicroIris software (a) for online selection of term(s) and/or code(s) from a vocabulary control tool, such as, a thesaurus, subject headings list, classification

scheme, nomenclature list or code list which is in the form of a MicroIisis database, and adding the selected term and/or codes to specified field(s) in one or more records of a MicroIisis database. The terms or codes may be selected from one or more lists. The terms and codes may be added to one record specified by its MFN or a set of records specified by a range of MFNs, or in the set of records retrieved through a search expression. The code(s) selected may be class number(s) or other codes, and these may be added to the same or a different field to which, say the thesaurus term(s) or subject headings are added; (b) for fast opening of the data entry worksheet of MicroIisis database record(s) retrieved by specifying a master file number (MFN) or a range of MFNs or through a search expression, for correcting, modifying data in those records globally; (c) online updating, or modifying one vocabulary control tool with terms and/or codes selected online from other vocabulary tool(s) or code list(s).

4. LIST OF AUTHORITY LISTS

Authority lists for cataloguing documents, etc. and Selected Documentation Standards.

1. Anglo-American Cataloguing Rules. 2nd ed. Chicago, American Library Association, 1978.
2. Cairo Demographic Centre. Library Database Manual. Cairo, CDC, June 1987.
3. Di Lauro, Anne, and Sly, Naureen, Guidelines for the Building of Authority Files in Development-Information Systems. Ottawa, International Development Research Centre, 1985. (Recommended Methods for Development-Information Systems, v. 2) (IDRC-TS52e)
4. Di Lauro, Anne. IDIN Manual for the Creation and Management of a Bibliographic Data Base using MICRO-ISIS. (Prepared on behalf of the OECD Development Centre for the Inter-Regional Co-ordinating Committee of Development Associations). Paris, Organization for Economic Co-operation and Development, 1988.
5. International Federation of Library Associations and Institutions. International Office for UBC. Names of Persons: National Usages for Entry in

Catalogues. 3rd ed. London, IFLA International Office for UBC, 1977.

6. International Federation of Library Associations and Institutions. International Office for UBC. Supplement to Names of Persons: National Usages for Entry in Catalogues. London, IFLA International Office for UBC, 1980.
7. International Federation of Library Associations and Institutions. International Office for UBC. Names of States: an Authority List of Language Forms for Catalogue Entries. London, IFLA International Office for UBC, 1981.
8. International Organization for Standardization. Code for the Representation of Names of Languages. Geneva, ISO, 1988. (ISO 639-1988)
9. International Organization for Standardization. Codes for the Representation of Currencies and Funds. 2nd ed. Geneva, ISO, 1981. (ISO 4217-1981)
10. International Organization for Standardization. Codes for the Representation of Names of Countries. 3rd ed. Geneva, ISO, 1988. (ISO 3166-1988) (Updated by "ISO 3166 Newsletter", Berlin, ISO 3166 Maintenance Agency Secretariat. Irregular)

11. International Organization for Standardization. Documentation-Transliteration of Arabic Characters into Latin Characters. Geneva, ISO, 1984. (ISO 233-1984)
12. International Organization for Standardization. Format for Bibliographic Information Interchange on Magnetic Tape. Geneva, ISO, 1981. (ISO 2709-1981)
13. International Organization for Standardization. Writing of Calendar Dates in All-Numeric Form. Geneva, ISO, 1976. (ISO 2014-1976)
14. International Serials Data System. ISDS Manual. Paris, ISDS International Centre, 1983, with revisions to Sept. 1987.
15. Morin-Labatut, Gisele, and Sly, Maureen. Manual for the Preparation of Records in Development-Information Systems. Ottawa, International Development Research Centre, 1982. (Recommended Methods for Development-Information Systems, v. 1) (IDRC-TS40e)
16. Simmons, Peter, and Hopkinson, Alan, Eds., CCF/F: the Common Communication Format for Factual Information. Paris, Unesco, 1992. (PGI-92/WS/8)
17. Simmons, Peter, and Hopkinson, Alan, Eds., CCF/B: The Common Communication Format for Bibliographic Information. Paris, Unesco, 1992. (PGI-92/WS/9).

18. United Nations. Department of Conference Services. Documentation and Terminology Section. Acronyms and Abbreviations Covering the United Nations System and Other International Organizations. New York, UN, 1981. (Terminology Bulletin no. 311/rev. 1) (ST/CS/SER.F/331/rev. 1)
19. United Nations. Department of Conference Services. Documentation, Reference and Terminology Section. Names of Countries and Adjectives of Nationality. New York, UN, 1985. (Terminology Bulletin no. 333) (ST/CS/SER.F/333) (and amendments)
20. Yearbook of International Organizations. Brussels, Union of International Associations. Annual.

ANNEX 1 : Questionnaire for a Survey on Agricultural Institutions and the Present Status of Agricultural Information Services in Sudan

Purpose : The response to this questionnaire will be used to assess the prevailing status of the agricultural information services in Sudan.

Your help would be highly appreciated

1. Name of institution/organization : -----

2. Date of establishment : -----
3. Name of parent body : -----
4. Address : P.O. Box : ----- Town : -----
Telephone : ----- Telex : -----
Fax : ----- Telegram : -----
5. Objectives (please describe the main objectives of your institution) :-----

6. Activities (please describe the major activities of your institution) : -----

7. Nature of work
 - Agricultural research only ----
 - Agricultural research partially -----
 - Agricultural research as support to the major occupation of the institute -----
 - Teaching/academic -----
 - Commercial -----
 - Extension services -----
 - Consultancy -----
 - Others (Please specify) -----

8. Major fields of specialization

- 1.
- 2.
- 3.

9. Type of institution :

- a. private ----- b. public -----
c. others (please indicate the status of your
institutions) -----

10. Is there any on-going project/survey? Yes --- No -

If Yes, please list title of ongoing projects

1. -----
2. -----
3. -----

11. Does your institution have any of the following
information system (Tick where appropriate)

- Library
- Documentation
- Information Centre
- Others (Please specify) -----

12. What are services you provide? (Tick where
appropriate)

- References services
- Current awareness
- Database search
- Others (specify) -----
- Reading and Loan
- Selective
Dissemination
information
- Electronic-mail

13. Give the total number of your library/information
centre staff in each category :

Ph.D. ----- M.Sc. ----- Higher Diploma -----
B.Sc. Agriculture ----- B.Sc. Library -----
B.Sc. other specialization ----- Middle Diploma ---
Certificate Course ----- High School -----
Number of foreign trained scientists -----

14. Information resources available and processing

a) Collection : Total -----
 Volume -----

Books and monographs (% or No.) -----

Bound volumes of serials (% or No.) -----

Current serials title (No.) -----

Technical reports (%) -----

Government publications (%) -----

Microfilms (ft) -----

Microfiche (No.) -----

Others (Please specify) (% or No.) -----

b) Equipment :

	Type	No.
- Binding equipment	-----	----
- Computers (micro- mini, or mainframe)	-----	----
- Microfiche reader/printer	-----	----
- CD-ROM reader	-----	----
- Reprography equipment	-----	----
- Others (Please specify)	-----	----

c) Software use purpose

	Name
- Word processing	-----
- Data base management	-----
- Others (specify)	-----

d) Technical processing and Vocabulary Control

- Classification Scheme (name) -----
- Catalog code (name) -----
- Agrovoc -----
- Other thesaurus -----
- Subject heading list -----

15. Are your library/documentation/information centre computerized? Yes ---- No ----

If Yes, Which services?

- Cataloguing -----
- Acquisition -----
- Online services of remote databases -----
- Search services of databases of outside origin-
- Databases -----
- Serials -----
- Totally automated -----
- Others (Please specify) -----

16. Arrange/rank group of users on a scale from 1 to 5 in priority order giving 1 to top priority :

- Researcher -----
- Managers -----
- Administrative staff -----
- Instructors/students -----
- External readers -----
- Others (Please specify) -----

17. Do you follow up your users' needs, opinions, and comments? Yes --- No ----

If Yes, How?

18. Do you plan your acquisition in consultation with the users?

Yes -----

No -----

19. Is your library/documentation/information centre designated as a material centre for any specialized area? Yes ___ No ___

If Yes, in what area?

1. _____
2. _____

20. Are there scientific and technical publications produced by the institution?

Yes ----- No -----

21. If Yes, please specify the type of publications (Books, Scientific journals, etc.) and their number produced monthly/annually.

Type of publication	No. produced	
	monthly	annually
1.		
2.		
3.		
4.		

22. How do you produce your publications?

Manually ----- Computerized -----

23. If computerized, please write :

Name of database : -----

Subjects covered : -----

No. of records : -----

24. Please indicate on a scale from 1 to 5 any shortcomings in your services (either from users comments or self-realization) in a ascending order giving 1 to most important shortcoming :

- Inadequate general collection of books, journals, etc. ----
- Lack of current journals, books, and other document -----

- poor physical facility for users as well as staff
- Lack of processing equipment and other information technology (for example CD-ROM reader) -----
- Poor information management and handling -----
- Absence of external databases available/accessible -----
- Others (Please specify) -----

25. What do you think are the causes for the shortcomings (indicate in a ascending order using a scale from 1 to 5, 1 being the most important cause)?

- Poorly motivated staff -----
- Shortage of skilled workforce -----
- Poor management -----
- Budgetary constraint -----
- Foreign exchange constraint to purchase required items from abroad -----

26. Does your institution cooperate with other institutions? Yes ---- No -----

If Yes, indicate the ways of cooperation

- Exchange of documents or acquisitions
- Staff exchange
- Information exchange upon request
- Input into a National Database
- Network system with computers in other institutions
- Any other form (Please specify) -----

27. Does your library collaborate with any institution outside the country?

Yes ----- No -----

If Yes, Please list type of cooperation and give name of institution

Type of collaboration	Collaborating country
1. -----	-----
2. -----	-----
3. -----	-----

28. Do you think cooperative activities with other information services will benefit your information services? Yes ---- No -----

If Yes, in what ways (indicate in a ascending order using a scale from 1 to 5)

- Sharing the existing resources (including using information technology -----
- Access to wider information sources (including to national and international databases -----
- Training for your staff -----
- Professional consultancy -----
- Acquisition of required information sources and equipment -----
- Others (Please specify) -----

29. Does your institution have its own scientific and technical information policy? Yes ---- No -----

If Yes, Please write the :-

Objectives : -----
Priorities : -----

30. Give budget of your library/information centre

31. Does the institution possess information telecommunication policy? Yes --- No ----

If Yes, what type of relationship exists (specify)

ANNEX 2 : QUESTIONNAIRE FOR A SURVEY ON INFORMATION
NEEDS

1. Name : -----

2. Position : -----

3. Name of the Institution : -----

4. Address :

Postal :-----

Phone : -----

5. Academic qualification

- Higher degree/Diploma -----

- Subject (major) -----

- Institution -----

6. Field of specialization : -----

7. Nature of Work :-

Research -----

Teaching/academic -----

Consultancy -----

Others (specify) -----

8. Are you currently conducting any research?

Yes -----

No -----

If Yes, What is it about? (please be brief and specific)

9. Does your institution have any of the following information system? Yes -- No -- (Tick where appropriate)

- Library

- Documentation Centre

- Information Service Unit

- Others (Please specify) -----

10. If any of the above information system is available, for what purpose do you use its facilities? (Tick where appropriate)
- Borrow books and journals for preparation of research
 - Consult journals in order to keep abreast with developments in your field
 - Others (please specify) -----
11. Does your information system provide you with any of the following services? (Tick where appropriate)
- Current awareness services (informing users of new items received e.g. public display of new items received or display of lists showing new items added to the collection)
 - Selective dissemination of information (Giving specific information to specific users about items received relevant to their field of specialization).
 - Online searches of data bases (interactive interrogation of databases containing bibliographic information or source data, held on a host computer)
 - Question and answer services
 - Reference services
12. Do you feel that your library/documentation/ Information Centre meets your information requirement? (Tick one)
- Yes ----- To some extent ----- No ---
13. If the answer to question (12) is No or to some extent, What other sources of information do you use to meet your information requirements?
-
14. If the answer to the question (8) is No, in your opinion, why your institution did not establish any library or information unit?
- Lack of need
 - Lack of management awareness
 - Shortage of fund
 - Any other reason (specify) -----

15. Please, indicate if possible, the extent to which inadequate information facilities hamper your work as a researcher?

- Does not hamper my work
- Hampers it but not seriously
- Seriously hampers it (please explain) -----

16. Do you get materials from other sources through your library/documentation/information centres?

Yes ----- No -----

17. How long does it take to get them?

- 1 - 7 days
- 8 - 15 days
- a month
- more than one month

18. If you travel in order to have access to other library/documentation/information centre facilities, how far do you travel? (Tick where appropriate)

- 1 - 5 km.
- 6 - 10 km
- above 10 km

19. How often do you use library/documentation centres of other institutions?

- Frequently (at least once a day) -- Sometimes --
- Rarely ----- Not at all --

20. If not at all or rarely, why?

- Do not know what is available -----
- Not relevant -----
- Do not have transport or easy access -----
- Others (please specify) -----

21. What materials, relevant to your field of specialization would you like your library/documentation/information centre to add to its collection? (name those materials that are currently not available in your institutions)

Thank you very much for time you spent in filling this form. Your help would be highly appreciated.

ANNEX 3 : QUESTIONNAIRE FOR EXPERTS IN AGRICULTURE
AND INFORMATION SCIENCE IN SUDAN

Your help would be highly appreciated

1. Name : -----

2. Other name(s) : -----

(please give your name as you would be like it to
appear in the databases, i.e. beginning with the name
under which you wish to be indexed).

3. Year of birth : -----

4. Sex : -----

5. Nationality : -----

6. Permanent Mailing Address : -----

Telephone : Home ----- Office -----

Telex : ----- Cable : ----- Tax : -----

7. Academic qualifications :

1. Field of study -----

Degree -----

Year obtained -----

Name and place of institution awarding degree -----

2. Field of study -----

Degree -----

Year obtained -----

Name and place of institution awarding degree -----

8. Main field(s) of specialization (please indicate what you consider to be the subject areas in which you are particularly competent. Please be specific. -----

9. Main publications (please list two of your publications which you consider to be most relevant in relation to your field of specialization, your professional experience and your consultancy/expert assignment, if any).

1. -----
2. -----

10. Main working language : -----
Other working language : -----

11. Employment Record (you are requested to furnish information about your current employment, your last employment (the one immediately preceding your current employment) :

1. Current employer : -----

Title of your post : -----
Duration : From ----- to -----

Address of employer : City ----- country -

P.O. Box ----- Cable ----- Telephone ---

Concise descriptions of your duties and responsibilities : ----

2. Last employer : -----

Title of your post : -----
Duration : From ----- to -----

Address of employer : City ----- Country --

P.O. Box ----- Cable ----- Telephone -

Concise descriptions of your duties and responsibilities-----

12. Main consultancy or expert assignments undertaken during the past three years (Where relevant, you are requested to furnish information on two consulting/expert assignments you have undertaken during the past three years. If you were engaged in more than two such assignments, provide information on the two you consider to be the most relevant in relation to your field of specialization and work experience).

1. Description of assignment : -----
Duration : From ----- to -----
Place : -----

2. Description of assignment : -----
Duration : From ----- to -----
Place : -----

Thank you very much

ANNEX 4 : INTERVIEW OUTLINES

- Name
- Position
- Do you have an information system in your institutions?
- Do you find what you want from your institution library?
- Is there any problem when you collect information for your research?
- Are you usually used the library, or only for your research?
- What types of materials do you require from the library?
- When was the centre/institution established?
- Do you aware of publications of other institutions?
- Do you have qualified person?
- Is there any cooperation between your institution and others?
- What is your qualification?
- Is there any problem in your services as a librarian?
- Have you get any training in library services?
- Does government support your activities?
- How are the library users?
- How much do they use the library and for what purpose?
- What do they read?

During the interviews and discussions, the questions were elaborated to elicit additional information.

ANNEX 5 : LIST OF THE AGRICULTURAL

ORGANIZATIONS/INSTITUTIONS SURVEYED

1) Higher education institutions in agriculture and environmental studies :

- Khartoum University - Shambat branch library serves three faculties :
 - Faculty of Agriculture;
 - Faculty of Veterinary Science; and
 - Faculty of Animal Production.
- Khartoum University - main library - Sudan Collection.
- Sudan University for Science and Technology - three departments :
 - College of Agriculture and Food Technology, Shambat (main library);
 - Veterinary and Animal Production Department, Kuku; and
 - Forestry Science and Wood Technology Department, Soba.
- Juba University - College of Natural Resources and Environmental Studies.
- University of Gezira - Faculty of Agricultural Science.
- Ahfad University College for Women (private University) :

- Rural Extension and Development Unit; and
- School of Rural Education, Extension and Development.
- Khartoum University, Institute of Environmental Studies (IES).
- Khartoum University, Development Studies and Research Centre (DSRC).

2) Research institutes/centres :

- Agricultural Research Corporation (ARC).
- Food Research Centre - Shambat.
- Forestry Research Centre - Soba.
- Fisheries Research Centre - El Shagara.
- Veterinary Research Administration - Soba.
- The Environmental and Natural Resources Research Institute, National Centre for Research (NCR).
- Western Sudan Agricultural Research project.
- Higher Council for Environment and Natural Resources.
- Forests National Corporation.
- Animal Production Public Corporation.
- Horticulture Administration - El Mogran.
- Range and Pastures Administration - Khartoum.
- Range and Pasture Research Section - (ARC).
- Medicinal and Aromatic Plants Research Institute, NCR.

- Veterinary Extension Department, General Administration for Public services of the Animal Resources Administration.
- Mechanized Farming Corporation.
- Southern Kordofan Agricultural Development Project.
- Rahad Agricultural Corporation.
- Drought and Desertification control Programmes Coordination and Monitoring Unit.
- Western Savannah Development Corporation.
- Soil Conservation, Land use and Water Programming Administration.

4) Development agencies :

- Ministry of Agriculture, Natural and Animal Resources
 - Main library named - Documentation, Information and Follow up Department; and
 - Agricultural Economics and Statistics Department
- Ministry of Finance and Economic Planning - Agricultural Department.
- Ministry of Higher Education and Scientific Research - The library.
- Agricultural Bank of Sudan - Research and Statistics Department and Monetary and Evaluation Department.

5) Information and documentation centres :

- Documentation and Information Centre - NCR.
- Arab Centre for Agriculture, Documentation and Information Centre of the Arab Organization for Agricultural Development.
- The Arab Authority for Agricultural Development and Investment - Documentation and Information Unit.

6) Non-governmental organizations

- The Food and Agricultural Organization of the United Nations (FAO) in Sudan.

ANNEX 6 :

**SAMPLE OUTPUTS OF SOME
DATABASES DEVELOPED**

**** PROFILE OF AGRICULTURAL INSTITUTION ****

Sample Record Outputs

Record No.	003
Name of Institution	SOIL CONSERVATION, LAND USE AND WATER PROGRAMMING ADMINISTRATION
Date established	1944
Parent Body	Ministry of Agriculture, Natural and Animal Resources
Address	P.O. Box 1942, Khartoum
Telephone	70059
Objectives	To develop land use plan to achieve a sort of integrated rural development within the entire context of natural resource management
Activities	Conserve soil south of latitude 14°N Conserve soils north of latitude 14°N Execute water harvesting projects in the semi-arid zone Water programming for both drinking and agricultural purposes.
Nature of Work	Agricultural research as support to the major occupation of the institution; Consultancy; Organizing training programme.
Specializations	Soil science and water management; Land reclamation; Socio-economic and environmental aspects
Type of Institution	Governmental institution
Ongoing Projects	Water Harvesting Projects, at Darfur, Kordofan and Eastern state Reclamation of soils, at Darfur and Kordofan; Land use map
Information System	Library and Documentation Section
Information Service	Databases search and Current awareness

**** PROFILE OF AGRICULTURAL INSTITUTION ****

Sample Records Outputs

Record No.	006
Name of Institution	FOOD RESEARCH CENTRE
Date established	1965
Parent Body	Agricultural Research Corporation
Address	P.O Box 213, Khartoum North
Telephone	611294
Objectives	Research and development for food industry; up-grading of traditional technologies; extension and training to food industry; etc.
Activities	Research and development in the areas of grain technology; fruits and vegetables technology; oil and fats technology; animal products technology; quality control; nutrition and marketing policies.
Nature of Work	Food research; Teaching; Extension services; Consultancy; Marketing
Specializations	Food Science; Food Technology; Nutrition
Type of Institution	Governmental institution
Ongoing Projects	Storage and ripening of fruits and vegetables, Khartoum; Suitability of major fruits, vegetables and legumes for processing Cereals and legumes processing and utilization, Khartoum
Information System	library
Information Service	References services; reading and loan
Publications	<u>Sudan Journal of Food Science and Technology</u> ; and pamphlets.

**** PROFILE OF AGRICULTURAL RESEARCH PROJECT ****

Sample Record Output

Record No.	001
Name of Project	DINDER FORESTRY PROJECT - PHASE 3.
Address	Forestry Extension Unit (FEN), Dinder Nursery.
Working language	Arabic and English
Objectives	Two distinct objectives proposed for the project : a) the establishment of an active Forestry Extension Unit (FEU) that will be managed jointly by the National Forestry Corporation (NFC) and by the project in such a way that after 3 years; and (b) the phased handover of the management and financial responsibility of an Nursery to the NFC so that all project inputs will have ceased by 31-10-1993 and the nursery will be able to maintain outputs at current annual capacity (up to 100,000 seedlings per year).
Activities	Carrying survey on the basis of which forestry and public health care. Extension activities have been concentrated in 11 contact village lying along the course of the seasonal river Dinder and north of Gueish. Extension aims to raise awareness among target populations of the potential benefits of tree planting and to supply the necessary skills and seedlings for tree establishment. Ground meetings, slide-shows, demonstrations, workshops, home and farm visits and a school programme are the main techniques. Seedlings have been supplied free from the project nursery.
Starting year	1992
Duration	1992-1994
Implementing agency	Concern; National Forests Administration; and Ford Foundation
Funding agency	Ford Foundation

**** PROFILE OF AGRICULTURAL RESEARCH PROJECT ****

Sample Record Output

Record No.	002
Name of Project	SOUTH WHITE NILE AGRICULTURAL PROGRAMME, 1992-1994.
Working language	Arabic and English
Objectives	To develop sustainable land use management practices that improve agricultural production and food security within the degraded environmental and socio-economic status of the traditional sector and which, using low input extension methodologies, demonstrate high adoption rates by farmers. To assist in the identification, design and implementation of short term agricultural-linked inputs within Concern's on-going Emergency Programme.
Activities	Extension services to expose farmers to a range of agricultural technologies that they would otherwise be unlikely to meet (e.g. improved seed, shelter belt establishment, animal powered farm implements; to elicit farmer participation to evaluate such technologies; to elicit farmer participation to research and develop agricultural practices more appropriate to the changing environmental, demographic and socioeconomic conditions of South White Nile (e.g. increased emphasis on legume intercrops, use of covercrops and fallow management); etc.
Description	Research and Development for Famine Mitigation Strategies and Post Emergency Agricultural rehabilitation
Starting year	1993
Duration	1993-1994
Implementing agency	Concern
Funding agency	Concern

**** PROFILE OF AGRICULTURAL INFORMATION SYSTEM ****

Sample Record Output

RECORD NO.	00001
Name of Library	SHAMBAT AGRICULTURAL LIBRARY
Status	Government
Date Established	1936
Parent Body	University of Khartoum, Faculty of Agriculture
Address	P.O Box 23, Shambat
Telephone	177876
Staff	1 B.Sc. library 1 Middle Diploma 3 Higher School Graduate
Doc. Collection	54,000 books; 150 Journals
Classification	Dewey Decimal Classification Scheme
Objectives	Services for teaching staff, under- and post-graduate students
Type of Users	Instructors/Academic staff, under- and post-graduate students and researchers
Info. Services	References services; reading and loan
Working Language	English, Arabic

**** PROFILE OF AGRICULTURAL INFORMATION SYSTEM ****

Sample Record Output

RECORD NO.	00002
Name of Library	ARAB CENTRE FOR AGRICULTURE, DOCUMENTATION AND INFORMATION (ACADI)
Status	Intergovernmental Institution
Date Established	1972
Parent Body	The Arab Organization for Agricultural Development (AOAD). Arab league
Address	P.O. Box 474, Khartoum
Telephone	452182-452176
Staff	1 M.Sc.in library sciences 2 B.Sc. in Agriculture 4 Other specialization 1 Middle diploma 5 High School graduate 2 Certificate Courses
Doc. Collection	26,000 books; 1100 current journals
Classification	Dewey Decimal Classification
Objectives	Agriculture development in the Arab countries
Activities	The centre collects, processes, stores, and disseminates both documentary and non-documentary information using modern information technology. It coordinates the output of the sectoral network for agricultural information as part of the Arab information network.
Type of Users	Researchers, decision makers, postgraduate students
Info. Services	References services, reading and loan, current awareness, Selective Dissemination of Information, database search.
Equipment	Microcomputers, mini, microfiche reader and printer, CD-ROM reader, and reprography equipment
Working Language	Arabic, English

*** PROFILE OF EXPERT ***

Sample Record Output

NAME	MAGBOUL, BAHIELDIN IBRAHIM
BIRTH	19411128
NATIONALITY	SD
QUALIFIC.	Effect of dietary protein supplementation and restriction on the course of pregnancy in the rat. M.Sc. Human Nutrition. Queen Elizabeth College, University of London, United Kingdom. 1968. Studies on experimental niacin depletion in the rat. Ph.D. Human Nutrition. Middlesex Hospital Medical School, University of London, United Kingdom. 1981.
SPECIALIZATION	Micronutrient nutrition, Assessment of nutrients in food
WORK. LANG.	Arabic. English.
	Employment Record
CURR. EMPLOY.	Research professor, Food Research Centre, Khartoum North, Sudan, 1991 up to now.
LAST EMPLOY.	Food Science and Nutrition, King Saud University, College of Applied Medical Sciences, Riyadh, Saudi Arabia, 1985-1991, Teaching different subjects in areas of food science and nutrition.
ASSIGNMENTS	Sudan, Agricultural Research Corporation, June, 1992 - November, 1992, Preparation of a strategic plan on research priorities in the area of food research.

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